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HEARING

ON

NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2020

AND

OVERSIGHT OF PREVIOUSLY AUTHORIZED PROGRAMS

BEFORE THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

ONE HUNDRED SIXTEENTH CONGRESS

FIRST SESSION

SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES HEARING

ON

DEPARTMENT OF THE AIR FORCE ACQUISITION AND MODERNIZATION PROGRAMS IN THE FISCAL YEAR 2020 NATIONAL DEFENSE AUTHORIZATION PRESIDENT'S BUDGET REQUEST

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DEPARTMENT OF THE AIR FORCE ACQUISITION AND MODERNIZATION PROGRAMS IN THE FISCAL YEAR 2020 NATIONAL DEFENSE AUTHORIZATION PRESIDENT'S BUDGET REQUEST

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES,
Washington, DC, Thursday, May 2, 2019.

The subcommittee met, pursuant to call, at 9:01 a.m., in room 2118, Rayburn House Office Building, Hon. Donald Norcross (chairman of the subcommittee) presiding.

OPENING STATEMENT OF HON. DONALD NORCROSS, A REPRESENTATIVE FROM NEW JERSEY, CHAIRMAN, SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

Mr. NORCROSS. Good morning. We will bring this hearing to order. The subcommittee meets today to review the Air Force acquisition and modernization programs in the fiscal year 2020 budget request.

I would like to welcome our distinguished panel today.

That includes the Honorable Will Roper, Assistant Secretary of the Air Force for Acquisition, Technology and Logistics; General Mike Holmes, the Commander of the Air Force Air Combat; Major General Nahom, Director of the Air Force Programs for the Deputy Chief of Staff for Strategic Plans; Lieutenant General Tony Ierardi—did I get that right? Terrific. Director of Structure—or Force Structure, Resources, and Assessments for the Chairman of the Joint Chiefs of Staff; and Vice Admiral Matt Winter, Director F–35 Joint Strike Program; the Honorable Bob Daigle, Director of Cost Analysis and Program Evaluation for Secretary of the Defense; the Honorable Bob Behler, Director of Operational Test and Evaluation for the Department of Defense; and Mr. Mike Sullivan, Director of the Defense Weapon System and Acquisitions for the Government Accountability Office, which I spent reading three of your reports about midnight last night. And thank you, very important.

I want to thank our witnesses for your service and your time here today. Look forward toward your testimony. As we review Air Force budget requests today, we want to review the changes that have been made over this year's budget over last year. And understand why the difference from what was forecasted last year in fiscal 19 budget to this year.

We need to understand how the Air Force budget request aligns with the objectives of the National Defense Strategy in competing and deterring our near-peer adversaries.

What investments are being made to increase the combat effectiveness, capacity, and capabilities of the Air Force intelligence, surveillance, and reconnaissance, or the ISR, plat, as well as tactical combat and training aircrafts, rotorcraft, and munitions.

What acquisition efficiencies and authorities are being implemented to more quickly modernize and reduce the advantage of many of our Air Force fleets of aircrafts under this subcommittee's purview.

One of the most important, arguably controversial changes we will talk about today relates to the Air Force decision to start a new recapitalization of the F–15C fleet. This involves advanced fourth-generation version of the F–15 now called F–15EX to complement the fifth-generation F–22 and F–35 capabilities.

We need to understand what new capabilities and certainly cost efficiencies the F–15EX can bring to the Air Force tactical aircraft portfolio and why the Air Force has shifted from what we heard for the last 4 years about fifth-generation fighters and why that has shifted. We also want an update on the F–35 program challenges in achieving significantly lower operational and sustainment costs that continues to dog this program.

The Air Force has told us they are going to reduce those costs by 43 percent in order to afford owning and operating the original inventories we had proposed. Forty-three percent is an incredibly high number, but we certainly understand why that is happening. We also want to understand how the Joint Program Office will get control and fix the problematic ALIS [Autonomic Logistics Information System] system.

We had a number of folks over the last 2 weeks brief us on that and looking forward in the program we need an update on the Block 4 development and its projected cost. In order to fully understand these issues we must first understand the capability and capacity of our tactical fighter industrial base.

What is the F–35 Program Office doing to increase the stability of the prime contractor's continuing problems with supply chain and parts management for both new production and fielded aircraft? And how does this factor in to supporting an increase quantities of the future F–35A purchase?

If we start to build the new F–15EX program, what are the production capacities and challenges anticipated by the Air Force? How will the Air Force ensure that the costs are controlled before committing to development and a production contract over several years?

Fifth- and fourth-generation fighter aircraft [are] a critical capability for our Air Force, and this subcommittee will continue to support these programs. But we don't have an unlimited budget. We don't have an unlimited budget.

We need to achieve real affordability, hard to define and sometimes elusive, but we can do this. The ranking member and I took an opportunity to travel, just a few weeks ago, to see the F–35 production line and then immediately thereafter went to the F–15 production line. And this is what makes you so proud of America. What we can build. What we can do.

The facilities, the workers, were just remarkable. And very much understood where they fit in to our national defense. Mrs. Hartzler

and I were impressed, I would even say inspired, and it was an excellent chance to see firsthand some of the things that we talk about here in this committee. And I want to publicly thank all those who made it possible to get that comprehensive look at these challenging programs. And certainly that fall into our jurisdiction.

Similar to tactical aviation, the subcommittee is also paying close attention to the ISR program, and efforts to sustain modernized key capabilities. As everyone may recall, last year's budget included a seismic shift in Air Force battle management command [and] control modernization technology. The long planned recapitalization of Joint STARS [Surveillance Target Attack Radar System] aircraft was abandoned, and in its place, a new concept—new concept existing yet to be defined program, coined the ABMS, Advanced Battle Management System.

The committee remains concerned about the lack of formal program structure, benchmarks, against which we would measure this ABMS progress, as well as uncertainty surrounding Air Force plans to provide effective and timely Ground Motion Target Indicator intelligence, the GMTI.

The subcommittee is also focused on how the budget request supports sustaining the Air Force big-wing ISR programs after several budget cycles [of] uneven funding and support and alternative planning—to support alternating plans to terminate different programs.

The Air Force appears to agree that we need all the current ISR capabilities it can muster. However, the service needs to map out a recapitalization program for those big-wing aircraft to ensure continued viability, relevance for the National Defense Strategy and the near-peer threats.

I look forward to your testimony and discussing these topics.

But before we begin with opening statements, I would like to turn to my colleague, who we just did our travel out west to a number of the bases, for her opening comments this morning.

[The prepared statement of Mr. Norcross can be found in the Appendix on page 45.]

STATEMENT OF HON. VICKY HARTZLER, A REPRESENTATIVE FROM MISSOURI, RANKING MEMBER, SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

Mrs. HARTZLER. Thank you, Mr. Chairman. And thank you for organizing that trip, too. It was very helpful and very pertinent to what we are talking about today.

I would like to thank everybody who is here today and to provide your testimony on the Air Force modernization efforts and the fiscal year 2020 request.

The National Defense Strategy Commission concluded that, quote, regardless of where the next conflict occurs, or which adversary it features, the Air Force will be at the forefront, end quote.

Modernization needs to be properly resourced to ensure the Air Force remains relevant and ready, which is why we need to work together to ensure a defense top line that shows real growth.

If we fail to do so then we will erase all of the gains that we have made over the past 3 years. We have a distinguished panel of witnesses here today and, given their expertise, I look forward to hav-

ing a healthy discussion on the appropriate fighter force structure required for the Air Force to meet the objectives of the National Defense Strategy.

General Goldfein has stated that, quote, we are going to be a mix well into the 2030s of fourth-gen and fifth-gen fighters and they complement each other. One plus one, fourth gen plus fifth gen, actually equals three fighters if they are used correctly because they each make each other better, end quote.

During my recent travels with the chairman, touring the fighter industrial base, and observing a recent Red Flag exercise at Nellis Air Force Base, it appears clear to me we will need a highly capable mix of fourth-generation and fifth-generation aircraft complementing one another in order to meet the objectives of the National Defense Strategy.

I understand the Air Force is striving for a 50/50 mix of fourth-generation and fifth-generation aircraft by 2030 that will meet that capability and capacity requirements.

General Goldfein has also stated that the F–15C fleet will not make it to 2030. And that, begin quote, we have got to refresh the F–15C fleet because I can't afford to not have that capacity to do the jobs and the missions right. If that is the case, then we need to focus on what is best for the F15–C fleet and I look forward to discussing this critical issue today.

The F–22 was the planned replacement for the F–15C fleet and the 2008 decision by the Office of the Secretary of Defense to truncate the F–22 buy is now proving that was a budget-driven, short-sighted decision with long-term consequences. There is no doubt the capabilities the F–35 and fifth generation brings to the battlefield against advanced threats by peer competitors is critically needed to meet the goals and objectives of the National Defense Strategy.

We all share concerns about rising F–35 operations and support costs affecting long-term affordability which could result in lower procurement quantities in the out-years.

For today, regarding the F–35 program, I am interested in receiving updates and discussing the initial operational test and evaluation that is ongoing; the acquisition plan and cost estimates for the Block 4 modernization program; the findings from the last Selected Acquisition Report from the Department of Defense, which showed increases for both acquisition and operation and support costs; the actions being taken to increase availability of spare parts and improve overall reliability and performance; and the actions being taken now, in this budget request, to lower operation and sustainment costs, to include ramping up organic depot capability, improving the Autonomic Logistics Information System, or ALIS, and improving the time associated for long lead parts.

The F–35 Joint Program Office along with the military services appear to be very focused on reducing these costs; however, significant challenges remain ahead. We look forward to working with each of you and industry in a collaborative manner to reach your objectives for this important program.

Today is also a good opportunity for the witnesses to update us on what they are doing to mitigate physiological episodes and how the Air Force is coordinating efforts with the Navy.

I was pleased that the budget request fully funds A–10 modernization, to include the re-wing effort, and I expect the witnesses to address this program, as well as touch on any operational readiness challenges in the A–10 fleet.

And finally, I am interested to hear today from our witnesses on the progress being made in the development of advanced munition capabilities. In order for us to maintain comparative advantage, we need to ensure that munitions and weapons are being upgraded and developed.

So thank you, Mr. Chairman, for holding this important hearing today and I yield back.

Mr. NORCROSS. Thank you for your comments. Given our large panel of witness today we ask they condense their opening remarks to approximately 3 minutes or less. And without objection, the formal written statements will be entered into the record. Without objection. So ordered.

With that, we will begin our opening remarks with Dr. Roper, followed by General Holmes, Mr. Daigle, General Ierardi, Mr. Sullivan, Dr. Behler, Admiral Winter. That gives you 7 out of 8, so, we have a great panel here with lots of knowledge. But we also have a time factor. So thank you for being here.

STATEMENT OF HON. WILLIAM B. ROPER, ASSISTANT SECRETARY OF THE AIR FORCE FOR ACQUISITION, DEPARTMENT OF THE AIR FORCE

Secretary ROPER. Chairman Norcross and Ranking Member Hartzler, members of the committee, thank you very much for holding a hearing on this important topic. I think it is fair to say that we are very excited to talk with you about the progress that we have made in this important portfolio. We are also very interested to talk about the challenges that we face and things that we can both work on together to overcome them.

We will talk a lot about programmatics and requirements and specifics of programs but I want to just start by saying that we come into this review looking at a strategic environment again. You know, China is no joke. They have a plan, they have capabilities to match us, both technologically, operationally, and we have to regain the ability to compete with them over time.

This committee has made important strides in giving us authorities to work at a greater speed, with greater agility, so that we do deliver capabilities at a speed of relevance for our warfighters.

We are trying to make strides this year to increase our connection with a broader defense industrial base, be able to work with tech startups, be able to work with the entire innovation base this country brings.

Because, ultimately, the bottom line is about giving the warfighter that critical advantage in the fight that the adversary doesn't have. I look forward to your questions today, to discussing the progress that we have made in acquisition reform.

But we are by no means done. We can never be satisfied with the pace at which we move. We can never be satisfied with the capabilities that we have. This will be a competition over time. And I hope that you will find the Air Force is taking this challenge seri-

ously and that we have made progress in becoming the competitive force that this nation needs.

Thank you.

[The joint prepared statement of Secretary Roper, General Holmes, and General Nahom can be found in the Appendix on page 48.]

Mr. NORCROSS. General Holmes.

STATEMENT OF GEN JAMES M. HOLMES, USAF, COMMANDER, AIR COMBAT COMMAND, AND MAJ GEN DAVID S. NAHOM, USAF, DIRECTOR OF PROGRAMS, OFFICE OF THE DEPUTY CHIEF OF STAFF FOR STRATEGIC PLANS AND REQUIREMENTS, HEADQUARTERS U.S. AIR FORCE

General HOLMES. The light doesn't come on, so. How is that, is it on now? Thanks. Okay, great, thanks.

Good morning, Chairman Norcross, Ranking Member Hartzler, and distinguished members of the subcommittee. General Nahom and I thank you for inviting us to join you today. And as part of our thankfulness, we will combine our statement and just do one.

I echo Dr. Roper's statement and I can attest to the acquisition advancements we have made under the authorities granted to us by the Congress. As the Commander of Air Combat Command, I am responsible for training and equipping much of the Air Force's fighter, rescue, command and control, intelligence, surveillance and reconnaissance, and cyber forces, all with the goal of ensuring that we present competent, effective, and lethal forces to combatant commanders.

On behalf of the over 93,000 airmen in Air Combat Command, I would like to thank you for ensuring that we received an on-time budget for this fiscal year. It is incredibly important for us in planning and execution stability, particularly as we focus on sustaining the force we have while we transition to a more modern force to meet the threats that Dr. Roper described.

Because of that budget, we are on track to meet the readiness goals set by the Secretary of Defense and Secretary of the Air Force and are able to begin rightsizing our force in accordance with the objectives of the 2018 NDAA [National Defense Authorization Act].

We do, however, face challenges in keeping these investments on track as a result of the natural disaster damage inflicted by hurricanes and floods at Tyndall and Offutt Air Force Bases.

Moving forward, our 2020 national defense budget request provides the modernization and sustainment funding we need to grow into a stronger and more lethal force.

However, as Dr. Roper discussed, we can't remain dominant against our peer competitors unless we also outpace them in our acquisition process. Our aging Air Force is currently too small to fight the wars of tomorrow.

We have made strides, but we must not lose sight of our responsibilities to sustain what we have while we modernize for the future.

I look forward to engaging with the Congress as we work together to address these challenges and again, thank you to the members of this subcommittee for your dedication to the Air Force, our armed services, and the American people.

General Nahom and I look forward to your questions.

Mr. NORCROSS. Mr. Daigle.

STATEMENT OF HON. ROBERT B. DAIGLE, DIRECTOR, COST ANALYSIS AND PROGRAM EVALUATION, DEPARTMENT OF DEFENSE

Mr. DAIGLE. Chairman Norcross, Ranking Member Hartzler, distinguished members of the subcommittee, thank you for the opportunity to present to you today the results of the Department's collaborative efforts on TACAIR [tactical aircraft] mix.

I will keep my opening statement very short. I just want to comment that I think this is a really good example of how the budget process can work well.

In 2016, Congress tasked the Department to do a fighter force mix study. The results of that study have since been validated by service analysis and by operational testing. That information informed the deliberations inside the budget process, inside the building cycle, and resulted in an agreement between the Air Force and the Navy and the Department on the right way forward on TACAIR mix to meet the demands of the National Defense Strategy.

I would like to thank your staffs, the staff of the Armed Services Committee, for the collaboration over the last few months following budget rollout; it has been a good team to work with. Thank you.

[The prepared statement of Mr. Daigle can be found in the Appendix on page 86.]

Mr. NORCROSS. General Ierardi.

STATEMENT OF LTG ANTHONY R. IERARDI, USA, DIRECTOR, FORCE STRUCTURE, RESOURCES, AND ASSESSMENT (J8), JOINT STAFF

General IERARDI. Chairman Norcross, Ranking Member Hartzler, distinguished members of the subcommittee, thank you for your support to the men and women in uniform who serve our nation and for the opportunity to address your questions related to tactical air and land forces initiatives.

In his testimony in March to the House Armed Services Committee, General Dunford discussed several challenges the Joint Military Net Assessment identified including the joint force's decreasing competitive advantage vis-a-vis our adversaries.

The 2019 Joint Military Net Assessment, and a follow-on competitive area studies assessment by the Joint Staff, outlined capability, capacity, and readiness issues within the tactical air portfolio that informed the Chairman's program recommendations to the Secretary of Defense in preparations for this year's budget submission.

The Chairman's recommendations focused on balancing the capabilities we need for today's operations with the depth, flexibility, and advanced technologies required to respond to the challenges of the future. From the joint perspective, fifth-generation capabilities remain essential to success against near-peer competitors.

However, adapting the force we have today while we design the force needed for those challenges tomorrow, requires a mix of capabilities within the TACAIR portfolio.

In the short term, the fourth-generation aircraft fleet provides essential capacity to meet the National Defense Strategy demands while we continue to acquire and modernize our fifth-generation aircraft.

In the long term, this portfolio transitions to a majority of fifth-generation aircraft as we continue to acquire the F–35 through 2040. In the interim, we must maintain a relevant mix of fourth-generation capability and capacity to meet the demands across the National Defense Strategy as multiple airframes exceed their service life over the next decade.

I would like to thank you again for the opportunity to appear before this committee, and I look forward to your questions.

[The prepared statement of General Ierardi can be found in the Appendix on page 91.]

Mr. NORCROSS. Mr. Sullivan.

STATEMENT OF MICHAEL J. SULLIVAN, DIRECTOR, DEFENSE WEAPON SYSTEM ACQUISITIONS, GOVERNMENT ACCOUNTABILITY OFFICE

Mr. SULLIVAN. Thank you, Mr. Chairman.

I am here today to discuss the F–35 Lightning II acquisition and sustainment programs, as well as the Advanced Battle Management System. Development of the baseline F–35 weapon system was recently completed after 18 challenging years.

While the cost of development increased by more than 50 percent and the services waited years longer than originally planned, the aircraft is fully capable today, when able to fly, to carry out all of its missions.

The remaining issues now are reliability and affordability. The program tracks eight reliability metrics today for the aircraft and is currently on track to meet four of them. Meeting these targets is critical for maintaining the aircraft's availability and mission capability goals within an affordable 60-year life cycle.

The current estimate for that cost is over a trillion dollars, and the Department is on record as stating that is not affordable. The program is working now to revise its reliability management plans and activities in hopes to make continued success as they move forward.

The program has also initiated activities to modernize the baseline aircraft with new capabilities, known as Block 4 modernization. The current estimated cost for this development program is about $10.5 billion through 2024.

We have concerns that the program will sign development contracts that lock in risk before it has completed an independent cost estimate or technology readiness review, two key activities that help to reduce risk prior to committing large amounts of funding.

We also believe that the modernization program should be a major defense acquisition program with its own cost and schedule baselines to provide the Congress with transparent program reporting.

With regard to the status of sustainment efforts, we have concerns that those cost estimates continue to rise. A large part of these rising costs are significant spare parts shortages and limited repair capabilities.

For example, between May and November of 2018, the aircraft was unable to fly about 30 percent of the time due to spare part shortages. GAO [U.S. Government Accountability Office] recently issued a report and made recommendations to improve this condition. The Department concurred with those recommendations.

The Air Force's Advanced Battle Management System acquisition is still in its very early stages. It is planned to eventually manage detection, identification, and tracking of airborne, maritime, and ground relocatable targets.

The Air Force is currently in the midst of performing an analysis of alternatives for delivering air-centric capabilities and is using an existing analysis to assess best alternatives for handling the ground target tracking capabilities.

Because the program is so young, we only have very preliminary observations on that. However, we plan to continue to report on that program as things unfold.

That concludes my statement, I look forward to questions.

[The prepared statement of Mr. Sullivan can be found in the Appendix on page 95.]

Mr. NORCROSS. Mr. Behler.

STATEMENT OF HON. ROBERT F. BEHLER, DIRECTOR, OPERATIONAL TEST AND EVALUATION, DEPARTMENT OF DEFENSE

Mr. BEHLER. Chairman Norcross, and Ranking Member Hartzler, and other distinguished members of the subcommittee, I too am honored to be here with this distinguished panel of witnesses to address the status of tactical air and modernization programs that fall under my oversight as the Director of Operational Test and Evaluation.

I would like to focus my opening comments in two key areas: the status of ongoing F–35 initial operational test and evaluation, and the operational test infrastructure needed to support emergent technologies for new weapons.

In January of 2018, I observed the start of F–35 operational evaluations with cold-weather testing in Alaska. Working with the program office and the operational test agencies, I approved additional operational evaluations, which enabled IOT&E [initial operational test and evaluation] to start 11 months early.

As of May, the test team has completed over two-thirds of all the open-air IOT&E testing and weapons events.

Operational testing to date has included cybersecurity, open-air test trials, which included F–35 deployments and weapon employment.

The test team has compared the F–35 to fourth-generation fighters against both legacy and modern surface-to-air threats. As prescribed in the fiscal year 2017 NDAA, comparison testing to examine the capabilities of the F–35A and the A–10C was completed last month, March.

The existing test plan specifies two final phases in IOT&E as open-air electronic warfare trials against robust, surface-to-air threats, and simulated dense, modern surface and air threats in the Joint Simulation Environment.

I have guarded optimism that the open-air testing will be completed later this fall, followed by test trials in the Joint Simulation Environment that will stress the F–35 against validated models [of] real advanced world threats. The current schedule projects IOT&E to be completed at the end of this calendar year.

Before closing, I would like to briefly turn to the topic of testing emergent technologies that are addressed in the National Defense Strategy such as hypersonics and artificial intelligence.

This is a very complicated challenge. Emergent technologies will drive the need for new test infrastructure requirements. Technologies like hypersonic weapon systems will require advanced data collection, long-range tracking capacity, and safety issues.

Weapons that use artificial intelligence and machine learning will require new measurement methods that can determine whether the computer will make the right decisions in combat.

Thank you for your attention and your continuous support of the service men and women. I look forward to your questions.

[The prepared statement of Mr. Behler can be found in the Appendix on page 117.]

Mr. NORCROSS. Admiral Winter.

STATEMENT OF VADM MATHIAS W. WINTER, USN, DIRECTOR, F–35 JOINT STRIKE FIGHTER PROGRAM OFFICE, DEPARTMENT OF DEFENSE

Admiral WINTER. Chairman Norcross, Ranking Member Hartzler, and the distinguished members of the subcommittee, I appeared before you last month with the Navy and Marine Corps. I am back here with my esteemed colleagues to talk about the U.S. Air Force acquisition and modernization efforts, and how the F–35 participates in that and supports the National Defense Strategy.

I continuously appreciate your insight, oversight, and interest in the F–35 program. As we look at what has occurred over this last year, considerable progress has been made, but as we have heard, there is still plenty of challenges that we must tackle together.

We have finished our Block 3 flight test, we have delivered Block 3F warfighting capability, we have begun IOT&E, we have definitized our Lot 11 production aircraft at an $89.2 million F–35A. That is a 5 percent reduction over the previous lot.

We have increased our U.S. depot repair capacity but not to the extent that we need to. We still have those challenges. We have upgraded some of our international maintenance and repair facilities in our European and Pacific region, and we have established credible flying hour metrics, cost per flying hour metrics, so we can get our hands around the total ownership cost for the F–35, together.

We have also supported numerous U.S. service operational activities across our U.S. services—the Marine Corps and Navy, and United States Air Force—to include the United States Air Force first combat employment that occurred this week in the CENTCOM [U.S. Central Command] AOR [area of responsibility].

In terms of Air Force modernization and acquisition, the F–35 remains the Air Force latest fifth-generation fighter and is planned to operate alongside their fourth-gen and fifth-gen aviation capabilities.

We see the F–35 truly as the quarterback of that joint force. And with its ability to collect, analyze, and share that data, it is a true force multiplier across the battlespace.

With over 400 aircraft fielded across all variants, the F–35 is more affordable and more lethal than it has been in the past. However, as I stated a month ago and I will tell you today, I am not satisfied as the PEO [Program Executive Officer] of the F–35 Joint Program Office.

We still face challenges in repair span times, industry's ability to provide spare parts quality and on time, our production flow and production line inefficiencies, and some of the labor skills that are being drawn away from the military enterprise into the commercial enterprise for aviation demand.

We are tackling these challenges together with a head-on clear mandate to drive in that affordability, that quality, and reliability across the enterprise.

This year's President's budget requests the resources to achieve the goals of 80 percent MC [mission capable], to get to an $80 million F–35A, and to get to an affordable cost per flying hour and costs per tail per year for our U.S. services.

On behalf of the men and women of the F–35 enterprise, you have my commitment to provide you the accountability and transparency the taxpayer demands, and the affordable game-changing capability the warfighter needs.

I thank you again for the opportunity to discuss the F–35 program and look forward to your questions.

Thank you, sir.

[The prepared statement of Admiral Winter can be found in the Appendix on page 135.]

Mr. NORCROSS. Thank you for all your testimony. The most expensive system that the United States has ever attempted, and we have some great results, but we have some challenges. Getting under that $90 million for the type A is great, but when the sustainment costs continue to be the numbers that we are looking at and not being ready 30 percent of the time, we have got some real challenges.

So, for the last 4 years in particular, we have been hearing about fifth generation, fifth generation. And this year it was dropped on our laps about an F–15 coming into play.

So, I want to start there. There is a number of other issues we have to address. General Holmes, past couple years we have been talking about the program that we are talking about today. The service life of the F–15C appears to be a real challenge at this point. Can you walk us through why this committee—I am fielding questions from virtually everyone saying, why are we only focus on fifth generation for years and now, fourth generation?

Why don't you walk us through specifically what has changed in the last 11 months for this decision to come before us.

General HOLMES. Is that better? Thank you. I will try to get better.

And to start, Mr. Chairman, I would go back to a couple of things that you talked about in your remarks and in the question. And the first is the limited budget that we face. Now, we have tremendous needs across the Air Force and across the armed services for im-

provements in modernization and sustainment, and we have to balance all those across all our portfolios.

And the second one I think is the health and the age of the 2,100 fighters that the National Defense Strategy requires for the Air Force to be able to accomplish the missions that they have asked us to do.

We have been on a path of purchasing less than 20 new fighters a year since Desert Storm. So that is a 1 percent replacement rate. That would put us on a 100-year recapitalization schedule for our fighters. And so that is how we get to a fighter force that averages more than 30 years old.

And the impacts of that are, our tremendous depot system and the American people that you saw on the assembly lines and also at the depots have worked miracles to keep those old airplanes useful. But we are getting to the point where it costs too much to do it. And the F–15C is a prime example of that.

The airplane has structural problems that will require replacement of major structural members, the longerons that run lengthwise in the airplane, followed by the wings being replaced, and then followed by bulkheads on the center fuselage, which means it would be better to buy a new airplane than to try to work through those repairs.

Mr. NORCROSS. That is important. Walk through. We originally budgeted approximately a million per plane. After the knowledge that came through on structural——

General HOLMES. Yes, sir.

Mr. NORCROSS [continuing]. What did that take the number up to?

General HOLMES. Well, so, the exact number will depend on the time that you go after, but that million per plane was based on fuselage longerons. And as you add the wings and the fuselage into it, the initial estimates we dealt with were in the tens of millions per airplane.

I think as we work with the prime contractor now, you can get that number probably down around $10 million or so per airplane, but that is an approximation. You don't really know until you open the airplanes up.

What we do know is that right now we have airplanes that are failing the inspection and are being parked until we can order the parts to begin that replacement process and our F–15 training unit at Klamath Falls in Oregon has nine airplanes that they are unable to fly because of the structural condition.

If you look across the rest of our fighter force, the F–15 is failing first. The A–10, as Ranking Member Hartzler, you know, pointed out, faces problems with wings. For the F–16 fleet, it is service life extension program that will require many airplanes to go into the depot to be repaired, which will cut down the availability of the entire fleet.

For the F–22, it is engines and the depot capability to support repairing and replacing engines to make up for the extra flying time.

So, what that means is, that we need more airplanes per year, and we are approaching a crisis point to get there.

And when we looked at the limited budget, as you pointed out, Mr. Chairman, we determined, along with the analysis that CAPE [Cost Assessment and Program Evaluation] did, and with the Department that the most cost-effective way to begin acquiring more than 48 fighters a year was to do a mixed buy of fourth- and fifth-gen airplanes.

You know, why is it more cost effective? Matt, Vice Admiral Winter, and his team have done a great job with Lockheed of driving down the cost of the air vehicle itself and producing an airplane that we are very happy with.

The guys flying the F–35 now are very pleased with the performance of the air vehicle itself and it is achieving great results at places like Red Flag, where Ranking Member Hartzler visited, and some of you were along with her, and in its first combat deployment.

We still face challenges in the sustainment cost as you pointed out and as Vice Admiral Winter pointed out, that I hope we will get to. But it will be multiple years to drive those sustainment costs down to where they match the F–15.

And then as we bed down additional fighters, there are additional costs that go with the beddown of the F–35 because you need low-observable maintenance facilities, you need some facilities that are not required for the F–15. There is additional cost per location if you add F–35s.

So ultimately, the balance between cost and our urgent need to meet capacity has led us to propose that we pursue a mixture of both fourth- and fifth-gen airplanes as the most cost-effective way to balance the capability that we need to acquire in the future with the capacity that we have to have every day to do the missions that the Secretary of Defense and our national leaders ask us to do.

Mr. NORCROSS. So, what started this initial question is that the F–22 was going to replace the F–15. That came up short. Then the F–35, if it had originally ramped up we would not be in this position; we are considerably behind. So of all the inventory that the Air Force could have picked, why the F–15EX?

General HOLMES. Thank you, sir. I think partly it was because of the F–15 being kind of the first airplane to fail, the F–15C. And if we want to replace aircraft and have the minimum impact on readiness across the Air Force, then replacing like aircraft with a reasonably like aircraft offers us the least reduction in readiness while we do it.

If an Air National Guard unit transitions from the F–15C to the F–35, it takes about 3 years to fully train all the aircrew members and the maintainers that work on the airplane in the unit because a lot of them are part-timers, and they have to schedule their training over a long period of time to be able to work through that.

If you replace the F–15C with an F–15EX, much of the airplane is the same, it is a very short training period to transition maintainers. A very small training program to transition aircrew members. And so it has the least impact on reduction or the least impact on readiness, excuse me, of the force during a transition.

And then we are able to take advantage of investment that other nations had made in improving the F–15 airframe. Saudi Arabia and Qatar had spent money to develop improvements to the air-

plane that would now be available to us at a reduced or no cost to incorporate. And for combination, I think for those two reasons, we picked the F–15EX.

Mr. NORCROSS. And we are focused on this because this is a major shift on the thinking. We are not anywhere near what the original projections were in purchasing the F–35, for a variety of reasons.

Would there be a scenario, given what we understand now for the F–35 line, that you would have to almost double the production in order for it to come in at a replacement rate that would keep the F–15EX from coming online?

Do we see that ability with the parts, like, coming in anywhere near what they need to? Is there anything we can do to the F–35 line to prevent us from going to the F–15EX?

General HOLMES. Mr. Chairman, I would probably ask for the details of that question to go to my friend Vice Admiral Winter in the Joint Program Office. But as we looked at the, what we think of as the seven or eight elements that it takes to actually field the weapon system of the F–35, producing the aircraft itself is one part of that. It is then keeping up with a simulator that matches the configuration of the airplane.

It is the AME [Alternate Mission Equipment], the other equipment that goes on the airplane where you can hang bomb racks and do those parts of it. It is the joint planning system, it is the ALIS. It is all the different parts, sustainment, depot of the system.

My concern would be bringing all of those eight elements along at the same time because right now, the air vehicle is out ahead of those other elements.

And so, producing more airplanes would be one part of it but keeping up in all of those other areas, to me, would be the challenge. But I think Vice Admiral Winter is more prepared to answer that.

Mr. NORCROSS. And we need to be focused. I get more questions on this issue than any other item. Why the shift. So, we are not backing off of the F–35. Is that an accurate statement?

Admiral WINTER. That is an accurate statement, sir.

Mr. NORCROSS. Is there anything, in your opinion, we could do, given the facilities, given the parts issue, the sustainment cost, that we could focus on in order for us not to also bring in that fourth generation?

Admiral WINTER. So, Mr. Chairman, I will talk about the business case that makes affordability a lucrative optic for F–35, and I will allow General Holmes and others to talk about would they not purchase F–15s.

But from an F–35 perspective, when we look at it theoretically, and when I mean that, bill of material, what does it cost to actually assemble an F–35. And we do that in a propulsion—so, engine from Pratt & Whitney, and the airframe and systems from Lockheed Martin.

When we look at our cost analysis for that, we can see a bill of material that is in an affordable range below $80 million. We can see——

Mr. NORCROSS. That is for the purchase?

Admiral WINTER. Yes. Yes, sir. I would start with the purchase because if you don't buy them, you don't need to sustain them. The fact that we are making that progress, and we are seeing the actual progress, is encouraging. My challenge is in the assembly.

So, the bill of material and the cost of the material keeps coming down because of volume. But the ability for those vendors and the supply chain to get those parts to the production line at the time we need them as the airframe is coming down the production line, is behind.

And so therefore, the cost, the labor cost of the human beings putting these things together, is my biggest cost increase. And so therefore, I am hitting a stagnant plateau with Lockheed Martin because they are 600 parts a month behind, on average; 600 parts not on the production line when I need them. So the aircraft is going slower down the production line than I need it to be. That drives cost.

And from that cost, I have to look across my portfolio. And when I look at sustaining the 400-plus aircraft that are out flying right now, I need parts to fix the airplane.

As Mr. Sullivan said, the reliability is getting better, but it is not where it needs to be. So it is a multi-dimensional interdependent problem that we are trying to solve.

Mr. NORCROSS. So, you are telling me the production line is in competition with the repair line for those parts when they become available.

Admiral WINTER. I am saying the supply chain is——

Mr. NORCROSS. Yes.

Admiral WINTER [continuing]. In competition, absolutely, sir. That supplier that generates a widget is generating a new widget for the production line, for our spares package, and we still have them repairing the ones that are breaking in the field.

Our initiative, to Ranking Member Hartzler's comment, we are taking that demand off the supply chain by putting it into our U.S. Air Force and Navy and Marine Corps depots here in the United States so we can repair the broken parts, allowing the supply chain to focus on generating new parts. But we are not there yet.

Mr. NORCROSS. I know Mrs. Hartzler has some questions on the F–15 and we will get back to some of my questions because everyone here is very focused on this.

Mrs. HARTZLER. Really, really good discussion, good questions, Mr. Chairman. Just to follow up on some of this.

So, I wanted to give Dr. Roper, and Mr. Daigle also, an opportunity to weigh in a little bit why the Air Force is buying a new fourth-generation aircraft over the advanced fifth generation.

Do you have anything you want to add? General Holmes gave a good explanation, but do you have anything you want to add?

Secretary ROPER. Ranking Member Hartzler, the number of aircraft that are needed to keep our readiness comes to me as a warfighter requirement.

So, the Air Force, working with others, look at the number of fighters that we need to buy each year to make sure that we have the capacity to go to war. And I think it goes without saying, we want as many fifth-generation systems as we can possibly have. We want to get the F–35 healed and fixed and into full-rate pro-

duction so that we can become an increasingly fifth-generation force.

But because of issues in the past, we can't buy that number of airplanes currently. And so, when the Commander of Air Combat Command says, I need more than 48 fighters per year, the Chief of Staff, we have to go look at the fourth-generation line.

Now, General Holmes hit it exactly correct. The F–15C is very difficult to sustain. I have been to Tinker Air Force Base twice to go through the F–15C line in depot maintenance. It is a hard aircraft to maintain, because over two-thirds of the fleet is past its service life.

We are having to now replace parts that weren't intended to be replaced. These are difficult to purchase, they have long lead times, especially the longerons. And so we are past the point the fighter was supposed to be.

Now, when you look at, is there an option to try to provide the warfighter a solution other than try to extend the Cs further in the future than they were meant to go, we can pivot to what our foreign military sales have done on the F–15E line. The upgrades that the Qataris and Saudi Arabia have done to that line would be major defense acquisition programs in and of themselves.

They have upgraded the radar, they have upgraded the avionics, they have updated the electronic warfare and the cockpit.

So this is a lot of foreign investment in that system that our warfighters can benefit from.

So going back to Air Combat Command and our Chief of Staff, I have two options to try to give them more than the 48 F–35s that they are getting.

It is a plan to try to sustain the Cs at high cost, or pivot to try to buy a much better aircraft that will be much more sustainable.

And from the acquisition point of view, of course, modernizing and benefiting from those over $2 billion of foreign investment is an appealing plan.

Mrs. HARTZLER. Very good, thank you.

Mr. Daigle, and I want you to expand a little bit more on, you alluded to, in your comment, that this whole mix study began in 2016 with Congress and the NDAA requiring this study. And as a result of that, that is what has resulted in the TACAIR mix that is being put forth.

So at what point in your study did you identify that we wanted to have F–15s and F–35s this year?

Mr. DAIGLE. So the fighter force mix study and subsequent analysis basically showed that as far as the eye can see, the Department will need a mix of penetrating assets and standoff assets. And this is common across any kind of portfolio we want to look at.

If we look at ISR, we have some very high-end penetrating stealthy ISR assets. We also have, for example, MQ–9s that are not really useful in that kind of environment that are really useful in permissive environments.

The same is true on the bomber fleet. We have, you know, high-end penetrating bombers, we have standoff bombers that are basically very large missile trucks, for lack of a better word.

So from our perspective, this is another version of that same conversation of how do we match the capabilities that we can procure to the mission sets that are generated under the National Defense Strategy. And that is what the fighter force mix did.

And it said, kind of as far out as the eye can see, that some kind of mix is going to be appropriate. And then we get into the affordability question. We have already talked in the room a number of times about the sustainment cost of the F–35 vice the sustainment cost of fourth-generation platforms.

And, Chairman Norcross, if you go back to a question that you asked about, could we ramp up. From the analysis that the Department has done, the next marginal dollar wouldn't necessarily go into increasing the richness, if you will, of the tactical aircraft portfolio.

If we look at tomorrow's warfights, the things that really matter are joint communications, space control. So, as long as there is a delta in the costs of the planes, and the Department doesn't see a pathway right now where we can get fifth-generation sustainment costs down to what we are seeing on the fourth-gen fleet, as long as that delta exists, then prudence dictates buy the platforms that align to the mission set in a way where you can kind of get as much capacity out of the available dollars as you can, and then take any money that you have left over and put it against the really highly critical gaps in the warfighting portfolio.

And again, I would naturally look to cyber and space and joint communications, joint battle management. Those things are really the drivers for the effectiveness of the joint force going forward based on the analysis that the——

Mrs. HARTZLER. Okay. Very good.

Mr. DAIGLE [continuing]. That the Department has been doing.

Mrs. HARTZLER. Thank you. I would like General Holmes and General Nahom to talk a little bit about how the F–15X and F–35 complement one another in their capability perspective and what unique capabilities that F–15X bring into the tactical fighter inventory, whether in terms of range, or payload, or standoff.

General HOLMES. Yes, ma'am. So beginning with the statement that, you know, there are environments that the F–35 can operate in that the F–15EX can't. And that is a simple fact. There are places that you wouldn't want to send the F15–EX that you can send the F–35 as part of a team.

But in the environment, say, of the last couple of years of combat over Syria, where we faced Russian air defenses and Russian fighters, the combination of F–15s, A–10s, F–16s, paired with an F–22 as a fifth-gen quarterback to be able to detect threats that the others can't, to be able to pass information to them that they wouldn't get on their onboard systems, has made them more effective and kept them safer in that environment.

And with the F–35 deployed there today, you will see the same thing and the benefits of partnership.

When the F–35 gets more information than anybody else has and then shares it across the network, then it makes the whole team better. And then the capacity that is in the fourth-gen fleet means that you can carry more weapons, you can stay out there longer. And so they do complement each other.

And as Mr. Daigle pointed out, no matter where we go with trying to get the 72 airplanes for the foreseeable future, we are going to have a mix of fourth- and fifth-gen airplanes flying together and fighting together to deter or counter the threats that we face.

Mrs. HARTZLER. General Nahom, do you have anything you want to add?

General NAHOM. No, ma'am. Just that that was really what we looked at very closely with our friends in CAPE over the summer. There is a difference in the costs of operating these airplanes right now based on the numbers we looked at over the summer. And it was trying to get to that capacity because when you get into—even in the 2030s, 10-plus years from now, there are missions we are going to rely on fourth-generation airplanes to accomplish.

Certainly they can't do some of the missions as General Holmes highlighted. But there are missions we are going to need to get done and we are going to rely on fourth-generation airplanes.

The F–15E, the A–10 for the next 10 years, and certainly the later block F–16s. And a significant problem we had looking at the portfolio as Dr. Roper highlighted, that we can't rely on the F–15C to get us to that point. So it was about a fill in that capacity.

Mrs. HARTZLER. Very good. I have a few more but let us get to some other members here. Thank you.

Mr. NORCROSS. Mr. Gallego.

Mr. GALLEGO. Thank you, Mr. Chairman. I had some questions for Dr. Roper.

What is the length of the projected life extension of the 173 A–10 Thunderbolts that have received new wing sets, and of the remainder that are planning to receive new wings?

Secretary ROPER. Congressman, thank you for the question. We are currently going through the source selection for those wings right now. We are certainly hoping that we are going to get to benefit from modern digital engineering practices so that we will be able to do the re-winging quickly. The specifics of how long we are going to be able to extend are going to be based on the specific proposals that come from vendors. But I am hoping for, you know, for at least 10 years.

So, I will take that for the record and once——

Mr. GALLEGO. Okay.

Secretary ROPER [continuing]. We are through selection, I will make sure I get you that information, sir.

[The information referred to can be found in the Appendix on page 161.]

Mr. GALLEGO. Good. I also see in the hearing memo that the remaining 108 A–10s in need of new wings will be delivered by fiscal year 2022. When will the re-wing of those aircraft be completed?

Secretary ROPER. Again, Congressman, that does depend on the specifics of the proposal. But we are incentivizing the rapid re-winging as quickly as possible. That is one of the performance metrics.

So, we know the warfighter needs to be able to fly those A–10s so we are incentivizing speed in the selection, sir.

Mr. GALLEGO. And the warfighter on the ground needs their air support.

Mr. Behler, I understand that you are moving forward on the comparison testing between the F–35A and the A–10C. And that testing the two planes' close air support, combat search and rescue, and airborne forward air control capabilities was completed in March at Edwards Air Force Base—almost messed it up, in March at Edwards Air Force Base.

Do you have any initial results of this operational testing that you would like to share with us? Mic.

Mr. BEHLER. Thank you very much for that question. We did complete it last month. We are still, of course, analyzing the data. The first testing was done last April. We got about two-thirds of it done then. And then the A–10s had to go back to the operation.

Brought them back in March and we were able to really stress both airplanes. And the whole idea was basically to look at the capabilities of both. I just want to make sure everyone realizes, this is not a fly off, which was better, because they both have awesome capabilities, kind of the same line of comments that General Holmes had.

We stressed these both day and night against moving targets, terrain where it is urban, we used the threats on the ground were radar-guided SAM [surface-to-air] missiles, we had MANPADS [man-portable air-defense systems], we had AAA [anti-aircraft artillery]. So this was a very stressful environment. When we had the combat search and rescue, we actually had a downed crew member out there at nighttime. And during that mission, we actually brought in either HH–60s or MC–22s to recover the downed crew member.

So, it was a very, very stressful thing but, you know, I am trying to—I have to stay within the operational security aspects, because——

Mr. GALLEGO. Sure.

Mr. BEHLER [continuing]. We have airplanes in combat as we speak with both of these. But I will just give you two very, I think, important points that we were able to find so far without analyzing all the data.

Is, the F–35, as we expected, has a big advantage in a high threat scenario where the stealth and sensor fusion really helps. In a lesser threat environment, we were able to put more weapons on the wings of the F–35. So, we were able to get much better loads on the aircraft.

The A–10C, as we thought, in a low threat environment, with more fuel and more weapons, they really do a very good job. And the other part about the A–10C is that they specialize avionics for those three missions that you have mentioned.

And one thing that can't be overlooked is that there is 40 years of experience close to the ground with the A–10 and training really matters. We had, in the second part of the testing in March, we had A–10 pilots, former A–10 pilots, that are now part of the F–35 force.

Mr. GALLEGO. Mr. Behler, just because I want to get a couple more questions in, I am going to cut you off.

Mr. BEHLER. Okay.

Mr. GALLEGO. When will get the full report? As to the committee.

Mr. BEHLER. Well, the committee will get the full report with the Beyond LRIP [Low-Rate Initial Production] Report which I hope is going to be at the end of this year. But we analyze the data. I would be happy to come at the right forum and give you the data as we see it when we have it.

Mr. GALLEGO. And who will be responsible for the final report? Will be it OT&E or the F–35 Joint Operational Test Team?

Mr. BEHLER. It will be me.

Mr. GALLEGO. It will be you.

Mr. BEHLER. I write the final report. It is called the Beyond Low-Rate Initial Production Report.

Mr. GALLEGO. Okay. And then what action does the Department intend to take based on this testing? Operational changes, change the deployment of the aircraft, or changes in terms of acquisition plans?

Mr. BEHLER. For the F–35 or?

Mr. GALLEGO. For the A–10C.

Mr. BEHLER. Well, I think—we did find something that we are finding, and we found the other day when we flew the F–35 in combat, is when we flew the fifth gen and the fourth gen, there was a very good synergy of the two platforms.

The F–35 works as a great quarterback. It is like a mini AWACS [Airborne Warning and Control System] out there. Data fusion, to be able to coordinate with the fourth gen really provides a good performance.

I think the biggest thing that may come out of this is developing new tactics to be able to do these missions and with a fifth-gen, fourth-gen mixture.

Mr. GALLEGO. Okay. Thank you. I yield back.

Mr. NORCROSS. Mr. Cook.

Mr. COOK. Thank you, Mr. Chairman. I want to get back to the F–22. I am not happy at all, but that is ancient history. It is gone. What I am unhappy about, I still always ask the questions about the parts for the F–22. And here we go again.

Why have that aircraft if you don't have the parts for it? It is just like the F–35. And I am showing my ignorance, but I think that is unpardonable, because that is a great aircraft, just as we are finding out about the F–35.

I had more questions about the F–35, it is too expensive, and I was probably the biggest pain on this committee, which I haven't changed at all.

But how can we ensure that that F–22, particularly in NORAD [North American Aerospace Defense Command] and everything else, and that is going to be one of our major points of—that they have those parts. I am going to start asking over and over again. Because I think there was C4 or C3 often, which means not combat ready or not deployable.

General Holmes, by the way, thank you for Red Flag, everybody on this committee should go there, it was fantastic.

General HOLMES. Thank you, Congressman. I, you know, I agree with you that the Air Force, we need to sustain the aircraft that we have and what I would come back to is the budget pressures that the Air Force was under with the Budget Control Act and the tight budgets that we looked at, and going back to the chairman's

comment of a limited budget. Trying to balance through that period.

Mr. COOK. Yes, I know, but a few of us here, Mike Turner always raises hell for the Air Force if he has had a haircut or not.

[Laughter.]

Mr. COOK. But there is a number of us that are strong advocates, and you remember when the U–2 was going to be killed, and General Scaparrotti said No, I need it in Korea. And I think it was one of the best decisions. By the way, I like the part where the U–2 is up—and that thing, the U–2 was not as old as I am, but it is getting close, because I am lying about my age every year.

Admiral WINTER. Sir, if I could, this year we moved almost half a billion dollars in——

Mr. COOK. I know, I know. And I love it. And just the fact that you take the frame, you do it all over again, put all the—I think that is, you know, a way to go. So, I am very, very happy with it.

Admiral, on the F–35 variant with the machine gun, are the problems over where that works external? I thought it was something problem or kind of, and I am not an aviator, obviously. I am a ground guy. But have we solved that with the machine gun? External? Maybe that is a bad phraseology to the aircraft. You know what I am talking about, I think.

Admiral WINTER. Yes, Mr. Congressman, thank you. For the F–35A, they have an internal machine gun, Gatling gun. And for the F–35B and C, they have a pod——

Mr. COOK. Okay.

Admiral WINTER [continuing]. That is on the center line that is——

Mr. COOK. I am talking about the B and C, primarily.

Admiral WINTER. Yes, sir. So, we have overcome the manufacturing inefficiencies that were the initial concerns of those gun pods with General Dynamics. And to date now, the testing of those gun pods are meeting the specification. The lethality evaluation is still ongoing by the operational testers.

Mr. COOK. Good. My last question.

And, Mike, close your ears. The S–400 [Russian anti-aircraft missile system], which as we know, we have had discussions with some of our allies that are acquiring the F–35 and also the S–400, this is going to be a problem with NATO [North Atlantic Treaty Organization] allies, I am afraid.

How concerned is anyone on this panel with the fact that we have perhaps one of the greatest aircraft, and you look at the screen, and no one detects us. It is going to change if we have that interface of technology, what have you. Any? No one wants to tackle that one at all? Probably smart reply. But yeah, Admiral.

[Laughter.]

Admiral WINTER. Well, sir, I will take the first stab. First of all, the Department and the administration has been very clear that an S–400 and an F–35 is incompatible, and we are on the record for that. And senior administration continues to have open dialogue with their counterparts in the government of Turkey.

From an F–35 perspective, we have been given direction to ensure that we can minimize any disruption from supply chain, for example. In the event if anything occurs later this summer, we are

tracking to the first aircraft arrival which are those two Turkish aircraft that are scheduled to fly into country in November, which will not occur if they procure the S–400.

I stay out of the S–400, but from an F–35 perspective, I can give you confidence that we are doing the appropriate actions in advance to minimize production disruption and to safeguard the technology that we have invested in. Yes, sir.

Mr. COOK. Thank you, Admiral. I am done.

Mr. NORCROSS. Mr. Brown.

Mr. BROWN. Thank you, Mr. Chairman. I am an Army guy and for those of you that didn't view the hearing yesterday, the Army fielded only four people to handle Army modernization. I see you have doubled the number here. I don't know what that says about the Air Force capability or capacity or readiness, but we are glad to have you here.

Let me ask you about the F–35 and specifically the lifecycle sustainment plan. And in the plan, it outlines a approach to getting to $25,000 cost per flight hour. And I think everyone seems to be in agreement that we can get there by 2025 and please correct me if I am wrong.

And my question is, how has the cost to operate the F–35 fleet come down since the first IOC [initial operating capability]? My understanding is that the cost controlled by the industry team have come down by about 15 percent over the past 2 to 3 years, and what actions is the Department doing to reduce the cost to operate and support the F–35.

And whoever is best equipped to field it, you will know better than I would.

Admiral WINTER. Mr. Congressman, I will start that from the——

Mr. BROWN. Okay.

Admiral WINTER [continuing]. F–35 JPO perspective first. First of all the lifecycle sustainability plan, the LCSP, as we call it, I will tell you that the traditional document is one that usually gives strategic guidance. This time, the Department took a different tact, and it is truly an implementation plan, with crisp actions, with followthrough, and metrics to track our ability to truly get our hands around the lifecycle costs of F–35. And we use the LCSP as our document to move forward with.

From a specific "25 by 25" [$25,000 by 2025] I will tell you that our current F–35A cost per flying hour is $44,000. That is on the record. That is actuals from fiscal year 2018. We have targets over the FYDP [Future Years Defense Program] and we have been doing—over the next 5 years to understand how we can actually march down the cost per flying hour to get to, as I said in my opening statement, to an affordable cost per flying hour for the United States services. Because they have other demands for those resources outside of the F–35.

Right now, we are targeting a $34,000 cost per flying hour for the F–35A in 2024. We know the levers, we know the initiatives in spare parts, in what we call depot-level repair. Being able to repair those parts. The ability for our service members to actually conduct the maintenance on the flight line, which reduces the turn-

around times, and be able to give them the tools and the maintenance plans to be able to do that work.

Mr. BROWN. So, are we confident that we can get to 25 by 25?

Admiral WINTER. I will go on the record, sir, that 25 by 25 is a target.

Mr. BROWN. Okay.

Admiral WINTER. I am targeting 34 in 24.

Mr. BROWN. Okay.

Admiral WINTER. So, it——

Mr. BROWN. Let me, if I can, because I have another question, and I don't have much time.

Admiral WINTER. Yes, sir.

Mr. BROWN. Like Representative Cook, oh he is no longer here. I am not really a ground guy, but I love the ground guys. I was rotary wing, so I am low and I am slow, and I like the A–10. And I know that you have talked about the A–10 versus the F–35 in terms of assessing its mission performance.

Moving away from that, given the conversation that we have been having about F–35, F–15X, what does that mean for the A–10? Are there, you know, and in terms of between now and when we project to be the last flight hour of the A–10 and the milestones between now and then, has any of that changed? And when is the last flight hour of the A–10?

General HOLMES. Thanks, Congressman. We like the A–10 too. And when you do the analysis, it is our most cost-effective and effective platform in that permissive environment to operate.

And we plan to keep the A–10, we plan to re-wing A–10s, we plan to get to the rest of their structural issues and what we call the hog back. And when you take care of wings and the hog back, the airplane can fly a long time. Beyond the ability of some of our other fourth generation——

Mr. BROWN. And let me just say this in my last 30 seconds, what I like about the A–10, aside from the performance evaluation, and the cost, and the fact that it is in the Maryland National Guard.

But what I really like about it is the F–35 is highly sought after. And everyone is going to be competing for that air time, and for that mission. But the guys on the ground, the men and women on the ground, they know that the A–10 has really a limited mission set—that it is close air support and that is what they want.

So, I hope that the A–10, and I am picking up perhaps where McSally left off when she went over to the Senate. I hope the A–10 has a long life remaining in the fleet.

Thank you, Mr. Chairman.

Mr. DAIGLE. Mr. Chairman, may I have 1 minute to respond? I just want to go back to the cost per flying hour for the F–35.

The JPO estimates—in 2024 is $34,000 per hour. For the As, our estimate's $36,000 per hour for the As, about the same.

The Department doesn't see a path to get to $25,000 per flying hour by fiscal year 2025. There is a fair number of studies going on right now that are going to provide some more information to that.

But that is a target, and it is not our projections for where we are actually going to be. And then after 2024, our projections are that the cost per flying hour are going to start to flatten out and

increase a little bit because the planes are starting to age, and we are going to have to bring them back into depot and so the costs are going to increase at that point, so.

Mr. NORCROSS. Mr. Gaetz.

Mr. GAETZ. Thank you, Mr. Chairman. And because I saw my friend, the gentleman from Ohio, Mr. Turner, scribing out his potential rebuttal to Mr. Cook's comments about Turkey, I wanted to echo Colonel Cook's concerns.

If Turkey wants to be treated like an ally, they need to act like one. And I appreciate Admiral's statements about the incompatibility of their plans with the S–400 and the F–35. But I am increasingly concerned about Turkey's malign influence campaign globally, and specifically in Venezuela.

And so, where they are extracting gold, they are bringing it back to prop up the lira, and that is creating broader instability. And so I think that the concerns with Turkey go beyond just the S–400. I think there are other foreign affairs concerns that we have with them, and I would be deeply concerned about the delivery of the F–35 system to them at this point given their broader bad behavior.

Moving more specifically to the subject of our hearing, Admiral Winter, I represent the great folks with the 33rd at Eglin Air Force Base that are engaged in the training mission with the F–35. They have at times been concerned about the delivery of parts so that they are able to complete the training syllabus and get you your great aviators to go and populate combat squadrons.

I have received more recent feedback that the standing up of parts depots and the Congress' investment in additional parts resources has been helpful. But can you provide an update as to our expectations to deliver those parts, because what I hate hearing from the 33rd is that, you know, they will send a part for repair and then that part will head out to a combat squadron and then we are kind of eating our seed corn.

And I know getting those parts to our combat squadrons is important but if we are not training the next generation of aviators, then ultimately that has an impact on the durability of our mission. Admiral.

Admiral WINTER. Mr. Congressman, thank you for that question, and your concern is a valid one. Our training fleet has been a priority behind our warfighter-coded—combat-coded fleet. And as we ramp up our parts production and parts delivery, we have gone back to the services, the Air Force, Navy, and the Marine Corps, to ensure that those priorities are aligned to their service priorities.

What is really bringing the training fleet back to full capability is the modification from TR–1 to TR–2. So that is a technical refresh of those older jets that are predominately down at Eglin and being able to have the updated capacity for computing, for displays, and for the radar and other systems that will increase their reliability.

That will be completed by the middle of next year. Right now, we are targeting June of 2020 of not all of just the training, but for the entire fleet. That is a first order effect of getting those, the 33rd specifically, up to the reliability levels of the rest of the fleet. Thank you, sir.

Mr. GAETZ. I appreciate that. And one of the other benefits that the 33rd has due to their location is that they are able to access the Gulf Test Range in a lot of their work and in a lot of the execution of the syllabus.

Can you speak to the importance within the training mission of having access to the telemetry and radar systems that allow our aviators to be well prepared when they head on to combat squadrons?

Admiral WINTER. Mr. Congressman, as the PEO for F–35, I think that is more in the lanes of either General Holmes or others.

Mr. GAETZ. Sure.

Admiral WINTER. But we provide the compete capability and the support for that training output.

Secretary ROPER. Congressman, Yes, we are really struggling with the mics here, but we are going to just try to push really quickly to get in. So, I cannot underscore enough how important our ranges are. I mean, we are dealing with a peer competitor again, which means we are going to have to test in operationally realistic environments. And they are going to be places that we are going to trust simulation but there is nothing better than getting data in the real world.

And so, the testing that we are able to do both in the Gulf and in some of our other ranges is critical to getting acquisitions correct. So, you will find us fierce champions of keeping our ranges fully operational, fully funded so that we get the benefits that they give Air Force acquisition and the Department as a whole. Because we test more than——

Mr. GAETZ. And the Gulf Test Range offers unique capabilities, right? Because it is the only place where we can live fire over water and have munitions land on land, right?

Secretary ROPER. Only place you can live fire over water, you have got our program executive office for weapons is at Eglin Air Force Base, so that is serendipitous. So, Eglin is a very important base for us in the Air Force. It is important for the nation.

Mr. GAETZ. And is it a good idea or a bad idea to launch experimental missiles over oil rigs?

Secretary ROPER. It is probably not a good idea, Congressman.

Mr. GAETZ. Right, right. So, I think it is critically important, as we are hearing you say, that in echoing Ms. Hartzler's comments that, you know, our munitions development is critical to execution of the National Defense Strategy to meet our near-peer adversaries.

The only place we are able to do this particular type of testing is the Gulf Test Range. And if 2020, if we do not take action in the NDAA or otherwise, we are going to have oil rigs there, instead of the weapons testing that we need to preserve the country.

Thank you, Mr. Chairman. And I yield back.

Mr. NORCROSS. Mr. Golden.

Mr. GOLDEN. Thank you, Mr. Chair. I just want to take a few moments, gentlemen. First of all, thank you for the conversation about the thinking behind your proposal for fifth-gen, fourth-gen mixture. I appreciate that very much.

I want to echo the sentiments of Representatives Brown and Gallego about the A–10 and just say that, you know, I hope that

you will continue to make sure that you maintain that asset and that capability well into the future and think about it beyond that. For the guy on the ground, the close air support is awfully important.

That A–10 is impressive, you know, when you have some kind of forward air controller out there with you, calling close air support, and being able to get nice and tight. It makes a big difference.

I know that doesn't figure into your testing, sir, but it inspires confidence on the ground and the sound of that 30 mm is just calming in its own special kind of way.

So, with that, let me just ask Mr. Behler, I would like to join Mr. Gallego in any kind of briefing that you give when you are ready to do that. So, thank you.

Mr. BEHLER. Yes, absolutely. And that should not be too long from now that we will have the final results.

Mr. NORCROSS. Mr. Turner.

Mr. TURNER. Thank you. I just want to begin by saying the only rebuttal I have to Mr. Cook is he knows I have a 2 o'clock haircut appointment today, so.

[Laughter.]

Mr. TURNER. He just wants to claim credit for it, but he already knows that I am having it cut at 2:00, so whatever.

[Laughter.]

Mr. TURNER. The—not as a pressing issue as Turkey obviously. Part of the problem I think that we have here with the F–35 and the 15X discussion is that regardless of the fact that the Air Force is saying that the recommendation for the 15X is not happening at the expense of the F–35, it is.

The Air Force is coming to us, requesting fewer F–35s in the future. And my concern is that we are going to be repeating the same mistakes that we have made before.

Admiral, as you know, our goal is more planes. The more planes we buy, the cost goes down. We don't have an ability to ramp up without having taken that step each and every year. Both in our supply chain, I mean, we are an unreliable purchaser.

So when we look to the supply chain and the need for people to invest downstream, and they look forward as to what the reliability of our commitment to purchase is, it is a riskier invest.

So, each year, if we ramp up, our costs go down, the supply chain gets a chance to respond. If we zig zag, if we go up and down, if we have future projections that we don't meet, we are affecting, we are causing our own problems in the delivery of parts and in the ability of the production line to continue at a faster pace.

Dr. Roper, you said that we are living currently with some problems that were created in the past. Aren't we creating those problems and continuing them in the future? Don't we need to make a greater commitment to the F–35 for it to have the sustainability in production, in supply chain, and in lowering costs?

Secretary ROPER. Congressman Turner, we are fully committed to the F–35 and we are making those investments to get to full-rate production. It is just a reality that the investments are long lead. We have to get the total supply chain under control and——

Mr. TURNER. But isn't that true that it is a rolling long lead? That if I don't make that decision this year, and then I have to

make it again next year, and then I have to make it again next year, you institutionalize the inability of the production line and of the supply chain to meet your needs.

Secretary ROPER. Yes, yes, Congressman, you don't just look at your supply chain for the immediate year. When we talk about F–35 in the Department, we talk about the path to getting to full-rate production and the investments that need to be made in the supply chain to get to full rate. So, we are buying——

Mr. TURNER. And so, you are currently planning on reducing your planned buys of F–35As by 30 in the future year defense plan and if I am in your supply chain and I look at that, and I am making a decision for investment, you have just negatively impacted my long-term plan which will not allow you in the future to ramp up production in the supply chain, right?

Secretary ROPER. So, Congressman, we are working very diligently with Lockheed Martin to get to full-rate production by Lot 15.

Mr. TURNER. Doesn't that require that you buy them? I mean, if you continue to project that you are going to reduce your production, you can't get to full-rate production. And no one is going to look at you as a reliable partner——

Secretary ROPER. Congressman——

Mr. TURNER [continuing]. By not taking that step of commitment.

Secretary ROPER. Yes, Congressman, I will certainly try to allay your concerns. That we want to buy the max number of planes that the line can produce in a healthy fashion. I am sure Admiral Winter would be happy to go through some of the issues that we are——

Mr. TURNER. Well we actually had that hearing. We know that there's extra capacity in the production line that can be met right now.

Secretary ROPER. But——

Mr. TURNER. We know that.

Secretary ROPER. But it has to be supported by the base——

Mr. TURNER. Right.

Secretary ROPER [continuing]. That can sustain that production——

Mr. TURNER. Dr. Roper—but we have had that—we have had that meeting. We understand that the capacity is there. Now, if you don't meet the full capacity this year, you are not going to have an ability to increase capacity the following year, because this is just stairstep. And if you flatline it, or if you have a jagged commitment to purchases, you are going affect that yourself.

General Holmes, it is great to hear you talking about the A–10. You know, this is a very frustrating discussion to have about the F–15X because, you know, there was no discussions whatsoever about the F–15X just months ago.

But it is a 40-plus-year decision that you are making. Now you sit in front of us and say how great the A–10 is but you know the only reason you have the A–10 is because we had hearings like this where the Air Force stood in front of us and said we need to stop the A–10 and we would not let you.

Similarly, there have been programs where the Air Force has said, we are going to go march this way, then we are going to go

march that way. How is it that a program gets—comes out of thin air with just months? No requirements, no competition. A 40-year-plus decision gets just airdropped in the middle of the Air Force long-range plan when there has been no discussion about this previously.

General HOLMES. Thank you, Congressman. Every year in my term as the Air Force 5/8 [A5/8, Deputy Chief of Staff for Strategic Plans and Requirements], the subject of more fourth gen came up and the F–15X usually came up as part of that discussion. And the reason is, is because it is a line that is open. The A–10 line is not open. The F–15 line is open.

So, every year there are proposals that come in and every year it has been considered. In the years prior to this year, we had all the money that we could use was given to try to get to 48 F–35s because of the limits on the budget.

And I do, I think there are a lot of people that are glad we still have the A–10 but the reason the Air Force had a discussion about the A–10 in the first place was because of the Budget Control Act and limited budgets. It drove us to try to make some choices and to bring choices to the Congress. I am glad we still have the A–10.

This discussion has been made every year in the 3 years I was the 5/8 and in the 2 years since then. The question is, why this year? And I think the reason why this year is partly what we talked about.

It is that the F–15C, we have more information it is not going to make it. F–15Cs are parked now that we can't fly and to try to get to 72 within the money that is available in the Air Force budget, and the money that the Department of Defense gives for the fighter portfolio, this was the way that we could get to 72 airplanes. It was not affordable to get to 72 airplanes in the F–35.

Mr. TURNER. Thank you, Mr. Chairman.

Mr. NORCROSS. Mr. Carbajal.

Mr. CARBAJAL. Admiral Winter, the April 2019 GAO report indicated that the F–35s were not meeting half of their reliability and maintainability metrics, which obviously leads to an expensive and less reliable asset that is costing a sustainment cost of about $1.1 trillion.

This is challenging, especially when you consider the supply chain problem that seems to exist. I understand that DOD [Department of Defense] has taken steps to address this issue and close the gap. But moreover, you mentioned that we are behind 600 parts per month. This is obviously very alarming.

How are we addressing this? Can you provide us with an update on this issue?

Admiral WINTER. Mr. Congressman, absolutely, and thank you for that question. I will make sure that I address the 600 parts to the production line, which aren't exactly tangential to the reliability, maintainability improvement program. That was the report subject by my colleague, Mr. Sullivan, which I will say that, I appreciate the GAO's continued help and engagement to ensure that we are keeping ourselves focused across all lines of effort in the F–35.

From our spare parts and our production parts, our supply chain is pressurized in being able to give the capacity of output for spare parts and sustainment, and production line new parts.

We have traced a couple of causal factors. One is the slowness of our prime contractors to actually put out what is called a purchase order. So being able to tell the supply chain to start generating those parts.

We have helped our prime contractors to increase the agility of their business systems to be able to do that.

Second, we have looked into our supply chain to determine where the capacity barriers are, and we are providing resources for them to increase capacity in the supply chain to generate those new parts.

Third, we are removing their requirement to repair those broken parts, and getting that stood up in our U.S. Air Force and Navy depots so that we can get more parts to the flight line for our maintainers to fix airplanes and more parts to the production lines so we can reduce that backlog and keep the production line moving forward.

Mr. CARBAJAL. So, if—to what extent has the problem now been addressed though? Eighty percent, fifty percent, what kind of success are we having?

Admiral WINTER. So, sir, because of what I call the delta growth, as we are ramping up the production so that the capacity needed for more parts, because of the increased production line, and the increased fielding of aircraft into our warfighter's fleets.

The demand signal we can measure, but we do not have a stable baseline of demand. That demand continues to move forward. To give you a percentage of what we have accomplished would be hard to calculate.

What I can tell you is that we have talked to the entire supply chain, from Lockheed Martin in the airframe and Pratt & Whitney in the propulsion system, and with consistent engagement for their requirement to tell us where their shortfalls are.

The majority of our supply chain is within the United States. But there are areas of our supply chain that are in the international domain that we need to continue to make sure that that stays whole.

So, right now, my main focus to Lockheed and Pratt is to make sure that their tiered suppliers, the first and second tiered suppliers, are communicating where their shortfalls are. That wasn't happening in the past. So I will take for the record a percentage of the supply chain that has been engaged.

But I will tell you that the majority of that supply chain has been engaged, and we have been identifying where those bottlenecks are in the supply chain, and we are tackling them as we get them identified.

[The information referred to can be found in the Appendix on page 161.]

Mr. CARBAJAL. Thank you very much.

Mr. Chairman, I yield back.

Mr. NORCROSS. Mr. Bacon.

Mr. BACON. Thank you, Mr. Chair. I have a whole series of questions so if we have time afterwards, maybe I can get a second round in if time allows. Well, first of all, thank you for being here.

I have worked with General Holmes and widely respected and trusted and it is good to see you again. Especially with a couple more stars on. So, congratulations. And my first question is, what I think I heard from you today, was a strong affirmation for the F–35, F–15 mix. But do I have that right?

General HOLMES. Yes, sir. The F–35 is the future of the Air Force. And to get us through this period, we need to pursue a mix of airplanes and this is the most cost-effective way to do it.

Mr. BACON. You know, it seems to me we are in this situation because we canceled the F–22 production around 2010. Is that a fair judgment?

General HOLMES. Congressman, I think that is certainly a factor. That we canceled the F–22, and then we made decisions to wait based on what we hoped could be accelerated in the F–35, and it turned out it wasn't able to be accelerated.

Mr. BACON. Right. What is our air-to-air superiority requirement? And how much does the F–22 fulfill of that requirement?

General HOLMES. Right now, we have performed air superiority requirements to [Off mic], certainly, on the front lines in inter [Off mic]. We will continue to bring modernization requirements as every day, our adversary gets a little bit better, every day, it gets a little harder to maintain that purpose. Looking for the shot that remains.

If you want to [Off mic] better the entire Air Force, then [Off mic] air superiority [Off mic] for us to control the air so that they can operate on the ground underneath it. So we can take modernization [Off mic] critical [Off mic] its path to work.

And at the same time, we are investing our money in new technologies that will someday be a successor in the Armed Forces' capability that will make sure we can do that into the future.

Mr. BACON. Thank you. Go ahead.

Secretary ROPER. And, Congressman, as we modernize the F–22, one of the things that we are really excited about is switching to open architecture. So, once we open up the systems, that will give us a great tool to keep it current. We will work software concurrently and modernization and sustainment so that if the warfighters' needs shift between modernization to sustaining and back to modernization, we will have a production pipeline that can deal with that.

But open systems have to be our standard going forward. We have to design things up front for sustainability.

Mr. BACON. Right.

Secretary ROPER. So, that is a lesson learned that we are taking to all new programs, but I am excited to get it on F–22.

Mr. BACON. Come back to the Echoes. This is like my third question, I was going to come back to you on it. But I want to ask Admiral Winter.

On the F–35, you know, we had this giant sensor, all these sensors on the F–35. Are we making progress on getting that data off the jet, real time, back to your operations center, so that the follow-on sorties have that data before the F–35 lands.

Admiral WINTER. Mr. Congressman, that is a great question. Internally, from a tactics perspective, our multi-functional advanced data link communication amongst F–35s is the primary information exchange. And then our Link 16 conduit to other non-F–35, not just airframe, but from surface ships to satellites and everything in between.

From a data engagement on the aircraft itself, to be able to come back from a mission planning, and more importantly, from a threats-based affects to be able to update our mission data files, we are challenged in being able to meet the turnaround times that our warfighter needs.

General Holmes has made it crystal clear that we need to get our mission data file reprogramming agility up to speed. We need to get our simulators ahead of the aircraft software releases, and we need to get our ALIS system up to speed to be able to generate at scale the growing fleet.

We have initiatives, investment initiatives, supported by this subcommittee, on all three of those efforts to get after that. Thank you, sir.

Mr. BACON. Yes. This is a real important issue, Mr. Chairman. You have phase 2, phase 3, your best sensors are the F–35, maybe the F–22, perhaps the B 21 in the future. But we have to get that data off real time, because there is other guys getting ready to go into the fight. And they can't wait 2 or 3 hours for the aircraft to land. So I think it is an important problem to work on.

Dr. Roper, you already talked about this a little bit. You know I have been a big advocate for the modular open system architecture, or last cycle we were calling it SOSA [sensor open systems architecture]. Now we are calling it MOSA [modular open systems approach]. Are we making good progress when it comes to EW [electronic warfare] and ISR with these open architectures?

Secretary ROPER. Congressman, we are. It is much easier to do when you are in the design of a program. You make it one of the criteria for the competitive award.

For programs that we already have designed from the past, we are really having to work hard to get it into them as part of the sustainability imperative. Things like F–22, the F–35 and Block 4 when they get TR–3 will have open systems on it.

It is a challenge because if the system wasn't designed for it, you have to do a lot more work to put it in after the fact. But in terms of lowering cost for sustainability and keeping the warfighters' edge through the ability to modernize it, it is completely worth it.

Mr. BACON. Okay. Thank you.

Mr. Chairman, I am out of time, but if we have time to come back later, I do want to talk about the light attack program. Because there is some question about where we are at with that. Medium-altitude ISR, want to have some information there. And also some EW questions.

But, if we have time when we are done.

Mr. NORCROSS. Ms. Hill.

Ms. HILL. Thank you, Mr. Chairman. And thank you all.

General Holmes, you just talked about the challenges on air superiority to near peers. We just heard yesterday from NORTHCOM [U.S. Northern Command] that the F–35's the best possible way of

combating the challenges that we are facing up north in the Arctic Circle, from Russia.

And I am just curious, the thoughts around moving to the 15X. How are we looking for that in the long term? How are we going to be able to keep the edge? Keep the warfighter's edge? And I guess this question goes to anyone who wants to chime in on it.

General HOLMES. As I think I understand the question is that if we invest in the F–15X instead of the F–35? How about now? How about now? There we go, thank you. It is the impact of F–15Xs in the homeland defense role vice the F–35.

We'll—right now our day-to-day alert of the United States is covered by a mix of F–16s and F–15s. And as we go forward in the future, we will have a mix I think of fourth and fifth gen threats. For some of the scenarios, having a big airplane that carries a big payload and an electronically scanned radar that can find cruise missiles won't be in a threat environment that requires that very sophisticated low observability of the F–35.

For some cases, where you are trying to move forward and take on long-range bombers that are escorted by sophisticated fighters, and shooting long-range cruise missiles, it will be.

So, I think you will see a mix of the forces presented to the NORTHCOM just like you will see a mix in the forces we present to other COCOMs [combatant commands] of fifth gen and fourth gen, and they will have a requirement for both.

Ms. HILL. Okay. So, oh, go ahead.

Mr. BEHLER. I would like to add a comment about how we are going to test these things. So, we have a Joint Simulation Environment that is getting close to being complete and we will be putting the F–35 in a test in there to fight against simulated accredited threats like the J–20, J–21, surface-to-air threats, electronic warfare, in an environment that we can't do in open air.

So, going forward, as we develop the Block 4 and other capabilities, the B–2 and other fifth-generation assets will have to use this simulation environment to really look at the capabilities that it has against the fifth generation.

I will add one more point, is that fifth-generation pilots like to fight against fifth-generation threats. And today, we do not have any fifth-generation full-size threats that we need to think about in the future.

Ms. HILL. But aren't we going further out, isn't that the long-term issue that we are doing to be dealing with, right? Today we have got F–15s—I am sorry, F–15Es, F16s, where do we, you know, I feel like we are going to be moving into a more and more challenging environment.

We are not getting to a point where we are going to be moving into fully functional fifth-generation and all-fifth-generation fleet. And by the time that we are having this conversation again, we are already going to be moving into sixth generation.

So, you know, what does this mean for the long-term sustainability, and then going back to what my colleague said earlier, the supply chain, I think that is a real challenge that we have when we are not making predictable procurement, then how are we going to ensure that we do deal with those challenges on an ongoing basis. Anyone.

General HOLMES. I guess the—thank you, Congresswoman. The one thing I would add is that as we said, we love the F–35, we are committed to the F–35. We have not budged from our total buy, and the total program, and our goals to acquire the F–35.

It is a question of when and how and how will we pay for it and how will we continue to modernize the airplane to adjust it to improving threats. Thank you, though, for your interest in——

Ms. HILL. So, can you talk about the cost per hour on the F–15X? I know that you talked about trying to get it down to $25,000 for the 35. What do we project as the cost per hour on the 15X?

General HOLMES. Mr. Daigle, you want to?

Mr. DAIGLE. Yes, I think I will say something. All right. I will tackle that one, but first let me go back to the operational side of the conversation.

Even in the high-end warfights, there will be, as General Holmes said, instances of which you need penetrating aircraft going forward.

But there will still be missions in the high-end fight where you don't need those assets. Where you still need cruise missile defensive air bases, for example, like. And in that situation, for those missions, having a higher inventory of weapons on the plane makes more sense than investing in the stealthy aspects of that plane because you don't need them to go forward.

The 15X cost per flying hour estimate, between 2020 and 2035, which is the way we did it in program budget review this year, is $29,000 per flying hour. The F–18s, by way of example, the F–18E/Fs right now are about $23,000 per flying hour. F–15Es I think are sitting right around 34, but they are a little bit older than the EXs would be.

Ms. HILL. Okay. Thank you. And then, General Holmes and Lieutenant General Ierardi, I was hoping you could talk a little bit about the role that the U–2 still plays in the modern world knowing that there is probably some skeptics that think that with drones and satellites, why are we still flying these 50-year-old planes. But what makes their ISR capability unique?

General IERARDI. Just from the joint perspective, I mean, the balance of capabilities are important. So, you know, while we develop enhanced capability in all domains—and we are certainly pressing to do that—retaining the capability to do things, to surveil and recon targets from all realms remains important. Especially in the near term as we look out into the 2020s and the kinds of capabilities we will require.

Ms. HILL. Thank you. I yield back.

Mr. NORCROSS. Mr. Wittman.

Mr. WITTMAN. Thank you, Mr. Chairman. I would like to thank our witnesses for joining us today.

I want to go to our Air Force members here. We have gotten a sneak peek of a pretty exciting aircraft, the XQ–58A Valkyrie UAV [unmanned aerial vehicle] platform that has a tactical capability there. Pretty amazing in what it will do with both defensive and offensive counter-air measures. Also being able to soak up enemy fire. Also being able to take on enemy air defenses.

Let me ask a question about how that platform, first of all, is going to be integrated into the fight. And we look at certain con-

cepts, the whole idea, will it fight by itself, will it integrate in with existing aircraft, will it kind of be a wingman in that battlespace.

Secondly is, has it been developed so that—and we know that systems out there like Link 16 where these systems get to not only talk to each other, but talk to other systems out there.

Is this, XQ–58A, is it being developed to work directly with the F–35 and if so, how will that affect where you are operating now in future contested airspace. And what will this do to either change the way we fight or to give us additional capabilities in what we do in that high-end fight.

General HOLMES. Thanks, Congressman. And I am sure that Dr. Roper may want to add something to this.

I would start by saying that we are testing some exciting things and part of the reason we are testing these exciting things is because of Dr. Roper coming over to join us as our senior acquisition executive and bringing over some ideas and helping our guys come up with new ones.

I think the test article of the Valkyrie as you spoke is a test of a lower cost, more attritable, more affordable resource that we are now flying, and we will have the chance to fit into some of our concepts and see how it works.

It is a test article that still would have to have sensors, would have to have the command and control system to make it work, would have to work through the weapons part, and I think the goal of flying it is to get it out there and test it and experiment with our fourth- and fifth-gen existing airplanes and with the things we might field in the future, and see how they work.

I would also like to give a plug to the Air Force's warfighter integration capability, an office that we have stood up in our headquarters Air Force A5 that is focused on exactly what you spoke of, sir, to come up with concepts for the future on how to do these things better.

Secretary ROPER. Congressman Wittman, you and I have spoken about this many times. When I was in OSD [Office of the Secretary of Defense], I thought there was a powerful role to give a high-end fighter a wing man that you could take risk with, that you could attrit, that would not necessarily have to return and land. And the Valkyries platform that we have started, and an OSD program called Avatar that we are now promoting into a 6.4 or prototyping program called Skyborg.

The initiative is to do precisely what General Holmes said. And that is to try to determine what sensors, what payloads, what networking do we need to put on it to give the fighter pilot a huge advantage flying against an enemy that does not have the ability to take risk.

So we will learn this not just by doing technology demonstrations, we are going to be working with the operator, with the warfighter. And we are excited to see where this program goes.

And in terms of where it goes, when the F–35 gets Tech Refresh 3, it gets a system called open mission systems, which would allow the F–35, if we so chose, to command and control UAVs. So, the pilot would truly be able to quarterback a team of systems. It sounds like the future, but it is here. And we hope that the Valkyrie will help us get that over the goal line.

Mr. WITTMAN. Well, the Valkyrie too is very, I think, appropriate because we look at costs and how we get more per our unit cost, as you and I have talked about, than our adversaries get per their unit cost. We have to be able to do more. We have the technology to do that.

The Valkyrie is one of those areas at a very low price. About $3 million, roughly, per aircraft. If you make more, the price goes down. I think it is particularly significant that that is part of our strategy, too. Not only to invoke cost on an adversary, but to save cost on our side.

One other thing, too, is as we talk about the F–15EX, will the F–15EX be able to integrate in its air combat systems the ability to work jointly then with the Valkyrie in that airspace? Because if we are going to be investing in that aircraft out in the future, and it can't integrate with another future platform there that gives it an enhanced capability, then you do have to question the investment that we are making now with that F–15EX.

Secretary ROPER. Congressman, that is what we are currently working. So, I have given the authority to our program office to develop an acquisition strategy. We have talked about the importance of open mission systems. We think it is critically important, if we pursue the F15–EX, to have it be an open system. Not just for the sustainability, but for the option to do the things you just mentioned, sir.

Mr. WITTMAN. Okay. Very good. Thank you, Mr. Chairman, I yield back.

Mr. NORCROSS. That was the bell. I think we have about 10 minutes. So we are going to split the time between Mrs. Hartzler and myself. A lot of great discussion. I want to hear from the Joint Staff about the decision making on the F–15E. What your view was it, why, and following up on Mr. Turner's question, did this plane at this time, with capabilities that are available, why was this one selected, and the view from your end.

General IERARDI. Thank you, Mr. Chairman. Last year as the NDS was—Secretary Mattis directed the NDS, National Defense Strategy, but we also had a Joint Military Net Assessment that the Chairman of the Joint Chiefs had directed us to look at. And this is, in shorthand, competitive areas that we assess ourselves against our adversaries to understand the net outcome.

In implementing the National Defense Strategy, the Chairman also asked us to look at these competitive areas and what could we do in the competitive areas which span the domains, including the air domain, to enhance our competitive advantage against our adversaries. And we, in the Joint Staff, looked at, among other things, the requirement to have a mix of capabilities that we thought would enable us to be successful as we looked out to a 5-year period.

This occurred in the summer of last year in time to provide some feedback into the program budget review in the fall. Our perspective at the time was that first we needed to have the fifth-generation capability for the high-end fight that we envisioned that was captured in the National Defense Strategy guiding the Department.

Second, we also saw that we had to have additional capacity in terms of being able to meet the combatant commanders' require-

ments in multiple locations, but also to reinforce a main fight, if that happened, with more aircraft, more bombs, the ability to have, while the F–35 program comes onboard over the next several years, in greater quantities as we remain committed to that program.

Filling that gap with F–15s, new F–15s, ones that could carry greater ordnance, provide the combatant commanders in multiple theaters with additional capacity, was something that we saw as an important characteristic.

And so, as this came together in the fall in the program budget review, we looked at this from the standpoint of a balance of capabilities that was appropriate as we looked to the future.

Mr. NORCROSS. So, what I heard is capacity was important.

General IERARDI. Capacity was important.

Mr. NORCROSS. So, did you look at doubling down additional resources for F–35 issues out there as a possibility?

General IERARDI. It was a possibility. Cost was a factor. Capacity was, in our assessment, a main factor but cost was a factor. And given that balance, as we looked at some of the numbers that CAPE was running in the Air Force, we thought that a mix of aircraft was the best outcome.

Mr. NORCROSS. The F–15, let me just switch. Talk about some of the systems; it is an active line. So, the F–15C of almost 30 years ago, and the one today. It was mentioned to us the EPAWSS [Eagle Passive/Active Warning and Survivability System] system and some of the radar because of the large diameter of the fuselage was critical in this decision.

Can you touch base on that?

General NAHOM. Yes. The, the F–15EX has got some significant advantages over the C model just because of the development that was done over the years. And as Dr. Roper said, the Qataris and Saudi Arabia certainly helped us with the investment.

The APG–82, the AESA [active electronically scanned array] radar on the front, the EPAWSS system, as well as the internal computer that is going to come off the line and it is going to help support some of these systems.

It is going to have many additional weapon stations over what a C model has, which is going to give it some magazine depth, which will make it very unique in certain mission sets, especially in the counter cruise missile and other missions that this aircraft can do. That is going to give you advantages over what a C model can do right now.

Just purely over 30-plus years of technological advancement into the F–15C. Much of that enabled by our allies.

Mr. NORCROSS. Mrs. Hartzler. Thank you.

Mrs. HARTZLER. Sure. Thank you. I am going to take 2 minutes and then yield the remaining 3 to Representative Bacon.

But the F–35 baseline, and this is going to Mr. Sullivan, the baseline program was developed concurrently doing development, production, and testing all at the same time which led to much of the cost and schedule overruns and now the program office is taking a new acquisition approach to Block 4, referred to as continuous capability development and delivery.

Given your acquisition expertise, do you think this approach can be successful? I can't—Yes.

Mr. SULLIVAN. We have concerns because when we look at it, the first thing is it is a $10.5 billion estimated investment today and that is not for the complete program. That would be through 2024. They don't have independent cost estimate yet, which would usually be done by CAPE. They have their own cost estimate.

But we like the independent estimates to go with a complete business case before you sign a contract that is going make a major investment of this kind of money, $10.5 billion. We would also like to verify the technologies that are going to go on the Block 4. Block 4 is a lot of new software and some hardware as well. They are going to do a Technology Refresh 3, putting in new processors and things like that.

There is going to be work done on the weapons bay, there is going to be new weapon integration on there. I think Small Diameter Bomb II, and a couple of other weapons. So, it is not a small thing, obviously, given that money.

So, we have made a recommendation that it should be its own major defense acquisition program because of—it meets the statute, you know, $10.5 billion is a lot of money——

Mrs. HARTZLER. Yes.

Mr. SULLIVAN [continuing]. For one single investment. So we would like to see it have its own baseline. Right now, it is just part of the F–35's, you know, the baseline aircraft's program. So, the $10.5 billion has been——

Mrs. HARTZLER. Yes.

Mr. SULLIVAN [continuing]. Kind of put in with the baseline, at this point.

Mrs. HARTZLER. I thought that was a very interesting proposal you mentioned that in your opening remarks.

Thank you. I yield the rest of my time to Representative Bacon.

Mr. BACON. Thank you. I know we are getting pressed here with our votes. I will try to be real quick and just try to make our responses to the point.

But my first is Dr. Roper. On the light attack, the Air Force expressed commitment to a light attack platform, and now it sounds like it has sort of pulled back from that, despite the fact there has been a lot of investments made there.

We heard from SOCOM [U.S. Special Operations Command] that there is a definite requirement for a light attack platform. So where are we at with the light attack?

Secretary ROPER. So, Congressman, I will begin but I am sure that General Holmes will want to give the requirements point of view. From an acquisition point of view, light attack was an interesting approach to take. To go out and start working with industry, gain experimental data to determine what performance could be gained with commercially available aircraft.

I think we have learned a lot working with the two vendors and we are proud to continue working with them. I believe we will be purchasing a few of each aircraft and going out and continuing to do operationally realistic tests and look at some additional modernizations.

But I think we have also learned that there are other aircraft that could do the light attack mission. That there is a case for turbojets, there is a case for drones. And so rather than do what

acquisition so often does, is commit early, we want to make sure that we have experimented with every option so that when we make the choice to proceed, we do so with confidence and having as much data on the table as we can have.

Mr. BACON. General Holmes, anything to add?

General HOLMES. Just the authorities that Congress gave us let us go fast. And let us work through—trying to work through these decisions much faster than we would have been able to in the past and we are grateful for that.

As we look at a light attack airplane, the requirements are a mix of what would the U.S. Air Force use, and then how would we use that role, that airplane, to partner with our allies in places that don't need the higher end air assets, and with partners that can't afford one.

So, all the way through the program, we have looked at, could we acquire an airplane that's also there is an interest in some of our partners that can't afford to operate an F–35 and maybe not even an F–16 to be able to have an aircraft that fits their requirements. And we did our business case analysis. Most of the people that would pursue a turboprop airplane already have one or are acquiring one.

And so we wanted to open the aperture and look at some other aircraft types, and see if we can find one that is low cost to communicate, is low cost to operate, but still meets the requirements for our partners so that they can do things on their own and we don't have to do it for them.

Mr. BACON. I have an RC–135 question then I will have to wrap up. We keep hearing—I get mixed signals from the Air Force on medium-altitude manned ISR, but yet we know on a phase 0, phase 1, nothing can replace it right now. I think there is an ACC [Air Combat Command] study that says exactly that, in fact. I just want to hear your view on the commitment towards the RC–135 program. Obviously important for our district.

General HOLMES. And Air Combat Command as well, sir; that is, you know, that is half of what we do. We are going to continue to pursue a mix of modernized air systems, but we also want to look at the other ways to gather that information.

As the threat gets better and better and better as you understand very well, they are capable of pushing our air assets off further and further, which makes it hard for them——

Mr. BACON. [Inaudible.]

General HOLMES. No, yes, sir. In this preparing the battlefield stage, there is, right now, there is nothing to take the place of the RC–135. Over time as we look at Advanced Battle Management System and as we look at the ISR flight plan that General Jamieson has put together, we will be gathering that information in a mix I think of overhead space systems and airborne sensors.

But for now, there is no substitute for the mix that we have which is why we are not advocating this year to remove anything from what we have.

The RC–135, as you know, is continuously updated by Big Safari and a fantastic effort to keep it relevant. And we believe those airframes are sustainable for at least the near term, and we will be weighing, like we have with all of our platforms, these big-wing

platforms as they reach the end of our service life, should we buy another big-wing platform or is it time to invest in a way to do that capability in phase 1, and phase 2, but also out into phase 3 and phase 4. And those are the decisions that we are weighing as we go forward. Thanks for the question and for your interest in the subject.

Mr. BACON. Thank you, Chairman.

Mr. NORCROSS. First of all, I would like to thank the witnesses. It was a great discussion. We have some very big decisions ahead of us. And certainly my colleagues for hanging in there.

We are adjourned, thank you.

[Whereupon, at 10:56 a.m., the subcommittee was adjourned.]

A P P E N D I X

May 2, 2019

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

MAY 2, 2019

Statement of the Honorable Donald Norcross
Chairman, Subcommittee on Tactical Air and Land Forces

Department of the Air Force Acquisition and Modernization Programs in the Fiscal Year 2020 National Defense Authorization President's Budget Request

May 2, 2019

The hearing will come to order.

The subcommittee meets today to review the Air Force's acquisition and modernization programs in the fiscal year 2020 budget request.

I would like to welcome our distinguished panel of witnesses:

- The Honorable Will Roper, Assistant Secretary of the Air Force for Acquisition, Technology and Logistics;
- General Mike Holmes, the Commander of Air Force's Air Combat Command;
- Major General David Nahom, Director of Air Force Programs for the Deputy Chief of Staff for Strategic Plans and Requirements;
- Lieutenant General Tony Ierardi, Director of Force Structure, Resources, and Assessments for the Chairman of the Joint Chiefs of Staff;
- Vice Admiral Mat Winter, Director of the F-35 Joint Strike Fighter Program;
- The Honorable Bob Daigle, Director of Cost Analysis and Program Evaluation for the Secretary of Defense;
- The Honorable Bob Behler, Director of Operational Test and Evaluation for the Department of Defense; and,
- Mr. Mike Sullivan, Director of Defense Weapon System Acquisitions for the Government Accountability Office.

I want to thank our witnesses for your service, the time you're giving us today, and I look forward to your testimony.

As we review the Air Force's budget request today, we want to review the changes that have been made in this year's request – and understand why items are different from what was forecasted in last year's fiscal year 2019 budget for this year.

We want to understand:

- how the Air Force's budget request aligns with the objectives of the National Defense Strategy in competing and deterring near-peer adversaries;
- what investments are being made to increase the combat effectiveness, capacity, and capabilities of the Air Force's intelligence, surveillance, and reconnaissance platforms - or "ISR" platforms – as well as tactical combat and training aircraft, rotorcraft, and munitions; and,

- what acquisition efficiencies and authorities are being implemented to more quickly modernize and reduce the average age of many Air Force fleets of aircraft under this subcommittee's purview.

One of the most important and arguably controversial changes we will discuss today relates to the Air Force's surprising decision to start a new recapitalization of the F-15C fleet.

This involves an advanced 4th Generation version of the F-15 - called F-15EX - to complement their 5th generation F-22 and F-35 capabilities.

We want to understand what new capabilities and cost-efficiencies the F-15EX can bring to the Air Force's tactical aircraft portfolio - and why the Air Force has shifted from the plan to only buy 5th generation or greater fighter capabilities.

We also want an update on the F-35 program's challenges in achieving significantly lower operations and sustainment costs.

The Air Force has told us they need to reduce those cost by 43 percent in order to afford owning and operating their full inventory objective.

We also want to understand how the Joint Program Office will get control of and fix the problematic Autonomic Logistics Information System, or ALIS, program.

Looking forward in the program - we also need an update on Block 4 development and projected cost.

In order to fully understand these issues, we must first understand the capability and capacity of our tactical fighter industrial base.

What is the F-35 program office doing to increase and stabilize the prime contractor's continuing problems with supply chain and parts management - for both new production and fielded aircraft? And how does this factor into supporting increased quantities of future F-35A purchases?

If we start a new-build F-15EX program, what are the production capacity and capability challenges anticipated by the Air Force?

How will the Air Force ensure that costs are controlled before committing to a development and production contract over several years?

5th and 4th Generation fighter aircraft are a critical capability for our Air Force - and this subcommittee will continue to support these programs - but we don't have an unlimited amount of money

We need to achieve real "affordability" - as hard to define and elusive as that concept may be.

The Ranking Member and I took the opportunity to travel last month to see the F-35 and F-15 production lines.

There is no doubt that American industry is the best in the world - our workers and facilities are second to none.

Mrs. Hartzler and I were very impressed - even inspired - and we learned a lot.

I want to publicly thank all those who made possible such a comprehensive look at these challenging programs and capabilities in our jurisdiction.

Similar to tactical aviation, the subcommittee is also paying close attention to Air Force ISR programs and efforts to sustain and modernize key capabilities.

The long-planned recapitalization of the Joint-STARS aircraft was abandoned - and in its place appeared a new concept of existing and yet-to-be-defined programs coined the "Advanced Battle Management System," or ABMS.

The committee remains concerned about the lack of formal program structure and benchmarks against which to measure ABMS progress - as well as the uncertainty surrounding Air Force plans to provide effective and timely Ground Motion Target Indicator intelligence support, or "GMTI," to our ground combat forces.

The subcommittee is also focused on how this budget request supports sustainment of Air Force big-winged ISR platforms.

After several budget cycles of uneven funding and support - and alternating plans to terminate different programs, the Air Force appears to agree that we need all the current ISR capabilities it can muster.

However, the service needs to map out a recapitalization plan for these big-winged aircraft to ensure their continued viability and relevance as our National Defense Strategy orients towards near-peer threats.

I look forward to your testimony and discussing these topics, but before we begin with your opening statements, I would like to turn to my colleague from Missouri - Mrs. Vicki Hartzler - for any comments she may want to make.

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HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE TACTICAL AIR AND LAND FORCES
UNITED STATES HOUSE OF REPRESENTATIVES

PRESENTATION TO THE
HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES
UNITED STATES HOUSE OF REPRESENTATIVES

HEARING DATE/TIME: May 2, 2019, 9:00 A.M.

SUBJECT: Department of the Air Force Acquisition and Modernization Programs in the Fiscal Year 2020 National Defense Authorization President's Budget Request

STATEMENT OF:

Dr. William B. Roper, Jr.
Assistant Secretary of the Air Force
(Acquisition, Technology & Logistics)

Gen. James M. Holmes, USAF
Commander, Air Combat Command

Maj Gen David S. Nahom, USAF
Director of Programs
(Deputy Chief of Staff, Plans and Programs)

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HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES
UNITED STATES HOUSE OF REPRESENTATIVES

Introduction

Chairman Norcross, Ranking Member Hartzler, and distinguished members of the subcommittee, thank you for the opportunity today to provide testimony on Air Force acquisition and modernization programs in the FY2020 National Defense Authorization President's Budget. The Air Force is in the midst of modernizing nearly every platform in our inventory. We appreciate congressional support as we modernize our platforms to meet operators' most pressing needs. What never strays far from our minds is the need to win the war for the future. We are entering an era of great power competition and we will not remain superior if we cannot build and field faster than other militaries.

Over the past year, the Air Force has made great strides to supercharge its acquisition engine – stripping nearly one century out of acquisition program schedules – by fully embracing congressional authorities to rapidly prototype and by tailoring acquisition approaches to fit programs' unique needs. Threaded throughout the programs discussed in this testimony are examples of acquisition best practices that are producing better results and meeting warfighter needs faster. Program Managers of major acquisition programs have challenged necrotic, traditional acquisition approaches and have flipped the script to accelerate programs using section 804 authorities. Programs are collaborating with a wider range of industry partners to do business at the speed of ideas, something we hope to increase with our Air Force Pitch Days.

Additionally, agile software development practices are becoming more widespread across a variety of mission areas. The FY2020 National Defense Authorization President's Budget request supports modernization efforts of top priority to our warfighters. As important, it enables us to continue to push new acquisition tools to keep our feet firmly planted on the accelerator to improve all of our current and future acquisition programs.

Safety Implementation and Statistics on Trends

Physiological events and mitigation strategy implementation

We remain committed to solving physiological events across the Air Force and joint services. The last update to MIL-STD 3050, the DoD Design Criteria Standard for Aircraft Crew Breathing Systems with Onboard Oxygen Generating Systems, was in 2015. It is being updated to reflect lessons learned and system improvement from recent investigations. There is an immediate funding requirement to collect and assess Air Force-wide data to help validate requirements for new acquisitions. We have requested funds to acquire physiological sensors as we have minimal physiological data on pilots while flying compared to robust aircraft system data. Currently, Air Combat Command is partnering with NASA, the U.S. Navy, and industry partners; while leveraging commercial expertise from Google, Amazon, Microsoft, and others to establish in-flight physiological monitoring requirements to mitigate physiological events as a method to alert aircrew to Hypoxia or Hypoxia-like conditions that impact physiological performance.

Safety statistics on mishaps and trends

From FY14 to present, Air Force tactical aircraft Class A and B mishaps have remained fairly consistent both in rate and quantity. The Class A mishap rate slightly increased over the FY14 to FY18 period five year average (2.34) with a rate of 2.69 in FY18. The Class B mishap rate decreased over the five year average (3.78) with a rate of 2.92 in FY18. Due to their higher costs, fifth-generation aircraft increasingly comprise a greater percentage of Class A and B mishaps. From FY14 to present, 33% of the Class A and B Tactical Aircraft mishaps involved fifth-generation aircraft, although they comprised less than 19% of the tactical aircraft fleet

during that period. In FY18, fifth-generation aircraft flew 15% of total tactical aircraft flight hours, but accounted for over 50% of the tactical aircraft Class A and B mishaps.

Ejection seat modernization strategy and implementation

The Next Generation Ejection Seat (NGES) program to upgrade the seats in the Air Force's F-16, F-15, F-22, B-1, and A-10 fleets, is on track to begin testing in FY21. The Program Executive Officer will determine the specific acquisition strategy in the upcoming weeks. The program schedule aligns with the FY20 President's Budget Request which includes $10 million in FY21 to fund the initial qualification testing efforts. Funding allotted prior to FY21 has been used to conduct risk reduction activities and acquisition strategy planning support.

The NGES program plans to release a draft request for proposal (RFP) in April followed by the final RFP later in FY19. Additionally, we are fully prepared for an FY21 start, and postured to execute early if additional funding becomes available.

Fighter Force Structure

We remain committed to the dual-capable F-35 and its game-changing capabilities, while we continue to modernize and sustain our aging legacy fleet. However, our current fighter force of 55 squadrons is too small. To restore readiness of the force, we must refresh the fighter fleet with a mix of 4th and 5th generation aircraft to ensure the right capacity and capability to fully implement the National Defense Strategy.

The Air Force needs approximately 2,100 fighters to meet current warfighting demands. Force structure studies project that number to increase. The current Air Force fleet is aging and some platforms will run out of service life soon. The F-15C/D fleet, a majority of older block F-

16s and some A-10s will reach the end of their service life in the next 10 years. In order to arrest the retirement rate and grow to the future requirement, the Air Force would need to procure 72 new aircraft each year.

Certain wartime environments in the future require the F-35 and other advanced capabilities. The Air Force remains fully invested in the F-35 program, including modernization and capability enhancements through the FYDP. The Air Force has not changed its planned total procurement of the F-35, and will buy 48 aircraft per year through the FYDP. No funding was taken from this program to go towards the funding for the 4th generation refresh.

To procure 72 aircraft per year while balancing other priorities, we need additional 4th Generation aircraft to refresh our aging fleet. Although 5th Generation fighters are more capable in several respects, there are a wide array of existing missions 4th Generation fighters can satisfy. The F-15EX is the most cost-effective and immediate way to refresh capacity, reduce operating costs, and improve the capability of the existing 4th Generation fleet. The F-15EX can refresh existing bases with minimal MILCON, and no extensive pilot and maintenance retraining. Our budget requests the funding to buy 80 aircraft over the next five years.

F-35

The F-35A is the centerpiece of the United States Air Force's 5th generation multi-domain capability and it is a critical force multiplier for legacy forces. We remain fully committed to the F-35 program of record of 1,763 aircraft. Our budget requests $6.5 billion in FY20, and $31.7 billion across the FYDP, to continue production and integrate vital capabilities. We expect to have over 20 combat-ready
F-35 squadrons in our inventory by 2030. To ensure those squadrons are ready to achieve

National Defense objectives in future threat environments, we are working to field full F-35 Block 4 capabilities as quickly as possible.

Our budget decreases the F-35 buy profile by 18 aircraft between FY20 and FY23 in order to align the procurement timeline with capability development and reduce retrofit costs. In addition, we continue to focus on ensuring Autonomic Logistics Information System (ALIS) operates as intended: 1) ALIS must fully operate as intended; 2) F-35 Reprogramming Enterprise must update F-35 Mission Data Files at the speed of war to ensure operational relevancy; and 3) F-35 simulator must be current with fielded aircraft operational flight programs, have sufficient fidelity to provide effective training, and be distributed mission operations network capable.

We are taking a phased approach to achieve 80% mission capable (MC) rates by September 2019 in our combat coded F-35s by addressing prioritized efforts to improve supply chain performance, reduce depot span time, accelerate modifications, and optimize unit level performance. Combat coded aircraft at Hill AFB were at 64.5% MC ending February.

F-22

The F-22 is the only operational multi-mission air superiority fighter aircraft that combines stealth, supercruise, maneuverability, and integrated avionics to make it the world's most capable air superiority aircraft. The F-22 request adds $953 million in FY20, and $5.2 billion across the FYDP, for modernization efforts essential to gain and maintain air superiority against evolving threats. The Capability Pipeline, a Section 804 program, combines former TackLink16, TACMAN and GPS M-code programs to deliver slices of each capability on a regular cadence to the field. Future modernizations will leverage the "Capability Pipeline" as a vehicle to rapidly prototype and iteratively field critical enhancements with capabilities delivered

to the fleet on a regular cadence and ensure first look, first shoot, and first kill capability in highly contested environments.

As you are all aware, our F-22 fleet was significantly impacted after Hurricane Michael struck Tyndall AFB, Florida. All aircraft that sustained damage from the hurricane, with the exception of three, have been returned to serviceable condition. Of the three still undergoing repair, two are undergoing stabilizer and flap repairs at Eglin AFB, Florida with estimated completion dates in April and May. The third aircraft is undergoing structural repairs, as well as routine scheduled depot maintenance, at Hill AFB, Utah with a scheduled completion date in September.

Thirty-one F-22 aircraft attached to the 43rd Fighter Squadron have relocated to Eglin to continue flying training unit (FTU) operations. Challenges include the relocation of support personnel, equipment, access to facilities and aircraft parts. The movement of aircraft parts from the Tyndall supply warehouse to Eglin is expected to be complete by 1 April 19. Additionally, the F-22 aircraft have been unable to undergo needed low observable (LO) maintenance, negatively impacting fleet LO health and driving all aircraft to non-mission capable, but flyable status. Two LO spray bays at Tyndall were recently returned to service enabling routine LO maintenance operations to improve fleet health. Eglin and Tyndall leadership teams have also coordinated the use of a spray bay located at Eglin to further expand capacity and accelerate LO recovery.

The 24 aircraft assigned to the 95th Fighter Squadron have been redistributed to Joint Base (JB) Langley-Eustis, Virginia; JB Elmendorf-Richardson, Alaska; and JB Pearl Harbor-Hickam, Hawaii. Five of the 24 are currently undergoing routine depot maintenance. Ten aircraft were reassigned to Langley, which facilitated a loan of three aircraft to Nellis AFB,

Nevada to meet mission requirements. Elmendorf and Hickam each received seven aircraft. The additional aircraft are expected to provide increased efficiencies in mission execution and improved unit readiness. Personnel and equipment needed to support the additional aircraft at each site are still in the process of relocating, which is expected to occur through August.

As would be expected, the MC rate of the F-22s slowed due to Hurricane Michael's impacts. The fleet MC rate of 67.4% is up just over one percent since the start of the fiscal year. For example, a ~35% reduction in flying contributed to some of the supply rate improvement due to a reduced demand signal. Still, combat coded fleet supply rate did improve from 20% in August 18 to 10.6% as of mid-March 19. However, gains are offset by a maintenance of 27.1% for February 19, mainly driven by LO work.

F-15

The F-15C/D supports both Homeland Defense and the air superiority mission. Our F-15C fleet is aging, with two-thirds of the fleet past its designed service life. The 234 F-15Cs in the Air Force inventory will reach the end of their designed service life in the next six to eight years, and our analysis shows additional service life extension programs are not cost effective. Our budget proposes to replace our aging F-15C fleet with a modernized successor by purchasing the F-15EX. We propose to buy 80 aircraft across the next five years. This allows us to benefit from foreign partner investments in the F-15 line to begin a cost-effective replacement of our F-15C fleet. The Air Force remains fully committed to advanced 5th generation capabilities and the F-35. The decision to refresh the 4th generation fighter force helps mitigate capacity risk while balancing near term readiness concerns.

The F-15E fleet provides all-weather, long range global precision attack in all but the highest threat environments. Our F-15 budget requests $2.1 billion In FY20, and $12.6 billion

thru the FYDP, to continue modernization efforts to ensure the aircraft remains viable through the 2040s. Modernizing the F-15E with Early Passive Active Warning Survivability System (EPAWSS) demonstrates our commitment to building a more lethal Air Force. EPAWSS will allow the F-15E to attack targets in high threat environments that the aircraft cannot currently engage.

F-16

The F-16 is the Air Force's primary multi-role fighter and Suppression of Enemy Air Defense (SEAD) aircraft. This program is in the midst of the largest modernization period in program service history in order to remain operationally capable through the 2040s. The program adds $443 million in FY20, and $3.8 billion across the FYDP, for modifications to ensure the F-16 can operate and survive in today's threat environment. Major efforts in this year's budget include a service life extension program comprising 12 structural modifications, effecting 300 aircraft, with the biggest structural changes being wings, canopy sill longeron, and lower bulkhead. In addition, there are several avionics capability upgrades including the Active Electronically Scanned Array (AESA) Radar upgrade, this replaces the current mechanically scanned radar, with greater ability to detect, track, and identify low-observable, low-flying, and slow-flying target. This joint emerging operational need is critical for the F-16 platform to meet aerospace control alert mission requirements in order to properly defend the homeland against modern threats, these radars will begin fielding in 2019.

Another key avionics capability upgrade is Auto-Ground Collision Avoidance System (AGCAS) that prevents most controlled flight into terrain by executing an automated recovery maneuver to avoid collisions. The AGCAS system already has eight confirmed saves on F-16 block 40/42/50/52 aircraft. Working with Air Force Research Laboratory we were able to

integrate this capability on F-16 Block 25/30/32 analog flight control computers when completed. We are excited to continue fielding this life saving capability for our warfighters.

As of 1 March 2019 F-16s were at 71.9% MC, about four percent higher than when we started the fiscal year. We have begun realizing positive impacts from our initial sustainment surge to push parts to the field and through the depot repair lines. As a result, the field's not mission capable supply rates have dropped from 14% in September to 11.4% in February. Further decreases in supply rates are anticipated through the summer as spares investment continues to deliver in greater numbers.

A-10

The A-10 is an effective close air support platform for the current counter violent extremist organization fight. Our analysis anticipates that, without further wing funding, aircraft groundings due to wing lifespan will begin in FY21, with at least 26 aircraft grounded by FY23. To maintain the A-10 fleet, we must continue to replace the wings to ensure the A-10 remains operationally capable through the 2030s. Our current budget requests an additional $174 million in FY20, and $780.3 million across the FYDP to modernize the A-10, including $100 million for 10 more wings. The new wing contract is currently in source selection with contract award planned for late FY19.

Ongoing Operational Test and Evaluation Efforts and Results

The 2016 and 2017 National Defense Authorization Acts restrict retiring or divesting A-10s until completion of the F-35 Initial Operational Test and Evaluation comparative tests and associated reports, and these are briefed to the Defense Congressional committees. The Comparative Tests are scheduled to complete in Fall 2019, with Initial Operational Test &

Evaluation and Air Force reports complete Spring 2020. Preliminary results indicate that the F-35 is a valuable close air support asset and it makes other participants in the mission better.

Light Attack

The Light Attack effort supports the National Defense Strategy second line of effort for our allies and partners, finding ways to increase their ability to contribute to the counter-violent extremist fight. The Light Attack Experiment taught us important lessons we would not have learned through a traditional acquisition process. The experiment sought to test whether an existing commercial aircraft could perform as a combat capable and cost-effective platform to support the global campaign to counter violent extremist organizations. Key to the experiment was the demonstration of an exportable information-sharing network that will improve interoperability with allies and partners. Based on available aircraft that met experimental criteria, we focused last year on only one aircraft type.

With the Light Attack effort being additive to the Air Force's topline, the FY20 budget requests $35 million, and $1 one billion across the FYDP to expand the experiment in this budget to include additional aircraft types (rotary, unmanned, turbojet) and technologies. Additionally, we intend to continue our close partnership with industry and allies to further this technology as we determine the best strategy going forward. We remain committed to developing a cost-effective and increasingly networked counter-violent extremist capability to deepen these partnerships and directly support the National Defense Strategy.

Next Generation Air Dominance

The Air Force is investing in technologies as part of a family of capabilities enabling air dominance in the most challenging operational environments. The requirement to establish and maintain air superiority within the battlespace cannot be understated – it underpins the joint force

operations in every theater. Air superiority remains a core function of the Air Force, however is not a birthright, and given threat advances, cannot be assumed. Next Generation Air Dominance, (NGAD) is our program that supports studies, analyses, technical maturation, and prototyping activities leading to enhancements in lethality, survivability, interoperability, and persistence to ensure air superiority.

This budget requests $1 billion in FY20 and $6.6 billion across the FYDP to fund the continued development of a next generation open mission system architecture, advanced sensors, cutting-edge communications using open standards, and integration of the most promising technologies into the family of capabilities. Furthermore, this program incorporates novel agile acquisition practices through its competitive industry consortium approach that is yielding favorable results and provides greater value for the taxpayer. Our efforts are being shaped by multiple analyses, including recommendations from the CSAF approved Air Superiority 2030 Flight Plan, recently completed NGAD Analysis of Alternatives, and several others from renowned analytic organizations. Continued investment in NGAD technologies is critical to ensuring continued air dominance within emerging threat environments for all future joint operations.

Trainers

T-1, T-6, and T-38

The Air Force is continuing investment efforts in its trainer platforms, including modernization programs for the T-1, T-6, and T-38 fleets. The T-1A Avionics Modernization Program will modernize the T-1A fleet and address known obsolescence and diminishing manufacturing supply issues. The Air Force is completing installation of Automatic Dependent Surveillance-Broadcast (ADS-B) Out across the entire T-6 fleet, modernizing the Aircrew

Training Devices and Crew System life support equipment, and providing logistics support. Additionally, research and development activities will be funded for the Next Generation On-Board Oxygen Generation System (OBOGS) to improve the safety of pilot training and address on-going physiological events in the T-6 aircraft. Modifications are also required to sustain and upgrade the T-38C fleet, including Pacer Classic III, Talon Repair, Inspection, Maintenance, and front canopy replacement programs until T-X is delivered. The FY20 requests are $26.8 million, $13.0 million, and $37.9 million for the T-1, T-6, and T-38 fleets, respectively.

T-X

The Advanced Pilot Trainer (T-X) contract was awarded to the Boeing Company on September 27, 2018. The budget request in the FYDP has been reduced to reflect the approximate $10 billion cost savings realized from the original program cost estimate. T-X replaces the Air Education and Training Command's existing fleet of 429 T-38C aircraft with 351 aircraft and associated simulators, ground equipment, spares, and support equipment. The T-X will provide student pilots with the skills and competencies required to be better prepared to transition into 4th and 5th generation fighter and bomber aircraft. The FY20 request of $348.4 million continues the program's Engineering and Manufacturing Development effort, ensuring we meet a 2024 Initial Operational Capability and 2034 Full Operational Capability.

Air Force Pilot Training Next initiative and implementation

Air Force Pilot Training Next is an initiative that brings training processes from the industrial to the information age by integrating new and emerging technologies and individualizing access to learning in order to capitalize on the talents of teachers and learners. Specifically, it introduces a path to next-generation learning through the use of virtual and augmented reality, advanced biometrics, artificial intelligence, and data analytics in order to

optimize learning, individualize training, and expedite the program to the speed of the learning. PTN is currently comprised of 26 students from across the Air Force (9), Navy (2), Air National Guard (2), UK Royal Air Force (1), current/former RPA pilots (7), and enlisted airmen (5). The overall goals of PTN are to 1) create tagged and structured data for future artificial intelligence / machine learning (AI/ML) analysis, 2) improve the IP and student experience, and 3) provide off-ramps to graduate students based on competence, not time.

Current and Forecasted Pilot and Aircrew Shortfalls and Mitigation Strategies

As of FY18, the Air Force was approximately 2,000 pilots short of the required 21,000 Total Force manned pilots. The Air Force is making progress with increased production and leveled retention rates. Current pilot training initiatives have enabled the AF to increase Undergraduate Pilot Training (UPT) production from 1,211 pilots in FY18, to a projected output of 1,480 pilots in FY20. Increased UPT production is a key component of the pilot recovery plan, but achieving pilot manning health also requires robust and effective retention efforts to ensure we have both the correct size and shape of the force. To improve aircrew retention, the Air Force is focusing on improvements to both quality of service and quality of life. Examples to date include modernizing and creating transparency in the assignment process and providing additional support in squadrons to allow aircrew to focus on primary duties.

Rotorcraft

The FY20 Budget continues investment in the Air Force's critical rotorcraft modernization programs, including the CV-22 Osprey, HH-60G, Combat Rescue Helicopter (CRH), and UH-1N Replacement programs.

CV-22

The FY20 PB requests $83.3 million, and $760.7 million across the FYDP, for the CV-22 fleet to assist in execution of the National Military Strategy by providing transformational mission capability to special operations forces warfighters. The Air Force continues to make improvements to the CV-22 with modifications designed to improve reliability, survivability, and capability. Future efforts will make the CV-22 more cost-effective while ensuring the viability of its unique long-range payload capacity coupled with vertical take-off and landing capability.

HH-60G and Combat Rescue Helicopter

The Air Force is the only Service with a dedicated force organized, trained, and equipped to execute theater-wide Personnel Recovery. The HH-60G fleet currently accomplishes this mission by conducting day, night, and marginal weather Combat Search and Rescue (CSAR) operations to recover isolated personnel in hostile or permissive environments. Due to the advancing age and current attrition rates of the HH-60G, the Air Force must continue to modify existing HH-60G helicopters while utilizing the Operational Loss Replacement program to meet Combatant Command requirements until we can fully recapitalize with the Combat Rescue Helicopter (CRH) program. The CRH will be specifically equipped to conduct CSAR across the entire spectrum of military operations. The FY20 Budget adds one test aircraft to bring the total fleet to 113 air vehicles. The Air Force has fully funded the CRH program to meet National Military Strategy objectives through Personnel Recovery missions. The FY20 Budget requests $22.7 million and $1.1 billion for the HH-60G and CRH programs, respectively.

UH-1N

The UH-1N Replacement helicopter is an element of the Air Force nuclear enterprise reform initiatives and also supports operational airlift within the National Capital Region. Last September, the Air Force awarded the $2.38 billion fixed price UH-1N Replacement contract. This contract will deliver up to 84 replacement helicopters, training devices, and associated support equipment to replace the legacy UH-1Ns. The FY20 Budget requests $171 million for the UH-1N Replacement Program, which will fund the continued integration of non-developmental items, the non-recurring engineering work required to certify the modified air vehicle, and preparations for the test program. The first two test aircraft will deliver in the first quarter FY20.

Open Skies Treaty Aircraft Recapitalization Program

The Open Skies Treaty Aircraft Recapitalization program will design and develop a new weapon system from two missionized, small airliner class commercial-derivative aircraft. The Acquisition Strategy was approved in September 2018 to pursue a full and open competition via a Section 804 rapid fielding approach. This is the fastest path to treaty certification in the fourth quarter FY22 and saves 20 months of schedule to the second and final aircraft delivery. To support this timeline, the Air Force released the draft RFP on 28 February 2019 and plans to release the final RFP in late April 2019 with contract award in February 2020.

Munitions

While operational demand for preferred munitions continues, so do our efforts to secure sufficient inventories for our warfighters. During the last several years, we have successfully ramped up production capacity across the portfolio, and our FY20 Budget Request funds preferred munitions to industrial production capacity. Thanks to strong Congressional support

and funding, this budget continues to improve on significant FY19 munitions gains and emphasizes the advanced munitions most relevant to the high-end fight.

Consistent with prior budgets, the FY20 request again leverages increased base budget and Overseas Contingency Operations (OCO) funding to rebuild inventories and replenish the large number of munitions expended to counter violent extremist organizations around the world. Additionally, this budget also requests funding to develop more lethal weapons capabilities to meet future operational requirements. As we continue working to synchronize munition inventories with National Defense Strategy objectives, the Air Force is grateful for the continuing Congressional support to confront these challenges. To ensure success, munitions procurement will remain an item of interest across the FYDP.

Joint Direct Attack Munition and Small Diameter Bomb

The Joint Direct Attack Munition (JDAM) is the air-to-ground weapon of choice and is experiencing a 134% increase in expenditures so far in FY19 compared to FY18. In FY15, JDAM production capacity was 18,500 tailkits per year; by FY18 tailkit production increased to 45,000 tailkits per year to meet the needs of the Services and Foreign Military Sales (FMS) partners. The Air Force plans to procure 37,000 tailkits in FY20 with a request of $1.07 billion, with Navy and FMS partners procuring the remaining production capacity.

Small Diameter Bomb I (SDB I) provides reduced collateral damage effects and increased load-out per sortie for our warfighters. Due to its high operational utility, the Air Force ramped the line from 3,000 weapons per year in FY15 to 8,000 weapons in FY17. The Air Force's FY20 budget requests $275.4 million and plans to order 7,078 weapons and the remaining quantity is available to FMS partners.

SDB II will complete Initial Operational Test and Evaluation in FY19, and in conjunction with the Navy, the Air Force's FY20 budget requests $212.4 million to procure 1,175 weapons, maximizing the production capacity. Though not yet fielded, the SDB II will soon provide a key air-to-ground capability to kill mobile and fixed targets through adverse weather from standoff ranges. All of these production increases expedite the inventory replenishment of our critical munitions and build stockpiles for future needs.

Finally, Hellfire missiles provide a time-sensitive, direct strike capability for our remotely-piloted aircraft and remain in high demand around the world. Production capacity, shared between Hellfire and Joint Air-to-Ground Missile (JAGM), was ramped up from 5,000 missiles per year in FY15 to 11,000 missiles per year in FY19. The FY20 budget requests $299.6 million and procures at least 3,859 Hellfire missiles. With other Services and critical FMS partners, the production line will remain funded to maximum production capacity.

Joint Air-to-Surface Standoff Missile and Advanced Medium Range Air-to-Air Missile

As the Air Force responds to current operational demands, we are also looking to the future to ensure we are prepared to defend against more advanced threats as directed in the National Defense Strategy. Doing so requires advanced weapons capabilities, and the FY20 budget request reflects the Air Force's plan to continue investing in those areas, specifically with the Joint Air-to-Surface Standoff Missile (JASSM) and the Advanced Medium Range Air-to-Air Missile (AMRAAM). These weapons provide unique capabilities in an anti-access/area denial (A2/AD) environment.

JASSM is the premier air-to-ground, low observable missile for defeating threats in highly contested environments. The FY20 budget requests $482.5 million to procure 430 missiles. The program is focused on meeting 2018 National Defense Strategy objectives for

increased inventory by implementing a strategy to ramp up production rates and monitor subsystems for obsolescence. To achieve this, we have partnered with industry to expand production capacity to satisfy a 47% increase in our inventory objective.

Production of AMRAAM missiles, a critical air dominance weapon, remains consistent with FY19 procurement levels by requesting $332.3 million for 220 Missiles, as industry partners begin to cut-in a solution to obsolescence issues through the Form Fit Function Refresh (F3R) effort. Cut-in of F3R begins this year with initial deliveries starting in FY21, and production rate continues to ramp up through FY24.

Stand-In Attack Weapon and Extended Range Weapon

To defend the Nation in an increasingly competitive global environment, we must look beyond currently fielded weapons systems and invest in future advanced munitions capabilities. To that end, the Air Force continues to invest in the Stand-In Attack Weapon (SiAW) to deliver a strike capability to defeat rapidly relocatable targets that create the A2/AD environment. The FY20 Budget requests $162.8 million, and $841.4 million across the FYDP. Additionally, the Air Force is investing $246.2 million in FY20, and $587 million across the FYDP, in the Extended Range Weapon (ERWn), a rapid prototyping program to develop an advanced multi-role interceptor missile to defend against and defeat missile threats. Finally, the FY20 Budget request continues to invest in rapid prototyping programs to develop hypersonic weapons for long-range, prompt strike capabilities.

Intelligence, Surveillance, and Reconnaissance

Aligned with the National Defense Strategy, the Air Force is aiming to reorient the Intelligence, Surveillance, and Reconnaissance (ISR) Enterprise by aligning ends, ways, and means to address the peer threat environment through the increased use of human-machine

teaming. The end goal is a ready Next Generation ISR Enterprise possessing a decisive advantage for the warfighter while remaining competent across the entire spectrum of conflict.

To meet the challenges of a highly contested environment, the future ISR portfolio will consist of a multi-domain, multi-intelligence, collaborative sensing grid that utilizes advanced technology; it will be resilient, persistent, and penetrating to support both kinetic and non-kinetic capabilities alike. The FY20 budget submission takes the first steps towards repurposing, retooling, automating and stabilizing the force to ensure the ISR Enterprise can achieve this vision within the next decade. The Air Force aims to increase both the quality and quantity of ISR capabilities with fewer Airmen while remaining competent across the Range of Military Operations. The very innovation and technologies our Airmen have created in the field will allow our entire ISR Enterprise to advance and posture for operations in the digital age.

E-3 Airborne Warning and Control System

The current E-3 Airborne Warning and Control System (AWACS), with planned modifications, is viable until 2038. The FY19 PB restored O&M, procurement and MILPERS for one active duty E-3 AWACS operations squadron, five PMAI, one BAI, and one attrition reserve aircraft with manpower. In the FY20 PB, the Air Force continues to invest and enhance the E-3 AWACS in support of combatant command and joint requirements. The Air Force continues to modernize the E-3 fleet through several major upgrade efforts to ensure it can support 5th to 4th generation aircraft, meet Federal Aviation Administration and international mandates and sustain availability rates. The largest modernization efforts include Block 40/45 modification to upgrade the mission computer, Diminishing Manufacturing Sources Replacement of Avionics for Global Operations and Navigation (DRAGON), modification to upgrade avionics, meet safety-of-flight

mandates, mode five installation, Mobile User Objective System (MUOS), and other radio datalink upgrades.

E-8C Joint Surveillance Target Attack Radar System

The Air Force developed and implemented a funding strategy to increase the operational and maintenance availability of the legacy E-8C Joint Surveillance Target Attack Radar System (JSTARS) to ensure aircraft viability and maintain battle management command and control/ground moving target indicator radar coverage into the future. Current funding is applied to a key communication system project that will replace diminishing manufacturing source equipment with modern Common Data Link. The program is exploring further efforts to maintain system viability in future years, including installing the Mode five transponder, and ARC-210 radios. The aircraft availability standard is 68%. FY18 ended with E-8C aircraft availability at 40.2%. The System Program Office is executing multiple initiatives to address declining fleet aircraft availability rates, which should improve aircraft availability to 62.3% by FY23. These initiatives include implementing a base level Organic Depot and instituting commercial airline maintenance best practices, with a target of reducing standard depot maintenance timelines by 25% and increasing the intervals between Programmed Depot Maintenance from two years to six years.

Substantial risk remains as to whether or not the Air Force will be able to provide six deployed E-8C aircraft to the Combatant Commanders to meet the force presentation mandate from the FY19 NDAA, Section 147(f)(l). Risk increases significantly without resolution of engine shortages and procuring a test asset for modernization. We project that in FY21, we could deploy four to five aircraft. Deploying six aircraft is possible, but doing so would require a temporary halt of JSTARS aircrew initial qualification training, significant reduction in

continuation training or a halt in installation of mandated equipment upgrades. Our current estimate is that the earliest we could have six JSTARS aircraft forward deployed, without negatively impacting training or equipment upgrades, is by October 2022.

MQ-9

The Air Force's FY20 investment funding request of $1.1 billion will continue MQ-9 fleet modernization efforts aimed at providing cutting edge capabilities to the Combatant Commands. To date the MQ-9 fleet has flown approximately two million hours, with 91% of those hours supporting combat operations. This extraordinary level of warfighter support is facilitated by a unique program architecture in which MQ-9 sustainment and modernization efforts are managed as separate, yet fully integrated and complementary programs of record. This allows the Air Force to focus on operating and sustaining fielded MQ-9s while robust development and testing of planned modernizations is conducted in parallel. This strategy keeps the MQ-9 relevant with regards to the needs of the Combatant Commands while at the same time addressing future and emerging requirements. By structuring this way, mature and proven upgrades for the program at large are delivered when and where they are needed.

MQ-9 modernization efforts include the new Block 50 Ground Control Station currently in development, a new DAS-4 sensor package, an extended range enhancement for Block 5 aircraft and an effective and reliable open systems architecture. Additionally, the MQ-9 program is actively engaged in mitigating the operational and maintenance impacts of sustaining a multi-configuration fleet as well as enabling airspace integration and access. The desired end state is a 100% Block 5 MQ-9 fleet operated exclusively by Block 50 Ground Control Stations in Mission Control Element operations, with Block 30 Ground Control Stations used solely for launch and recovery operations.

RC-135

The Air Force is committed to sustaining and upgrading the RC-135 fleet as it continues to be our most capable, relevant and viable signals intelligence platform. Continued modernization utilizing rapid acquisition and fielding processes is critical as we address emerging peer threats and the return to great power competition. The RC-135 is critical to our decision advantage as it provides vital intelligence data at unrivaled speeds to both the national-level intelligence community and the tactical-level warfighter.

The FY20 investment funding request of $289.9M facilitates mission system improvements for the entire RC-135 variant fleet. Efforts include the automation of additional search and detection capabilities, improved near-real-time data distribution and collaborative processing, exploitation and dissemination supported by enhanced artificial intelligence algorithms. Finally, our partnership with the United Kingdom's Royal Air Force on the RC-135 continues to set the standard for cooperative efforts that strengthen alliances while increasing partner interoperability.

RQ-4

The RQ-4 Global Hawk unmanned aircraft system provides high altitude, long endurance, all weather, wide area reconnaissance and surveillance. The FY20 investment funding request of $257.5 million, $1.6 billion across the FYDP, furthers modernization efforts, to include MS-177 sensor integration, a ground segment modernization program and a communications system modernization program.

The MS-177 sensor is on track for Initial Operating Capability in the third quarter of FY19. The MS-177 will utilize the Block 30 ISR Payload Adapter, which has been fully tested and approved for future modifications. The Ground Segment Modernization Program is

progressing smoothly, with installation of upgraded cockpits at Grand Forks Air Force Base and Beale Air Force Base projected for completion in FY20. Finally, the program's efforts to modernize ground and air vehicle communications equipment is also moving forward. The Communications System Modernization Program will improve RQ-4 communications capability while alleviating diminishing manufacturing source (DMS) issues with current equipment.

U-2

The Air Force has programmed resources to retain the U-2 through FY24 to address combatant commander and intelligence community requirements. This effort promotes sensor interoperability and ensures modularity with other platforms where applicable.

WC-135

The mission availability of the current WC-135 fleet of two aircraft is well below acceptability and as such, we will replace the two WC-135s, investing $210M to convert three KC-135R aircraft to three WC-135Rs.

Multi-Domain Command and Control

In future conflict, the prerequisite to achieving a strategic advantage over a peer competitor will be the ability to exercise multi-domain command and control. The Air Force approach to multi-domain control and control is focused on complicating our future adversaries' abilities to defend themselves. The Air Force is developing a Multi-domain Operations Center to fill a joint capability gap in command and control across regional and functional combatant commands. In FY20, the Air Force will experiment with enterprise data to address network challenges with a goal of eventually fielding a "Data Lake" to serve as a command and control platform across air, space, and cyber domains. We plan to have an initial capability by FY22 and then continuously expand the capability through rapid software acquisition.

Advanced Battle Management System

The Advanced Battle Management System (ABMS) will realize the vision of multi-domain command and control to propel our warfighting capability through a layered family of systems construct. We are striving for the capability where any sensor can talk to any shooter whether in space, on land, at sea, in the air, or in cyberspace. Our aim is to have intelligence and targeting data transformed into timely and actionable information through trusted networks and intelligent algorithms that enable our people to focus on decisions. In this construct, information is a service, rather than a platform, and the layers of sensing and the communication pathways will provide reliability and assurance in a contested environment.

We have started reviews to evaluate existing and emerging potential technologies and platforms across the Defense Department, the Intelligence Community, and the commercial world, to perform integrated analysis of the capability of various options to contribute to the fight and prioritize investment over time. We are beginning to develop requirements and standards for engineering discipline during execution, and all along the way to challenge ourselves and our Labs, commercial, and government partners to demonstrate capability early. As we pursue ABMS, we will maintain the right mix of legacy and future capabilities over time to be ready to fight. We are dedicated to pursuing ABMS thoughtfully. In total, from FY19-FY24, the Air Force is funding $3.8 billion towards the pursuit of ABMS across supporting programs. The FY20 PB request includes $525.5 million for investments across sensors, battle management command and control, communications, and architecture activities.

To date there have been no changes to the Joint Requirements Oversight Council requirements for the ABMS Initial Capabilities Document. The Initial Capabilities Document addresses JSTARS requirements for ground centric requirements, in addition to air centric

targets as well. ABMS will be able to perform the mission sets associated with both the JSTARS and AWACS platforms and possibly assume other roles of the Theater Air Control System. Additionally, Ground Moving Target Indicator (GMTI) requirements are being folded into the overarching ABMS architecture.

We are moving forward on ABMS, with the Analysis of Alternatives beginning in January 2019. It is being accomplished on a compressed schedule with release of results expected in the Fall 2019 timeframe. The on-going Analysis of Alternatives addresses our ability to conduct both the air moving target indicator (AMTI) mission and ground moving GMTI mission from permissive to highly contested environments in a disaggregated manner.

Recently we hired a Chief Architect, as a permanent Senior Executive Service equivalent position, and he officially began work this month. His first of many tasks will be to oversee the ABMS architecture design, enterprise communications and integration across programs. He will also identify technologies to enable horizontal and vertical integration across operating environments and warfighting domains.

Air Operations Center/Kessel Run

Air Operations Center (AOC) Weapon System interoperability with the multi-domain command and control (MDC2) vision remains essential to the AOC way ahead. The fielded AOC Weapon System Increment 10.1 legacy system will not support the MDC2 vision without significant improvements and modernization, and the Air Force is committed to fielding a modern architecture for the AOC that enables the goal of a common command and control platform. The FY20 PB request includes $148 million to support sustainment and the additional AOC development capacity required to retire the AOC 10.1 infrastructure and software while

leveraging modern commercial software best practices. This year's budget request is required for the AOC to remain viable and will result in faster decision making capability, leading to more success in combat when fighting against a near-peer adversary.

Kessel Run

We are revolutionizing the way we build and deliver software. The Air Force's Software Factory, the Kessel Run organization, is proving we can get valuable software released faster, with higher quality and reduced risk using an agile software development operations (DevOps) approach. This approach focuses on obtaining immediate user feedback, allowing for rapid delivery of capability that matters most to the warfighters. Kessel Run's initial effort, the AOC Pathfinder, was successfully completed in July 2018 and transitioned to the AOC Weapon System Block 20 development effort using Section 804 authorities of the FY16 NDAA. The Air Force appreciates the use of these rapid prototyping and rapid fielding authorities, which have created a potential two-year schedule savings to retire the outdated legacy AOC 10.1 baseline.

We are leveraging the flexibility in these authorities to not only make development faster and delivering capabilities in weeks instead of years, but to also achieve better results for planning, executing, and assessing theater-wide air and space operations. To date, we have successfully deployed capabilities at Langley Air Force Base, Al Udeid Air Base and Osan Air Base to prove out agile DevOps at scale. Within these deployed capabilities, we have demonstrated the ability to increase the speed of initial software product delivery by as much as 83 percent, and the ability to successfully deliver software application updates to users within hours. The Kessel Run organization also offers Enterprise Services, has expanded beyond AOC's current 17 applications, and is developing a diverse portfolio of 12 additional applications including business enterprise systems and a logistics information system for the F-35.

Cyber Warfare

Military operations in 21st century demonstrate the imperative to integrate cyber capabilities into multi-domain operations, project power in cyberspace, and defend our networks from adversarial attack. Our FY20 cyber warfare budget proposal reflects this reality and supports the Defense Department's priority of cyber defense, resilience, and continued integration of cyber capabilities into the full spectrum of military operations.

Unified Platform

Cyber operations demand network-centric and data powered operations, and Unified Platform provides that capability. Future conflicts at and below the level of warfare require the synchronization of information to coordinate appropriate responses in defense of our nation and accomplishment of Combatant Command objectives. Unified Platform delivers a common digital backbone facilitating the movement of cyber warfare data and information flows by connecting disparate cyber weapon systems across the military Services and U.S. Cyber Command. The FY20 funding request of $104.7 million, with $594.2 million planned across the FYDP, reflect the Air Force's commitment to network-centric operations. Unified Platform, one of the first 804 Rapid Acquisition programs, was designated in August 2018 and is serving as a pioneer for Agile Software Development Acquisition constructs. Unified Platform will facilitate information sharing, communication, and provide the ability to extract the insights required to remain relevant in the dynamic cyber terrain. We need the ability to rapidly develop, field, and modify Unified Platform, and the LevelUP software development factory ensures our continued technological superiority. We have already demonstrated early successes in merging disparate data sources and enriching the information to advance our cyber operations. We are postured to

accelerate the deployment of Unified Platform across the Cyber Mission Force and Service cyber components.

Joint Cyber Command and Control

The Joint Cyber Command and Control program addresses a challenge prevalent in current cyber operations, which is the lack of cyber situational awareness of the cyber terrain and battle management of cyber forces at the strategic level. The FY20 funding request is $29.5 million, with $197.5 million planned across the FYDP. Tomorrow's military operations must be integrated across all Services and Combatant Commands, and Joint Cyber Command and Control addresses this need. Current software applications and future programmatic initiatives are codifying an architecture, requirements, and development processes that will inform and empower Joint Force Commanders, Combatant Commands, and Service Component Commanders to make informed, operational decisions at speeds necessary in the cyber domain. To fulfill this, four prototypes are currently being analyzed for immediate deployment and future selection as "best of breed" components in the full Joint Cyber Command and Control solution. Employing existing resources today enables faster delivery of a full capability resulting in a quicker turn for cyber situation awareness and battle management capability.

Offensive and Defensive Cyber Warfare Systems

The Air Force continues to invest in improving its offensive and defensive cyber weapon systems. Defensive Cyberspace Operations proactively defends the Air Force network and DoD network enclaves against unauthorized intrusion, corruption, and/or destruction. Our cyberspace operators continue to protect our networks day and night and our acquisitions community continues to deliver new capabilities to meet the ever-changing threats in cyberspace. Our FY20 request doubles our procurement of Mission Defense Teams toolkits, supported by the FY20

request of $7.6 million, and $62.0 million across the FYDP. We are accelerating the growth to ensure Air Force wings are equipped with the right systems to defend their networks and keep their operations running securely.

The Air Force is also ensuring our offensive cyber forces are best equipped to align with the National Defense Strategy goals of lethality and competition below the level of armed conflict. In our FY20 budget request, we added $212 million in offensive cyber investments across the FYDP to ensure our Cyber Mission Teams are equipped with sufficient capabilities and capacity to conduct operations as required to meet the needs of our joint forces commanders. Tbese funds align directly with the DoD Cyber Strategy and work in concert with the investments from the other Services and U.S. Cyber Command. Air Force cyber capabilities provide critical support that protect Americans and our Allies both on the battlefield and at home every day.

Cyber Resiliency

The Cyber Resiliency Office for Weapon Systems (CROWS) continues to actively advance weapon system mission assurance in an increasingly cyber contested environment. CROWS enables smart modernization across the fielded fleet by identifying critical cyber vulnerabilities of existing weapon systems, developing enterprise-level mitigation solutions in conjunction with acquisition Program Executive Offices (PEO); and developing, publishing, and institutionalizing best practice system engineering techniques to build cyber resilient modifications and new systems. The CROWS has partnered with PEO Fighter/Bomber, as well as the C-17 and Joint Mission Planning System Program Offices, to prototype cybersecurity initiatives affecting enterprise hardware and software applications, worked with the F-15 Program Office and Defense Digital Service to increase robustness of next-gen ground

support systems, provided cyber training to over 147,000 Airmen, and developed contractual and practical guidance for the acquisition community to ensure our Air Force modernization efforts keep apace of adversary cyber capabilities.

Common datalink modernization

The Tactical Data Network Enterprise Program Office has multiple developmental efforts with regard to FY18 NDAA Section 234, which focus on secure, low probability of detect data link networks with the requirement of operating within contested and highly contested environments. These efforts include enhancements to Link-16 networks to address the effects of adversary jamming, software programmable Open Mission System (OMS) compliant radios capable of hosting a variety of advanced non-proprietary waveforms while also allowing backward compatibility, and Agile Communications, an experimentation effort that supports open standards and advanced apertures across aerial networks. In addition, 5th to 4th generation gateway provides redundancy in data sharing between 5th and 4th generation platforms. Finally, the Common Data Link Executive Agent is working closely with the Services to improve existing Low Probability of Intercept/Low Probability of Detection/Anti-Jam capabilities within the Common Data Link family of waveforms, to provide enhanced ISR support in future anti-access/area-denial airspace.

Modular Open Systems Approach

Modular, open systems, based in common and consensus based standards, reduces acquisition and lifecycle costs, improves innovation and competition, simplifies technology refresh, improves interoperability, and enables cheaper and faster modernization. The Open Architecture Management Office, established in January 2019, is posturing to be an Air Force wide office of expertise for common standards and open architecture efforts. The Open

Architecture Management Office, located under the Air Force Life Cycle Management Center, currently manages the Open Mission System and Universal Command and Control Interface initiatives. These consensus based standards initiatives are being implemented on major weapon systems, such as the F-22 and B-52 Radar Modernization Program. There are also significant efforts to ensure these standards are compatible with other consensus standards such as the Future Airborne Capabilities Environment and Sensor Open System Architecture. The Air Force efforts in modular, open systems will enable rapid and reduced cost modernization.

Conclusion

We want to give credit and thanks to Congress. Without the Rapid Acquisition Authorities given to us by Congress, there would still be a half-century of unnecessary time in over 20 of our programs. The Section 804 authorities allow us to develop and field technologies faster and smarter. Additionally, we appreciate the delegation of Milestone Decision Authority to the Service Acquisition Executive; we have subsequently delegated all medium and small programs to the field, increasing overall decision-making capacity and speed. Because of Congressional action, we can focus on performance—rather than process—in our rapid capability development efforts.

We will continue to look for opportunities, all centered on speeding our process, to remain competitive for tomorrow's Airmen as we remain dominant for today's. There will be no silver medal for building the world's second-best Air Force. The steps we have taken with the authorities you have given us demonstrate we do not intend to.

Dr. Will Roper

Dr. Will Roper is the Assistant Secretary of the Air Force for Acquisition, Technology and Logistics. As the Air Force's Service Acquisition Executive, Dr. Roper is responsible for and oversees Air Force research, development and acquisition activities totaling an annual budget in excess of $40 billion for more than 465 acquisition programs. In this position, Dr. Roper serves as the principal advisor to the Secretary and Chief of Staff of the Air Force for research and development, test, production and modernization efforts within the Air Force. In addition to his Air Force responsibilities, Dr. Roper is the Service Acquisition Executive for the Joint Strike Fighter.

Prior to his current position, Dr. Roper was the founding Director of the Pentagon's Strategic Capabilities Office. Established in 2012, the SCO imagines new—often unexpected and game-changing—uses of existing government and commercial systems: extending their shelf-life and restoring surprise to the military's playbook. Since 2012, SCO has grown from an annual budget of $50 million to the current $1.5 billion request in the President's 2018 budget with projects spanning new concepts such as hypervelocity artillery, multi-purpose missiles, autonomous fast-boats, smartphone-navigating weapons, big-data-enabled sensing, 3D-printed systems, standoff arsenal planes, fighter avatars and fighter-dispersed swarming micro-drones which formed the world's then-largest swarm of 103 systems. During his tenure as SCO Director, Dr. Roper served on the Department's 2018 National Defense Strategy Steering Group, Cloud Executive Steering Group and Defense Modernization Team.

Previously, Dr. Roper served as the Acting Chief Architect at the Missile Defense Agency where he developed 11 new systems, including the current European Defense architecture, advanced drones, and classified programs. Before this, he worked at MIT Lincoln Laboratory and served as a missile defense advisor to the Under Secretary of Defense for Acquisition, Technology and Logistics.

EDUCATION
2001 Bachelor of Science in Physics, Georgia Institute of Technology, Atlanta
2002 Master of Science in Physics, Georgia Institute of Technology, Atlanta
2010 Doctorate in Mathematics, Oxford University, England

CAREER CHRONOLOGY
January 2006 – June 2010, Missile Defense Advisor, MIT Lincoln Laboratory, Washington, D.C.
August 2010 – August 2011, Member, Missile Defense Advisory Committee, Missile Defense Agency, Washington D.C.
June 2010 – August 2012, Acting Chief Architect, Missile Defense Agency, Washington D.C.
August 2012 – February 2018, Director, Strategic Capabilities Office, Office of the Secretary of Defense, Washington, D.C.
February 2018 – present, Assistant Secretary of the Air Force for Acquisitions, Technology and Logistics, Headquarters U.S. Air Force, Washington, D.C.

MAJOR AWARDS AND HONORS
Department of Defense Medal for Distinguished Public Service
Secretary of Defense's Award for Excellence
USD/AT&L Award for Innovation
MDA Contractor of the Year
MDA Innovation and Technology Awards
Rhodes Scholar

(Current as of March 2018)

General James M. Holmes

Gen. James M. "Mike" Holmes is the Commander, Air Combat Command, Joint Base Langley-Eustis, Virginia. As the commander, he is responsible for organizing, training, equipping and maintaining combat-ready air, space, cyber and intelligence forces for rapid deployment and employment while ensuring strategic air defense forces are ready to meet the challenges of peacetime air sovereignty and wartime defense. The command operates more than 1,000 aircraft, 35 wings, 11 bases, and 1,348 units at more than 300 operating locations worldwide with 159,000 total force military and civilian personnel. As the Combat Air Forces lead agent, ACC develops strategy, doctrine, concepts, tactics, and procedures for air-, space-, and cyber-power employment. The command provides conventional and information warfare forces to all unified commands to ensure air, space, cyber, and information superiority for warfighters and national decision-makers. The command can also be called upon to assist national agencies with intelligence, surveillance and crisis response capabilities.

General Holmes entered the Air Force through Officer Training School in 1981 after receiving a degree in electrical engineering from the University of Tennessee. He has commanded the 27th Fighter Squadron, the 14th Operations Group, the 4th Fighter Wing and the 455th Air Expeditionary Wing. He has served in the Office of the Secretary of Defense and on headquarters staffs of the United States Air Force, U.S. European Command and Pacific Air Forces. Prior to his current position, he served as the Deputy Chief of Staff for Strategic Plans and Requirements, Headquarters U.S. Air Force, Arlington, Va.

He is a command pilot with more than 4,000 hours, including over 530 combat hours in the F-15A/B/C/D/E, and has also flown the T/AT-38, T-37, and T-1A.

EDUCATION

1981 Bachelor of Science degree in electrical engineering, University of Tennessee, Knoxville
1986 F-15 Fighter Weapons Instructor Course, U.S. Air Force Fighter Weapons School, Nellis AFB, Nev.
1987 Squadron Officer School, Maxwell Air Force Base, Ala.
1993 Air Command and Staff College, Air University, Maxwell AFB, Ala.
1993 Master of Arts degree in history, University of Alabama, Tuscaloosa
1994 Master of Airpower Arts and Sciences degree, School of Advanced Airpower Studies, Air University, Maxwell AFB, Ala.
1995 Armed Forces Staff College, Norfolk, Va.
2000 Air War College, by correspondence
2001 Master's degree in national defense studies, Naval War College, Newport, R.I.
2006 National Defense Studies Fellow, Maxwell School of Citizenship and Public Affairs, Syracuse University, N.Y.
2007 Joint Force Air Component Commander Course, Air University, Maxwell AFB, Ala.
2010 AFSO21 Executive Leadership Course, University of Tennessee, Knoxville
2011 Coalition Force Maritime Component Commander Course, Naval War College, Bahrain
2013 Joint Flag Officer Warfighting Course, Air University, Maxwell AFB, Ala.
2018 Leadership at the Peak, Center for Creative Leadership, Colorado Springs, Colo.

ASSIGNMENTS

September 1981 - August 1982, student, undergraduate pilot training, Columbus AFB, Miss.
September 1982 - November 1982, student, fighter lead-in training, Holloman AFB, N.M.
November 1982 - April 1983, student, F-15 conversion training, Luke AFB, Ariz.
May 1983 - December 1985, F-15 instructor pilot and Assistant Squadron and Wing Weapons Officer, 71st Tactical Fighter Squadron, Langley AFB, Va.
January 1986 - May 1986, student, USAF F-15 Fighter Weapons Instructor Course, Nellis AFB, Nev.
May 1986 - May 1989, F-15 Chief of Weapons and Tactics, 44th Tactical Fighter Squadron, Kadena Air Base, Japan

May 1989 - June 1992, F-15 Chief of Weapons and Tactics, Assistant Chief of Wing Weapons and Tactics, Flight Commander and Assistant Operations Officer, 7th Tactical Fighter Squadron and 9th Fighter Squadron, Holloman AFB, N.M.
July 1992 - June 1993, student, Air Command and Staff College, Air University, Maxwell AFB, Ala.
July 1993 - June 1994, student, School for Advanced Airpower Studies, Air University, Maxwell AFB, Ala.
July 1994 - October 1996, Air Operations Officer and Crisis Action Planner, Operations Directorate, Headquarters U.S. European Command, Stuttgart-Vaihingen, Germany
October 1996 - December 1997, Assistant Operations Officer, 27th Fighter Squadron, Langley AFB, Va.
January 1998 - May 1999, Operations Officer, 71st Fighter Squadron, Langley AFB, Va.
May 1999 - July 2000, Commander, 27th Fighter Squadron, Langley AFB, Va.
July 2000 - July 2001, student, Naval War College, Newport, R.I.
July 2001 - August 2002, Chief, Strategy, Concepts and Doctrine Division, Directorate of Operational Plans and Joint Matters, Headquarters U.S. Air Force, Arlington, Va.
August 2002 - July 2004, Commander, 14th Operations Group, Columbus AFB, Miss.
August 2004 - September 2006, Commander, 4th Fighter Wing, Seymour Johnson AFB, N.C.
September 2006 - June 2007, Chief, Checkmate, Directorate of Operational Plans and Joint Matters, Headquarters U.S. Air Force, Arlington, Va.
July 2007 - December 2007, Director of Strategic Plans, Programs and International Affairs, Headquarters Pacific Air Forces, Hickam AFB, Hawaii
December 2007 - March 2008, Special Assistant to the Director of Operational Planning, Policy and Strategy, Deputy Chief of Staff for Operations, Plans and Requirements, Headquarters U.S. Air Force, Arlington, Va.
March 2008 - April 2009, Commander, 455th Air Expeditionary Wing, Bagram Air Base, Afghanistan
April 2009 - July 2009, Special Assistant to the Assistant Vice Chief of Staff, and Director, Air Staff, Headquarters U.S. Air Force, Arlington, Va.
July 2009 - August 2011, Principal Director for Middle East Policy, Office of the Under Secretary of Defense for Policy, Office of the Secretary of Defense, the Pentagon, Arlington, Va.
August 2011 - January 2012, Director, Strategic Planning, Deputy Chief of Staff for Strategic Plans and Programs, Headquarters U.S. Air Force, Arlington, Va.
January 2012 – July 2013, Assistant Deputy Chief of Staff for Operations, Plans and Requirements, Headquarters U.S. Air Force, Arlington, Va.
August 2013 - July 2014, Vice Commander, Air Education and Training Command, Joint Base San Antonio- Randolph, Texas
August 2014 - March 2017, Deputy Chief of Staff for Strategic Plans and Requirements, Headquarters U.S. Air Force, Arlington, Va.
March 2017 - present, Commander, Air Combat Command, Joint Base Langley-Eustis, Va.

SUMMARY OF JOINT ASSIGNMENTS
July 1994 - October 1996, Air Operations Officer and Crisis Action Planner, Operations Directorate, Headquarters U.S. European Command, Stuttgart-Vaihingen, Germany, as a major
March 2008 - April 2009, Commander, 455th Air Expeditionary Wing and Senior Airfield Authority, Bagram AB, Afghanistan, as a brigadier general
July 2009 - August 2011, Principal Director for Middle East Policy, Office of the Under Secretary of Defense for Policy, Office of the Secretary of Defense, the Pentagon, Arlington, Va., as a brigadier general

FLIGHT INFORMATION
Rating: command pilot
Flight hours: More than 4,000, including over 530 combat hours
Aircraft flown: F-15A/B/C/D/E, T/AT-38, T-37 and T-1A

MAJOR AWARDS AND DECORATIONS
Distinguished Service Medal
Defense Superior Service Medal
Legion of Merit with oak leaf cluster
Bronze Star Medal
Defense Meritorious Service Medal

Meritorious Service Medal with two oak leaf clusters
Air Medal with three oak leaf clusters
Aerial Achievement Medal with three oak leaf clusters
Air Force Commendation Medal with oak leaf cluster
Army Commendation Medal

PUBLICATIONS

1994 The Counterair Companion, A Short Guide to Air Superiority for Joint Force Commanders, School of Advanced Airpower Studies, Air University, Maxwell AFB, Ala.
2018 Multidomain Battle: Converging Concepts Toward a Joint Solution, Joint Force Quarterly 88

EFFECTIVE DATES OF PROMOTION

Second Lieutenant Aug. 28, 1981
First Lieutenant Aug. 28, 1983
Captain Aug. 28, 1985
Major May 1, 1993
Lieutenant Colonel Jan. 1, 1998
Colonel July 1, 2002
Brigadier General May 2, 2008
Major General Jan. 28, 2011
Lieutenant General Aug. 2, 2013
General March 10, 2017

(Current as of December 2018)

Major General David S. Nahom

Maj. Gen. David S. Nahom is the Director of Programs, Office of the Deputy Chief of Staff for Strategic Plans and Requirements, the Pentagon, Arlington, Virginia. He leads a staff of military and civilians in the development, integration, evaluation and analysis of the Air Force Program across the Future Years Defense Plan and maintains the integrity and discipline of the Air Force Corporate Structure process.

General Nahom was commissioned through ROTC at the University of Colorado and is a distinguished graduate of both undergraduate navigator training and Euro-NATO joint jet pilot training. During his Air Force career General Nahom commanded at the squadron, group and wing level and is a command pilot with more than 3,500 hours in the F-22A, F-15A/B/C/D and F-111F.

In addition to his flying and command experience, General Nahom is a graduate of the U.S. Army Command and General Staff College and the NATO Defense College. He has held headquarters-level assignments at NATO Combined Air Operations Center Six, U.S. Forces Korea, Pacific Air Forces, Headquarters U.S. Air Force and Air Forces Central Command.

EDUCATION
1988 Bachelor of Arts in Economics, University of Colorado, Boulder
1993 Squadron Officer School, Maxwell Air Force Base, Ala.
2001 Command and General Staff College, Fort Leavenworth, Kan.
2001 Master of Military Arts and Science, Fort Leavenworth, Kan.
2008 Air War College, by correspondence
2009 NATO Defense College, Rome

ASSIGNMENTS
November 1988 – August 1989, student, specialized undergraduate navigator training, Mather AFB, Calif.
September 1989 – October 1989, student, AT-38 fighter lead-in training, 436th Tactical Fighter Training Squadron, Holloman AFB, N.M.
November 1989 – May 1990, student, F-111 Replacement Training Unit, 389th Tactical Fighter Training Squadron, Mountain Home AFB, Idaho
June 1990 – February 1993, F-111F Weapons Systems Officer, 492nd Tactical Fighter Squadron, RAF Lakenheath, England
March 1993 – July 1994, Euro NATO joint jet pilot training, Sheppard AFB, Texas
August 1994 – October 1994, Student, introduction to fighter fundamentals, Columbus AFB, Miss.
November 1994 – June 1995, Student, F-15C Fighter Training Unit, 95th Fighter Squadron, Tyndall AFB, Fla.
July 1995 – February 1998, Aircraft Commander, Flight Lead, Mission Commander, 71st Fighter Squadron, Langley AFB, Va.
March 1998 – June 2000, Instructor Pilot, Flight Commander, Assistant Director of Operations, 95th Fighter Squadron, Tyndall AFB, Fla.
June 2000– June 2001, student, Command and General Staff College, Fort Leavenworth, Kan.
July 2001 – July 2002, Chief of Fighter Operations, NATO Combined Air Operations Six, Eskisehir, Turkey
August 2002 – August 2008, Chief of Wing Training, Chief of Safety, Director of Operations, Squadron Commander, Deputy Commander for Maintenance, 60th Fighter Squadron, 33rd Fighter Wing, Eglin AFB, Fla.
August 2008 – January 2009, Student/Senior Course Member, NATO Defense College, Rome
February 2009 – June 2010, Chief, Training, Readiness, Exercises Division, J37 USFK, USAG Youngsan, Seoul, South Korea
June 2010 – July 2012, Commander, 18th Operations Group, Kadena AB, Japan
July 2012 – March 2013, Executive Officer to COMPACAF, Joint Base Pearl Harbor-Hickam, Hawaii

March 2013 – August 2014, Commander, 3rd Wing, Joint Base Elmendorf-Richardson, Alaska
August 2014 – August 2015, Director, Regional Affairs, Office of the Deputy Under Secretary of the Air Force, International Affairs, Headquarters U.S. Air Force, Arlington, Va.
August 2015 – April 2017, Deputy Director of Plans and Programs, Joint Base Langley-Eustis, Va
May 2017 – May 2018, Deputy Commander, U.S. Air Forces Central Command; Deputy, Combined Force Air Component Commander, U.S. Central Command, Southwest Asia
May 2018 - present, Director of Programs, Office of the Deputy Chief of Staff for Strategic Plans and Requirements, the Pentagon, Arlington, Va.

FLIGHT INFORMATION
Rating: command pilot
Flight hours: 3,500
Aircraft flown: F-22A, F-15 A-D, AT-38, T-38, T-37, F-111A/F

MAJOR AWARDS AND DECORATIONS
Defense Superior Service Medal
Legion of Merit with oak leaf cluster
Distinguished Flying Cross with oak leaf cluster
Defense Superior Service Medal
Defense Meritorious Service Medal
Meritorious Service Medal with three oak leaf clusters
Air Force Commendation Medal
Air Medal with four oak leaf clusters
Aerial Achievement Medal with three oak leaf clusters

EFFECTIVE DATES OF PROMOTION
Second Lieutenant Aug. 13, 1988
First Lieutenant Aug. 13, 1990
Captain Aug. 13, 1992
Major Dec. 1, 1999
Lieutenant Colonel April 1, 2004
Colonel July 1, 2009
Brigadier General Oct. 17, 2014
Major General June 2, 2018

(Current as of August 2018)

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UNITED STATES HOUSE OF REPRESENTATIVES

PRESENTATION TO THE
HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES
UNITED STATES HOUSE OF REPRESENTATIVES

HEARING DATE/TIME: May 2, 2019, 9:00 A.M.

SUBJECT: Department of the Air Force Acquisition and Modernization Programs in the Fiscal Year 2020 National Defense Authorization President's Budget Request

STATEMENT OF:

The Honorable Robert B. Daigle
Director, Cost Assessment and Program Evaluation.

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SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES
UNITED STATES HOUSE OF REPRESENTATIVES

Written Testimony of the Honorable Robert B. Daigle
Director, Cost Assessment and Program Evaluation
Hearing of the Tactical Air and Land Forces Subcommittee
House Armed Services Committee
Thursday, May 2, 2019

Chairman Norcross, Ranking Member Hartzler, distinguished members of the subcommittee; thank you for the opportunity to present the results of the Department of Defense's collaborative effort to acquire the appropriate mix of tactical aircraft for our future fights—a mix that can meet the challenges outlined in Department of Defense National Defense Strategy. I would like to thank your staff, and the staffs of the other defense committees, for the hours they have dedicated to discussing this important topic with us. Their insights have been very helpful. The result of this concerted work is United States Air Force, Department of the Navy, Joint Staff, and Department agreement that our strategy for procuring tomorrow's tactical aircraft force structure creates a powerful combination designed to succeed on tomorrow's battlefield.

The National Defense Strategy acknowledges an increasing complex global security environment, characterized by overt challenges to the international order and the re-emergence of strategic competition between nations. The Department of Defense's plan to win the potential conflicts that result from this increasingly tense atmosphere includes a broad set of missions that demand a mixture of penetrating and stand-off capabilities for both high-end fights with great power competitors and the increasingly more demanding operations at the lower end of the conflict spectrum.

The 5th generation F-35 is critical to winning future wars with near-peer competitors, and we remain fully committed to the program. Our budget submission for fiscal year 2020 funds procurement of 78 aircraft, underwrites our modernization requirements, and improves our ability to sustain the aircraft we are buying far into the future.

Our analysis determined that capacity is also important. Our current inventory of 4th generation aircraft is reaching the end of its service life more quickly than expected. This will create a fighter capacity gap if we don't address it. Since we are already on a path to buy the 5th generation fighters we need to meet peer competitor challenges, our analysis shows the best way to avoid a fighter capacity gap is to begin buying new 4th generation fighters now. These 4th generation fighters are the most cost effective way to meet lower-end mission demands, which ensures our 5th generation fighters are available for high end fights.

For Example, as illustrated in the following table, an F-35A is projected to cost approximately $47 million more per aircraft to acquire and sustain over 10 years than an F-15E, assuming each aircraft is flown 250 hours per year.

	Acquisition Cost per Aircraft* (FY20$M)	10 Year O&S Cost per Aircraft (FY20$M)	10 Year Cost of Ownership per Aircraft (FY20$M)
F-35A	$100	$110	$210
F-15EX	$90	$73	$163

*Note: The costs often cited for the F-35 JPO are Unit Recurring Flyaway costs which includes costs for airframe, government furnished equipment, engines, and engineering change orders. Acquisition cost is URF plus non-recurring engineering, ancillary equipment, technical data publication, contract support services, support and training equipment, factory training, and initial spares

Matching capabilities to missions with a mix of technologies is not a unique approach to designing a future force structure. Faced with the challenge of obtaining a minimum of 175 bombers by the 2040s, the Air Force plans to upgrade its 76 B-52s and buy at least 100 new B-21 stealth bombers. The Department of Defense is also exploring how small commercial space systems complement our exquisite current national security space assets. The Department is also purchasing light attack aircraft to conduct cost-effective operations in permissive environments.

PB20 therefore requests to purchase F-15EXs, and we must begin procuring these planes now. Waiting to procure F-15EX airframes after the production line closes would cost the Department of Defense about $10 billion dollars in development fees, money we could be using to buy new aircraft. This estimate is based on our experience with the F/A-18E/F.

The President's budget submission for FY 20 includes more than $12 billion in new procurement. $9.2 billion is allocated for 78 F-35s, $1.8 billion for 24 new F/A-18E/Fs, and $1 billion for 8 new F-15EXs. The proposed budget also requests $1.6 billion for F-35 modernization and $2.2 billion for F-35 sustainment, which includes accelerating depot stand-ups and increasing spare parts supplies to improve readiness.

Thank you again for this opportunity and I look forward to both your questions today and a continuing dialogue about this and many other important topics with all of the defense committees.

Robert Daigle
Director, Cost Analysis and Program Evaluation Office of the Secretary of Defense

The Honorable Robert "Bob" Daigle of Virginia was sworn in as the third Director of Cost Assessment and Program Evaluation (CAPE), Department of Defense on August 3, 2017. Prior to his confirmation, Mr. Daigle served as a Professional Staff Member on the House Armed Services Committee (HASC), where he directly supported the Chairman by leading the committee's defense reform team. During his tenure, the reform team prepared two stand-alone bills aimed at improving the agility of the defense acquisition system to respond to emerging threats and technological opportunities.

Before joining HASC, Mr. Daigle served as the Executive Director of the Military Compensation and Retirement Modernization Commission. While there, Mr. Daigle oversaw the most thorough quantitative analysis of more than 280 military compensation programs conducted in over 40 years. He was instrumental in proposing reforms, the majority of which were enacted by Congress, to improve military retirement, health care, and wartime readiness while saving $12 billion annually.

Mr. Daigle served previously in CAPE as the Director of the Program Resources and Information Systems Management Division. While there, he regularly participated in senior leader resource allocation deliberations and led the "engine room" for the Program Review, including program data collection and delivery of the Future Years Defense Program to the White House Office of Management and Budget (OMB) and Congress. He also served as the Special Assistant to the Director of CAPE and as an operations research specialist focused on military force structure, manpower, personnel compensation, reporting processes, and IT systems.

Mr. Daigle has also held leadership roles in several financial analysis and consulting firms. He served as the Executive Vice President of Advanced Securities Consulting, where he led quantitative analyses of bank, broker, and pension fund investment programs and provided expertise in asset/ liability management, risk management, securities finance, cash management, and corporate governance. Previously, he was the Executive Vice President for the Center for the Study of Financial Market Evolution, where he oversaw design, production, and long-term agendas for research, data acquisition, constituent outreach, legislative and regulatory outreach, and research dissemination. Earlier in his career, Mr. Daigle was the Director of Analytics for ASTEC Consulting in New York, NY and Burlington, VT. With ASTEC, he designed proprietary quantitative performance and risk models for pension fund investment strategies.

From 1992–1994, Mr. Daigle served as an infantryman in the U.S. Army at Bad Hersfeld, Germany and Fort Hood, TX. He earned six medals and certificates of achievement to include the Expert Infantry Badge.

Mr. Daigle holds Bachelor of Arts degrees in Economics and Mathematics from the University of Vermont, an MBA in Finance from Columbia Business School, and a Master of Science in International Security Studies from Georgetown University.

Mr. Daigle and his wife Veronica have two sons.

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UNITED STATES HOUSE OF REPRESENTATIVES

PRESENTATION TO THE
HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES
UNITED STATES HOUSE OF REPRESENTATIVES

HEARING DATE/TIME: May 2, 2019, 9:00 A.M.

SUBJECT: Department of the Air Force Acquisition and Modernization Programs in the Fiscal Year 2020 National Defense Authorization President's Budget Request

STATEMENT OF:

Lieutenant General Anthony R. Ierardi
Director, Force Structure, Resources, and Assessments

NOT FOR PUBLICATION UNTIL RELEASED BY
HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES
UNITED STATES HOUSE OF REPRESENTATIVES

Chairman Norcross, Ranking Member Hartzler, distinguished members of this subcommittee, thank you for your support of the men and women in uniform who serve our nation and for the opportunity to address your questions related to Tactical Air and Land Forces initiatives.

INTRODUCTION

In his testimony in March to the House Armed Services Committee, General Dunford discussed several challenges the Joint Military Net Assessment identified including the Joint Force's decreasing competitive advantage in the Air Domain. The 2018 Joint Military Net Assessment – a three-month study that included inputs from across the Department of Defense, the Intelligence Community, and academia – outlined capability, capacity and readiness issues within the Tactical Air portfolio that informed the Chairman of the Joint Chiefs of Staff's program recommendations to the Secretary of Defense. The Chairman's recommendations focused on balancing the capabilities we need for today's operations with the depth, flexibility, and advanced technologies required to respond to the challenges of the future.

TACTICAL AIRCRAFT FORCE MIX, CAPACITY ISSUES AND RISK MITIGATION STRATEGIES

From the Joint Force perspective, 5th generation capabilities remain essential to success against near-peer competitors. However, adapting the force we have today, while we design the force needed for tomorrow's challenges requires a mix of capabilities within the Tactical Air portfolio. In the short term, the 4th generation aircraft fleet provides essential capacity to meet National Defense Strategy demands while we continue to acquire and modernize our 5th generation aircraft. Long term, this portfolio transitions to a majority of 5th generation aircraft as we continue to acquire the F-35 through 2040. In the interim, we must maintain a relevant mix of 4th generation capability and capacity to meet the demands across the National Defense Strategy as multiple airframes exceed their service life over the next decade.

CURRENT AND FORECASTED TACTICAL AIRCRAFT SHORTFALLS AND MITIGATION STRATEGIES

The tactical aircraft portfolio faces both near-term capability shortfalls until we complete modernization efforts for our 5th generation fleet and capacity issues as our 4th generation fleet ages-out. Modernization of our 5th generation fleet, including Block 4 upgrades for the F-35,

remains a critical component of maintaining our competitive advantage against pacing threats. Through the 2030s, improving capability and capacity by recapitalizing the F-15C fleet with the F-15EX enables the Joint Force to feasibly meet Combatant Command demands while the tactical aircraft portfolio transitions to a majority 5th generation fleet by 2040. In addition to mitigating capability and capacity issues, filling missions that do not require stealth, for example defensive counter air of rear air bases, with multi-role 4th generation aircraft will enable the limited 5th generation aircraft fleet to focus resources and improve readiness for potential operations against peer competitors.

ADVANCED BATTLE MANAGEMENT SYSTEM

As I testified last year, our adversaries continue to field capabilities that threaten the survivability and viability of our large-body high-value airborne assets used for battle management, command, and control by forcing these aircraft outside of their effective ranges. The increasing threat has created challenges and risk across our Air Battle Management fleet, including the Joint Surveillance Target Attack Radar System (JSTARS) that will remain until the Air Force fields the Advanced Battle Management System with equal or greater capability. In the interim, the Joint Requirement Oversight Council has acknowledged the United States Air Force's risk mitigation strategy relating to JSTARS Ground Moving Target Indicator (GMTI) in accordance with 2019 NDAA.

CONCLUSION

I would like to thank you again for the opportunity to appear before the committee and I look forward to your questions.

Lt. Gen. Anthony R. Ierardi
Director of Force Structure, Resources and Assessment, J8

Lieutenant General Ierardi is the Director of Force Structure, Resources and Assessment (J8), Joint Staff, the Pentagon, Washington, D.C. He develops capabilities; conducts studies, analysis and assessments; and evaluates plans, programs and strategies for the Chairman of the Joint Chiefs of Staff. He serves as the Joint Requirements Oversight Council Secretary and as the Chairman of the Joint Capabilities Board.

Prior to the assumption of this assignment, Lt. Gen. Ierardi served as the Deputy Chief of Staff, G-8 Headquarters Department of the Army in Washington, D.C.

In previous assignments, Lt. Gen. Ierardi served as the III Corps Deputy Commanding General and Commanding General of the 1st Calvary Division, "America's First Team;" the Director of Force Management, Office of the Deputy Chief of Staff, G-3/5/7; Director, Joint and Futures, Office of the Deputy Chief of Staff, G-8; Executive Officer for the Department of Defense Counter-IED Senior Integration Group; and as Deputy Commander for Program, Combined Security Transition Command-Afghanistan. He commanded Joint Task Force North at Fort Bliss, Texas and served as Director of Capabilities Development, U.S. Army Capabilities Integration Center, U.S. Army Training and Doctrine Command, at Fort Monroe, Virginia. He also served as the Chief of Staff of the 2d Infantry Division at Camp Red Cloud, Republic of Korea and as Commander of the 2d Infantry Division's First "Iron" Brigade at Camp Casey, Korea. While assigned at Fort Hood, Texas, he served as the Operations Officer (G-3) of the 1st Cavalry Division and Commander of the 1st Squadron, 7th Cavalry Regiment.

Earlier in his career, Lt. Gen. Ierardi served as a Cavalry Troop Commander in the 2d Squadron, 2d Armored Cavalry Regiment in Bamberg, Germany, and participated in Operation Desert Storm while assigned to the 2d Armored Cavalry Regiment. Lt. Gen. Ierardi trained and served as a Latin American Foreign Area Officer, first as a student attending the Mexican Army's Command and General Staff College (Escuela Superior de Guerra) in Mexico City, and later as the Aide-de-Camp to the Commander of the U.S. Southern Command.

Lieutenant General Ierardi's awards include the Defense Superior Service Medal, the Legion of Merit, the Bronze Star, the Defense Meritorious Service Medal, the Meritorious Service Medal, the Army Commendation Medal, and the Army Achievement Medal. Lt. Gen. Ierardi holds a degree in Business Administration from Washington and Lee University, a Master of Arts Degree in Latin American Studies from Georgetown University and is also a graduate of both the U.S. Army Command and General Staff College and the U.S. Naval War College.

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Testimony

Before the Subcommittee on Tactical Air and Land Forces, Committee on Armed Services, House of Representatives

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DEFENSE ACQUISITIONS

Observations on the F-35 and Air Force's Advanced Battle Management System

Statement of Michael J. Sullivan, Director
Contracting and National Security Acquisitions

GAO-19-456T

GAO Highlights

Highlights of GAO-19-456T, a testimony before the Subcommittee on Tactical Air and Land Forces, Committee on Armed Services, House of Representatives

Why GAO Did This Study

In 2018, the F-35 program began operational testing. Also in 2018, the Air Force continued planning for the acquisition of ABMS, intended to modernize how DOD maintains command and control over and manages the future battlefield. Both the F-35 and ABMS are expected to play key roles in DOD's modernization efforts.

This testimony statement discusses (1) the F-35 program's development and modernization efforts, and progress in improving the aircraft's R&M and (2) DOD's current planning efforts for ABMS. This statement is based on two GAO reports on the F-35 published in April 2018 and an GAO's ongoing work concerning ABMS. To conduct this work, GAO analyzed DOD management reports, discussed the efforts with program and contractor officials, and compared both efforts to DOD policy and GAO acquisition best practices.

What GAO Recommends

In April 2018, GAO recommended that the F-35 program office complete its Block 4 business case before making more contract awards. DOD did not concur, citing that it has adequate knowledge to begin Block 4 development. GAO maintains that completing its business case before awarding its Block 4 development contracts would put DOD and the program in a better position to successfully develop Block 4 capabilities. GAO also recommended that DOD take action to improve its R&M performance. DOD concurred and noted the actions it would take.

View GAO-19-456T. For more information, contact Michael J. Sullivan at (202) 512-4841 or sullivanm@gao.gov.

May 2, 2019

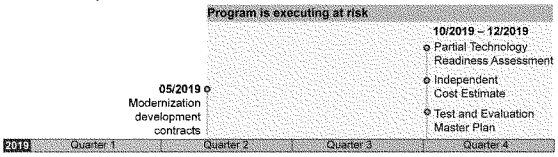
DEFENSE ACQUISITIONS

Observations on the F-35 and Air Force's Advanced Battle Management System

What GAO Found

The Department of Defense (DOD) wrapped up the F-35 development program in April 2018 and expects to complete operational testing in December 2019. DOD has turned its attention to modernization efforts—referred to as Block 4—to add new capabilities to address evolving threats. The program office estimates Block 4 to cost at least $10.5 billion through 2024. DOD plans to start Block 4 development without a complete business case identifying baseline cost and schedule estimates. Key documents for establishing a business case, such as an independent cost estimate, will not be ready before the program plans to award Block 4 development contracts in May 2019 (see figure).

Three F-35 Modernization Business Case Documents That Will Not Be Ready Before the Planned Development Contract Awards



Source: GAO analysis of Department of Defense data. | GAO-19-456T

Without a business case—consistent with acquisition best practices—program officials cannot be confident that the risk of committing to development has been reduced adequately prior to planned contract awards.

The program made slow, sustained progress in improving the F-35's reliability and maintainability (R&M). F-35 aircraft are assessed against eight R&M metrics, which inform how much time the aircraft will be in maintenance rather than operations. Half of these metrics are not meeting targets. While the program office has a plan for improving R&M, its guidance is not in line with GAO's acquisition best practices or internal control standards as it does not include specific, measurable objectives, align improvement projects to meet those objectives, and prioritize funding to match resources to R&M requirements. If the R&M requirements are not met, the warfighter will have to settle for a less reliable and more costly aircraft than originally planned. This contributes to the F-35's $1.12 trillion estimated sustainment costs and challenges with maintaining an expanding fleet that also has supply chain and logistics system problems.

GAO's ongoing work indicates that the Air Force's Advanced Battle Management System (ABMS)—intended to provide battle management command and control and surveillance across air, land, and sea—is in the early stages of planning. The capabilities and the strategy to deliver those capabilities are still to be determined. The Air Force plans to manage ABMS as a family of systems, integrating sensors from existing and future weapons programs, and overseen by a Chief Architect—whose role is still to be determined. The Air Force expects to further define ABMS after analyzing different options for delivering the capability. That analysis is expected to be complete in summer 2019.

Chairman Norcross, Ranking Member Hartzler, and Members of the Subcommittee:

Thank you for the opportunity to discuss our work on the F-35 Lightning II program and the Air Force's Advanced Battle Management System (ABMS). The Department of Defense's (DOD) 2018 National Defense Strategy outlines its strategic approach to build a more lethal force, which includes modernizing key capabilities to address future threats. Both the F-35 and the ABMS are expected to play a key role in DOD's modernization efforts.

DOD is now in its 18th year of developing the F-35—a family of fifth-generation strike fighter aircraft for the United States Air Force, Marine Corps, and Navy, as well as eight international partners.[1] The F-35 program has developed and is delivering three variants; the F-35A conventional takeoff and landing variant for the Air Force, the F-35B short takeoff and vertical landing variant for the Marine Corps, and the F-35C carrier-suitable variant for the Navy. The F-35 is DOD's largest acquisition program in U.S. military history, with total acquisition costs expected to exceed $406 billion to develop and procure more than 2,400 aircraft through fiscal year 2044. In addition, the Office of the Secretary of Defense's (OSD) Cost Assessment and Program Evaluation office estimates the F-35 program's sustainment costs to operate and maintain the fleet over the next 52 years to be $1.12 trillion.

ABMS is in the early planning stages and is intended to change the way the Air Force provides battle management command and control capabilities across air, land, sea, and space. ABMS would shift the emphasis from the current capabilities delivered by manned battle management platforms, such as the Airborne Early Warning and Control System (AWACS) and Joint Surveillance and Target Attack Radar System (JSTARS), to an integrated network of sensors providing new and upgraded capabilities.

This testimony is based on two reports we issued on the F-35 program in April 2019, our past F-35 work, and an oral briefing we provided to

[1]The international partners are the United Kingdom, Italy, the Netherlands, Turkey, Canada, Australia, Denmark, and Norway. These nations contributed funds for system development and all but Canada have signed agreements to procure aircraft. In addition, Belgium, Israel, Japan, and South Korea have signed on as foreign military sales customers.

Congress on ABMS in February 2019.[2] This statement (1) assesses the F-35 program's development progress, plans for modernization, and sustainment and supply chain efforts; and (2) describes DOD's current planning efforts for ABMS.

To assess the F-35 program's development and modernization plans, we reviewed program development documents as well as modernization planning documents that should be completed prior to awarding a development contract, according to GAO best practices. We interviewed DOD officials and contractor representatives regarding the program's development and modernization efforts. We analyzed monthly contractor reliability and maintainability (R&M) reports and compared these to program requirements. We reviewed the F-35 R&M Improvement Program—the program's plan to improve R&M metrics' performance. We also interviewed DOD officials and contractor representatives regarding the program's R&M performance. We also summarized our past findings on the F-35 program's supply chain and sustainment efforts.

To describe the Air Force's ABMS planning efforts, we reviewed and analyzed DOD program and planning documents. We also interviewed officials from DOD, including the Office of Cost Assessment and Program Evaluation, the Office of the Assistant Secretary of the Air Force for Acquisition, Technology and Logistics, Air Combat Command, and multiple Air Force program offices.

We assessed the reliability of the information we gathered regarding the F-35 program and ABMS by reviewing supporting documentation and interviewing knowledgeable officials. Based on these steps, we determined that all the data we used were sufficiently reliable for the purposes of this written statement. We discussed the information in this written statement with DOD officials and incorporated their comments as appropriate. The work on which this statement is based, has been conducted 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

[2]GAO, *F-35 Joint Strike Fighter: Action Needed to Improve Reliability and Prepare for Modernization Efforts*, GAO-19-341 (Washington, D.C.: Apr. 29, 2019); and *F-35 Aircraft Sustainment: DOD Needs to Address Substantial Supply Chain Challenges*, GAO-19-321 (Washington, D.C. Apr. 25, 2019).

that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

F-35 Modernization, Reliability, and Sustainment and Supply Chain Efforts Face Risks and Challenges

The F-35 plays a key role in DOD's modernization efforts. However, it faces concerns in several areas that will inform the program's cost and performance in the future. These include the risk in its modernization efforts, its aircraft not meeting all reliability targets, and sustainment and supply chain challenges. Specifically, the F-35 program plans to award Block 4 development contracts before it has key business case documents that would normally inform this decision. Also, the program is not meeting all of its Reliability and Maintainability (R&M) targets. Finally, the F-35 program's sustainment costs are rising as it also faces significant supply chain challenges.

The F-35 Program Will Start Block 4 Development without a Full Business Case

The F-35 baseline aircraft program completed development in April 2018. It started formal operational testing of the baseline aircraft in December 2018 after a 3-month delay. This testing was delayed for two main reasons: (1) to resolve critical deficiencies identified in developmental testing, and (2) to accommodate an unexpected grounding following the crash of an F-35B in September 2018. According to a test official, the program expects to complete testing in December 2019, about 3 months later than planned due to delays with the simulator that is used for more complex testing. Until that testing is complete, there is still a risk that additional deficiencies may be identified. With the program wrapping up development of the baseline program, it is transitioning to early development and testing activities for the Block 4 modernization efforts, which the F-35 Joint Program Office estimates will cost about $10.5 billion. With Block 4, DOD plans to add new capabilities and modernize the F-35 aircraft to address evolving threats.

In April 2019, we found that DOD will not have a complete business case for Block 4 before it plans to award development contracts in 2019.[3] Section 224 of the National Defense Authorization Act for Fiscal Year 2017 required DOD to submit a report containing certain elements of an acquisition program baseline—in essence, a business case—to include cost, schedule, and performance information and independent estimates—for Block 4. In 2018, we found that DOD's report to Congress

[3]GAO-19-341.

was incomplete.[4] In its report, DOD stated that the acquisition program baseline would continue to be refined over the next year. DOD officials stated that the updated F-35 program baseline, with the Block 4 efforts included, will be released in April 2019.

Over the past year, the program has already invested over $1.4 billion, in part to gain the knowledge it needs to develop that business case, such as a preliminary design review, as well as to establish Block 4 testing facilities and support early capabilities' development. The program incorporated some Block 4 activities into its acquisition strategy, which was approved in October 2018. However, we found that three key Block 4 business case documents will not be ready before the program's planned development contract awards in May 2019:

- **Independent Technology Readiness Assessment:** A Technology Readiness Assessment is a systematic, evidence-based process that evaluates the maturity of hardware and software technologies critical to the performance of a larger system or the fulfillment of the key objectives of an acquisition program. The program office plans to conduct a partial independent assessment of initial capabilities sometime between October and December 2019 with additional assessments to follow. A program official stated that technologies will not be integrated into the aircraft until they are adequately mature. However, without a complete independent Technology Readiness Assessment, the program will not have identified potential critical technology elements and, as a result, may be at risk of delaying the delivery of new capabilities.
- **Test and Evaluation Master Plan:** Although the F-35 program has begun testing Block 4 capabilities, it does not have an approved Test and Evaluation Master Plan. The Test and Evaluation Master Plan documents the overall structure, strategy, and objectives, as well as the associated resources needed for execution. Developmental and operational test officials have expressed concerns about the lack of an approved test plan, uncertain funding, the number of test aircraft available, and the draft test schedule, among other things. An approved, properly resourced test plan is essential for planning and preparing for adequate testing of the Block 4 capabilities. According to these officials, without an approved plan, the F-35 program is providing the test authorities with capabilities to be tested without

[4]GAO, *F-35 Joint Strike Fighter: Development Is Nearly Complete, but Deficiencies Found in Testing Need to Be Resolved,* GAO-18-321 (Washington, D.C.: June 5, 2018).

giving them the necessary direction on how to adequately prepare to conduct the tests, making it difficult to execute testing. While this is still a concern, F-35 program officials explained that over the past 3 months they have been providing the test authorities with the direction needed to conduct testing.

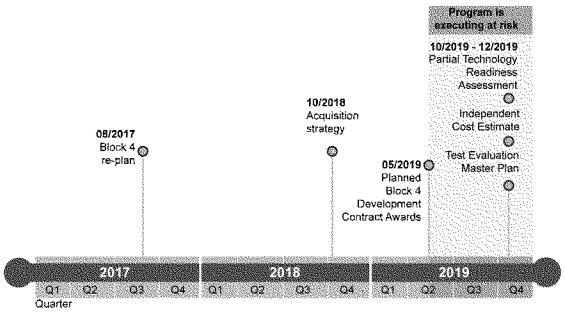
- **Independent Cost Estimate:** The Block 4 Independent Cost Estimate, which details the program's total estimated life cycle cost, is not complete. In August 2017, we reported that DOD estimated the development funding needed for the first phase of Block 4 was projected to be over $3.9 billion through 2022.[5] Since then, the program incorporated more fidelity and specific Block 4 efforts that were not in the original estimate into its Block 4 cost estimate. Based on the program office's latest estimate, the cost of Block 4 capabilities is expected to be $10.5 billion through 2024. According to OSD's Cost Assessment and Program Evaluation office, it will provide the Independent Cost Estimate between October and December 2019 to support the F-35 program's pending full-rate production decision, but this would occur several months after the program plans to award the Block 4 development contracts. According to the GAO Cost Guide, an Independent Cost Estimate is considered one of the best and most reliable estimate validation methods as it provides an independent view of expected program costs that tests the program office's estimate for reasonableness.[6] Without an Independent Cost Estimate, Congress does not have insight into the full potential cost of Block 4.

The expected completion dates for these documents are between October and December 2019, at the earliest. Figure 1 shows key Block 4 dates such as the Block 4 re-plan, which included revising the cost estimate for Block 4 that DOD established in 2017, the planned development contract awards, and planned completion dates for the three remaining critical business case documents.

[5]GAO, *F-35 Joint Strike Fighter: DOD's Proposed Follow-on Modernization Acquisition Strategy Reflects an Incremental Approach Although Plans Are Not Yet Finalized,* GAO-17-690R (Washington, D.C.: Aug. 8, 2017).

[6]GAO, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs,* GAO-09-3SP (Washington, D.C.: Mar. 2, 2009).

Figure 1: Three Business Case Documents Will Not Be Ready Before the Planned Development Contract Awards



Source: GAO analysis of Department of Defense data. | GAO-19-456T

As seen in figure 1, the program office plans to award Block 4 development contracts in May 2019, at least five months before any of the critical business case documents will be available. Based on best practices identified by GAO, without an independent Technology Readiness Assessment, Test and Evaluation Master Plan, or an Independent Cost Estimate, program officials cannot have a high level of confidence that the requirements are firm and that risk has been adequately reduced before beginning efforts estimated to cost $10.5 billion in funding to develop Block 4.[7] If program officials move ahead with Block 4 contracts without gaining the knowledge that a full business case would provide, Block 4 modernization efforts will be at risk of experiencing the same kind of cost and schedule growth the baseline development program experienced.

To address this risk, in April 2019, we recommended to the DOD that it should ensure the F-35 program office complete its business case, to include the three documents discussed above, at least for the initial Block 4 capabilities under development before initiating additional development

[7]GAO, *Weapon Systems Annual Assessment: Knowledge Gaps Pose Risks to Sustaining Recent Positive Trends*, GAO-18-360SP (Washington, D.C.: Apr. 25, 2018).

work.[8] DOD did not concur with this recommendation. In its comments, DOD stated that the F-35 program office has adequate knowledge to begin Block 4 development. We maintain, however, that completing its business case before awarding its Block 4 development contracts would put DOD and the program in a better position to effectively and successfully develop Block 4 capabilities.

The F-35 Program Is Still Not Meeting All Reliability and Maintainability Targets

As we reported in April 2019, the program has made slow, consistent progress in improving the F-35's R&M metrics' performance but half of the metrics are not achieving targets.[9] All F-35 variants are generally performing near or above targets for four of the eight R&M metrics, while still falling short for the other four. Each F-35 aircraft variant is measured against eight R&M metrics, four of which are in part of the contract. All eight R&M metrics are described in the program's Operational Requirements Document (ORD)—the document that outlines the targeted performance levels for these metrics that DOD and the military services agreed the F-35 should meet in 2000. Based on our analysis, while the program is on track to meet half of the targets, the program office has not taken adequate steps to ensure the others will be met. Additionally, in December 2018, the Director, Operational Test & Evaluation reported that, although performance for the four under-performing metrics has shown slow growth over the years, none of these metrics are meeting interim goals needed to reach requirements at each variant's maturity.[10] Each F-35 variants' R&M performance against these metrics is shown in table 1.

[8]GAO-19-341.

[9]GAO-19-341.

[10]Director, Operational Test & Evaluation, *Fiscal Year 2018 Annual Report* (December 2019). The F-35 aircraft reach maturity when all variants have flown a combined 200,000 hours, with each variant flying at least 50,000 hours. The F-35A reached its planned maturity in July 2018, but is still not near meeting four of its eight metrics. The F-35B and C variants have more time to meet their metrics before they reach their planned maturity in 2021 and 2024 respectively.

Table 1: The F-35 Reliability & Maintainability Metrics' Performance as of August 2018

Metric[a]	Contractually required	F-35A	F-35B	F-35C
Mission Reliability[b]—measures the probability of successfully completing a mission of average duration	✓	●	●	—
Mean flight hours between failure (design controlled)—measures time between failures that are directly attributable to the design of the aircraft and are considered fixable with design changes	✓	●	●	●
Mean time to repair—measures the amount of time it takes a maintainer to repair a failed component or device	✓	◓	◓	◓
Maintenance man hours per flight hour—measures the average amount of time spent on scheduled and unscheduled maintenance per flight hour	✓	●	◓	●
Mean flight hours between maintenance events—also referred to as the logistics reliability metric, measures time between maintenance, unscheduled inspections, and servicing actions, including consumables[c]	—	○	○	◓
Mean flight hours between removals—measures the time between part removals from the aircraft for replacement from the supply chain	—	○	○	○
Mean flight hours between critical failure—measures the time between failures that result in the loss of a capability to perform a mission-critical capability	—	○	○	○
Mean corrective maintenance time for critical failure—measures the amount of time it takes to correct critical failure events	—	○	○	○

Legend:
●: Metric is at or above current targets
◓: Metric is at or above minimum targets
○: Metric is below minimum targets
✓: Metric is contractually required
—: not available

Source: GAO analysis of contractor data. | GAO-19-456T

[a]Each metric is measured using a 3-month average and reported on a monthly basis; this table summarizes the Joint Reliability and Maintainability Evaluation Team's review of reliability growth and maintainability improvement data from November 2009 through August 2018.

[b]Mission Reliability is a key performance parameter. Mission reliability, as well as performance against the targets related to all of these metrics, will be evaluated during initial operational test and evaluation.

[c]Consumable parts are nonrepairable items or repair parts that can be discarded more economically than they can be repaired or that are consumed in use (such as oil filters, screws, nuts, and bolts).

Since the program began tracking R&M performance in 2009, it has seen small, annual improvements. Over the past year, all variants showed a slight improvement in targeted performance levels for one metric, the mean flight hours between failure—design controlled, but saw little or no discernable improvement for the four metrics not meeting targets. However, based on current performance, the program does not expect to meet those targets by full aircraft maturity. According to F-35 program

officials, the ORD R&M metrics should be re-evaluated to determine more realistic R&M performance metrics, but the program has not yet taken actions to do so. Until the program office does so, it remains accountable for ensuring those ORD R&M metrics are achieved.

In June 2018, we recommended that the F-35 program identify steps it needs to take to ensure the F-35 aircraft meet R&M requirements before each variant reaches maturity and update its R&M Improvement Program (RMIP)—DOD's action plan for improving R&M—with these steps.[11] DOD concurred with our recommendation but has yet to take substantive actions to address it. DOD did, however, complete 16 improvement projects since we last reported on this. Despite completing these projects, there were not significant gains in the R&M metrics not meeting targets. Program officials advised, however, that measurable improvements in R&M can take time to manifest. To speed this process, the program is accelerating planned upgrades to older aircraft where appropriate, which officials stated should translate to an overall improvement in the program's R&M performance.

The F-35 Program Office's Improvement Plan Does Not Address Under-Performing Targets

The F-35 program office has estimated that implementing all of the identified improvement projects currently contained in its RMIP could result in potential life cycle cost savings of over $9.2 billion by improving the F-35's R&M. However, we found that, as of December 2018, the guidance the F-35 program office has used to implement the RMIP does not define specific, measurable objectives for what the desired goals for the F-35's R&M performance should be or align improvement projects with R&M goals.[12] Furthermore, the RMIP has not been a funding priority.

[11]GAO-18-321. The F-35 program began tracking its R&M metrics in 2009 and documented the RMIP's approach in April 2014. In June 2018, we found that the F-35 program did not have a plan to ensure that all R&M targets would be met by each variant's aircraft maturity.

[12]GAO-19-341.

Federal internal control standards state that programs should define objectives when implementing programs such as the RMIP.[13] Although the F-35 program RMIP's guidance has a general goal of improving R&M, it does not identify achieving the eight R&M targets listed in the ORD as an objective. Program officials acknowledged that the RMIP's guidance does not include such an objective. Instead, officials stated they are using the RMIP to prioritize and fund projects that will improve aircraft availability and mission capability—neither of which are included in the eight R&M metrics, but are necessary and important initiatives.[14] The program is focusing on these two areas in part because a September 2018 memorandum from the Secretary of Defense to the Secretaries of the military departments included a goal for the F-35 fleet to attain a mission capable rate of 80 percent by the end of fiscal year 2019. According to program officials, improving these two areas will translate into improvements in the F-35 overall R&M. However, we found that the RMIP's guidance does not discuss these priorities or align how any improvement projects would ensure targets under all eight R&M targets will be met.[15]

In our prior work on weapon system acquisitions, we have identified a number of best practices for improving program outcomes if implemented, such as clearly establishing well-defined requirements and securing stable funding that matches resources to requirements.[16] We found that the program office has not prioritized or dedicated funding in its budget to

[13]GAO's *Standards for Internal Control in the Federal Government* require agencies to define measurable objectives when implementing programs. Agencies should also consider requirements when defining these objectives. Objectives should be defined in measurable terms so that performance toward achieving those objectives can be assessed. Measurable objectives are generally free of bias and do not require subjective judgments to dominate their measurement. Measurable objectives are also stated in a quantitative or qualitative form that permits reasonably consistent measurement. GAO, *Standards for Internal Control in the Federal Government*, GAO-14-704G (Washington, D.C.: September 2014).

[14]Aircraft availability (also known as air vehicle availability) and mission capability both measure the percentage of time during which aircraft are safe to fly, available for use, and able to perform at least one tasked mission. The air vehicle availability metric assesses all aircraft in the fleet, including those in the possession of the F-35 units and those at the depots for modifications. The mission capability metric assesses only aircraft that are in the possession of F-35 units.

[15]GAO-19-341.

[16]GAO, *Best Practices: Better Matching of Needs and Resources Will Lead to Better Weapon System Outcomes*, GAO-01-288 (Washington, D.C.: Mar. 8, 2001).

improve R&M, in part because program officials explained that they were focused on initiatives intended to lower the cost of the aircraft.[17] In addition, any current funding for R&M improvement projects comes from the program's operation and maintenance funds, which are only available for one fiscal year. Officials explained that, if the funding runs out or is used by the program for other efforts, then R&M projects will go unfunded or be suspended until new funding is available. In fiscal year 2018, for example, while some projects were completed, several other projects were suspended when that year's funding ran out. As of December 2018, according to a contractor representative, all of the identified improvement projects currently unfunded in the program's RMIP would cost about $30 million to implement, but were not funded.

Program officials also stated that they are in the process of revising the RMIP and have considered including more specific objectives in addition to improving aircraft availability and mission capability, such as more focus on improving R&M performance where ORD R&M targets are not currently being met. According to the program, any revisions to the RMIP and changes to how it will be funded, however, will not be complete until April 2019.

By not defining objectives in its RMIP guidance for meeting all eight R&M metrics, aligning which improvement projects will ensure those metrics are met, and prioritizing funding for those projects, the program is at risk of not fully meeting its R&M targets. As a result, the warfighter may accept aircraft that are less reliable than originally planned, and whose operation and sustainment costs may raise affordability questions. In addition, the military services recently identified the need to cut sustainment costs—by 43 percent in the case of the Air Force—to improve the F-35's affordability in sustainment. Increasing costs from less reliable aircraft will add strain to an already unaffordable program.

To address these issues, in April 2019, we recommended to DOD that it should ensure that the F-35 program office

1. assess whether the ORD R&M targets are still feasible and revise the ORD accordingly;
2. as it revises its RMIP, identify specific and measurable R&M objectives in its RMIP guidance;

[17]GAO-19-341.

3. as it revises its RMIP, identify and document which RMIP projects will achieve the identified objectives of the RMIP guidance; and
4. prioritize funding for the RMIP.[18]

DOD concurred with these recommendations and stated that it will take actions to address them.

Continued Concerns with F-35 Sustainment Costs and Supply Chain, and Logistics System

We have previously reported on the F-35 program's rising estimated sustainment costs and challenges maintaining an expanding fleet. In October 2017, we reported that estimated F-35 life-cycle sustainment costs increased by 24 percent from fiscal years 2012 through 2016 due to an increase in projected flying hours and other factors.[19] We also reported that sustainment costs were not fully transparent to the military services. For example, the Marine Corps received an initial funding requirement for fiscal year 2017 sustainment of $293 million, which then increased to $364 million in the execution without a full explanation from the program office. We recommended that DOD take steps to improve communication with the services and provide more information about how F-35 sustainment costs they are being charged relate to the capabilities received. DOD concurred with the recommendation and has begun taking actions to address it.[20]

In addition, DOD faces substantial supply chain challenges that are lowering F-35 aircraft performance. In April 2019, we reported that F-35 aircraft performance was falling short of warfighter requirements—that is, aircraft could not perform as many missions or fly as often as required.[21] Specifically, F-35A aircraft were mission capable only 52 percent of the time from May through November 2018—far short of the 80 percent target set by the former Secretary of Defense. This lower-than-desired aircraft performance is due largely to F-35 spare parts shortages and limited part

[18]GAO-19-341.

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

[20]In December 2018, DOD provided a report to Congress that discusses the steps that DOD is taking to provide increased transparency of F-35 sustainment costs to the U.S. services. Office of the Secretary of Defense, *Report to Congress on F-35 Joint Strike Fighter Sustainment Affordability and Transparency* (December 2018).

[21]GAO-19-321.

repair capabilities. For example, during this time period, F-35 aircraft were unable to fly about 30 percent of the time due to spare parts shortages.

Additionally, DOD's capabilities to repair F-35 spare parts at its depots are years behind schedule, which has resulted in an average of 188 days to repair an F-35 part and a backlog of about 4,300 spare parts awaiting repair at military depots or manufacturers. We also reported that DOD faces challenges managing, moving and maintaining accountability of F-35 parts within the supply chain. We made eight recommendations to DOD, including that DOD determine what actions are needed to close the gap between warfighter requirements for aircraft performance and F-35 supply chain capabilities. DOD concurred with the recommendations and identified actions that it was taking or planned in response.

Finally, the F-35's Autonomic Logistics Information System (ALIS) has the potential to lead to increased costs for the program if key issues are not addressed. ALIS is the F-35's central logistics system intended to support operations, mission planning, supply-chain management, maintenance, and other processes. In April 2016, we identified several risks, including that ALIS (1) was not initially designed to be deployable, (2) lacked redundant infrastructure, (3) did not communicate well with legacy aircraft systems, (4) had data accuracy and accessibility issues, and (5) had security risks.[22] In addition, DOD had not included certain analyses and information, such as historical cost data, to increase the credibility and accuracy of ALIS's estimated costs. Further, a 2013 DOD-commissioned study found that schedule slippage and functionality problems with ALIS could lead to between $20 billion and $100 billion in additional costs.

We have made several recommendations to DOD to improve ALIS planning and cost estimates, and to develop a performance measurement process for ALIS to better address problems based on actual system performance and user requirements.[23] DOD generally concurred with our recommendations and has taken some actions, including developing a plan that identifies and prioritizes key ALIS risks. However, more work remains. We are currently conducting a review examining DOD's progress in implementing our ALIS-related recommendations, addressing

[22]GAO, *F-35 Sustainment: DOD Needs a Plan to Address Risks Related to Its Central Logistics System*, GAO-16-439 (Washington, D.C.: Apr. 14, 2016).

[23]*See* GAO-16-439 and GAO, *F-35 Sustainment: Need for an Affordable Strategy, Greater Attention to Risks, and Improved Costs Estimates*, GAO-14-778 (Washington, D.C.: Sept. 23, 2014).

concerns from ALIS users, identifying emergent financial and operational risks associated with ALIS, taking near-term actions to improve ALIS functionality, and assessing DOD's actions regarding the long-term viability of ALIS to ensure capable sustainment of the F-35 fleet. We plan to issue a report based on our current work later in 2019.

Air Force's Advanced Battle Management System Acquisition Strategy Is in the Early Planning Stages

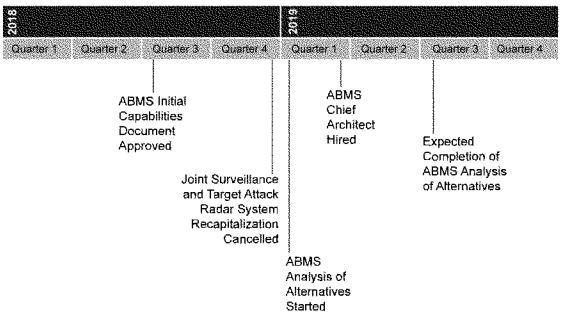
Based on our ongoing work, ABMS is early in the acquisition process, as the specific capabilities and overarching acquisition strategy are still to be determined by the Air Force. As a result, the Air Force has not yet established a cost and technical baseline for ABMS. When ABMS planning began in 2017, program officials stated that the intent of the program was to replace and modernize the capabilities of the AWACS system—which provides the warfighter with the capability to detect, identify, and track airborne and maritime threats. But changes in Air Force expectations for how it would fight during future conflicts led the department to assess options for developing a more robust and survivable air, land, and sea battle management system that can operate in contested environments. In July 2018, the ABMS Initial Capabilities Document—which describes capability needs and associated gaps—was approved by the DOD Joint Requirements Oversight Council.

Our ongoing work also found that, in December 2018, the Air Force determined it would not continue its planned JSTARS Recapitalization program—which was intended to provide surveillance and information on moving ground targets—well into the future, as initially expected. As a result of a recent study, the Air Force has extended the estimated service life of the JSTARS fleet, and will incorporate its capabilities into the ABMS in the short term, and retire JSTARS in the 2030s.

Our preliminary observations indicate that the details about ABMS are still to be determined. The Air Force expects to fully define ABMS through an Analysis of Alternatives (AOA) that it plans to complete by the summer of 2019, as shown in figure 2.[24]

[24]An Analysis of Alternatives is an analytical comparison of the operational effectiveness, suitability, risk, and life-cycle cost of alternatives under consideration to satisfy validated capability needs that are typically identified in an Initial Capabilities Document.

Figure 2: Preliminary Observations on Key Planning and Development Events for the Advanced Battle Management System (ABMS)



Source: GAO analysis of Department of Defense data. | GAO-19-456T

The ABMS AOA, led by the Air Force's Air Combat Command, will assess how ABMS will deliver air-centric capabilities, such as those currently provided by AWACS. Air Force officials explained that they plan to utilize an existing AOA completed for the JSTARS Recapitalization program, approved in May 2012, to identify and assess ABMS's potential ground target tracking capabilities. Originally planned as a 9-month study, Air Force officials stated that the ABMS AOA was shortened to a 6-month effort. As a result, the Air Force received conditional approval to reduce the number of alternatives studied from five to three.

Our ongoing work indicates that the Air Force plans to develop ABMS over three phases. The first phase began in fiscal year 2018 and goes through 2023. In this phase, the Air Force plans to integrate existing sensors, improve battle management systems, and upgrade communication networks across 10 existing acquisition programs. Table 2 includes information on three existing programs the Air Force plans to enhance during the first phase of ABMS.

Table 2: Preliminary Observations on the Advanced Battle Management System Existing Programs' Missions and Planned Enhancements for the First Development Phase

	Airborne Early Warning and Control System (AWACS)	Joint Surveillance and Target Attack Radar System (JSTARS)	Control and Reporting Center (CRC)
Mission	Provides air operations battle management, and air surveillance and identification	Provides ground surveillance to support attack operations and targeting	Provides battle management functions of joint operations, using data fused from various sources and sensors
Planned enhancements	Purchase seven legacy aircraft to modernize to current configuration Upgrade to Link 16 system to allow communication and data transfer to next generation fighter aircraft[a] Provide access to multiple levels of security data on aircraft	Upgrade Common Data Link communication system[b]	Add ground moving target warning capability Upgrade to Link 16 system[a]

Source: GAO analysis of Department of Defense documentation. | GAO-19-456T

[a]Link 16 is an anti-jam, high-speed, secure, data and voice communications standard.

[b]Common Data Link is a digital communications technology which provides a data link between aerial/space platforms and common ground stations.

According to an Air Force acquisition official, the technologies associated with the first phase are considered to be mature but there may be risks as the Air Force integrates technologies.

Air Force officials explained that their approaches to the second and third phases of ABMS are not fully developed, but noted that the phases would be informed by the AOA results. That said, the Air Force expects to start phase 2 in 2024 by integrating advanced sensors and software into its existing battle management command and control platforms while at the same time retiring JSTARS. Air Force officials have reported that the third phase, planned for the mid-2030s, is expected to provide multi-sensor, resilient battle management command and control capability using multiple types of communications methods, with an initial operational capability planned for 2035. The Air Force estimates that ABMS's acquisition cost through fiscal year 2024 will be $3.8 billion.

Because ABMS is composed of many different defense acquisition programs, the Air Force intends to manage it as a family of systems directed by a Chief Architect and not a traditional acquisition program manager. According to the Air Force, the ABMS Chief Architect is the first of its kind, and the Air Force believes the position will be instrumental in integrating the various programs and technologies into an overall system. Based on our preliminary analysis, the roles and responsibilities of the

Chief Architect have not been fully defined. However, according to the Air Force, the Chief Architect is expected to be responsible for (1) leading a high-level analysis and determining the overall design of ABMS, (2) coordinating with the service-level commands and the acquisition programs involved to make sure they are aligned with the ABMS development, and (3) identifying the enabling technologies for integration into ABMS.

Chairman Norcross, Ranking Member Hartzler, and members of the Subcommittee, this completes my prepared statement. I would be pleased to respond to any questions you may have. We look forward to continuing to work with the Congress as we to continue to monitor and report on the progress of the F-35 program and the ABMS.

GAO Contact and Staff Acknowledgments

If you or your staff have any questions about this testimony, please contact Michael J. Sullivan at (202) 512-4841 or sullivanm@gao.gov. Contact points for our Office of Congressional Relations and Public Affairs may be found on the last page of this statement. Individuals making key contributions to this statement are Justin Jaynes (Assistant Director), Diana Maurer, Jennifer Baker, Desirée E. Cunningham, Alissa Czyz, Stephanie Gustafson, Kasea Hamar, Jeff Hubbard, Jessica Karnis, Matt Metz, Robin Wilson, and Lauren Wright.

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Mr. Sullivan currently serves as Director for Contracting and National Security Acquisitions at the U.S. Government Accountability Office. This group has responsibility for examining the effectiveness of DOD's acquisition programs and practices in meeting its mission performance objectives and requirements. He has been directing GAO's F-35 reviews for over 15 years. In addition, he has directed reviews of several other major weapon system acquisitions such as F-22, Global Hawk, and various other major weapon acquisition programs for over 30 years. Mr. Sullivan has also developed and directs a body of work examining how the Department of Defense can apply best practices to the nation's largest and most technically advanced weapon systems acquisition system. This work has spanned a broad range of issues critical to the successful delivery of systems, including technology development; product development; transition to production; software development; program management; requirement-setting; cost estimating; and strategic portfolio management. The findings and recommendations from this work have played a major role in the department's recent acquisition policy revisions. Most recently, he has directed the GAO's annual assessment of major weapon systems programs for the Congress and GAO's work with Congress in establishing acquisition policy reforms. His team also provides the Congress with early warning on technical and management challenges facing these investments.

Mr. Sullivan has been with GAO for 33 years. He received a bachelor's degree in Political Science from Indiana University and a Masters Degree in Public Administration from the School of Public and Environmental Affairs, Indiana University.

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STATEMENT

BY

ROBERT F. BEHLER

DIRECTOR, OPERATIONAL TEST AND EVALUATION

OFFICE OF THE SECRETARY OF DEFENSE

BEFORE THE

HOUSE ARMED SERVICES COMMITTEE

TACTICAL AIR AND LAND FORCES SUBCOMMITTEE

**NOT FOR PUBLIC RELEASE
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COMMITTEE ON ARMED SERVICES
U.S. HOUSE OF REPRESENTATIVES**
HASC – MAY 2, 2019

Robert F. Behler
Director, Operational Test and Evaluation (DOT&E)
Office of the Secretary of Defense

Chairman Norcross, Ranking Member Hartzler, and distinguished members of the Committee, I appreciate the opportunity to discuss the test status of tactical air and mobility programs. In written testimony today, I will discuss six main topics:

1) Status of the ongoing F-35 Joint Strike Fighter Initial Operational Test and Evaluation (IOT&E), which will support a Full-Rate Production (FRP) Decision;
2) Updated test activity for several tactical air and mobility programs since the release of my Fiscal Year (FY) 2018 Annual Report;
3) Test infrastructure needed to support emergent technologies;
4) Software and cybersecurity;
5) Progress and implementation of the 2016 National Defense Authorization Act (NDAA) Section 804, or middle-tier acquisition programs under DOT&E oversight; and
6) DOT&E focus areas for FY20.

F-35 Joint Strike Fighter Test Activity

DOT&E has been working closely with the F-35 Joint Program Office (JPO), Service Operational Test Agencies (OTAs), and other stakeholders to design and conduct the most rigorous operational testing of any fighter aircraft in U.S. history. This test rigor is worthy of the F-35's groundbreaking capabilities and complexity. These agencies have welcomed DOT&E involvement and advice throughout my tenure, and it has been a pleasure to serve with them, and specifically VADM Mat Winter to provide a comprehensive and independent evaluation of the F-35 to inform the fielding, combat employment, and upcoming modernization of the weapon

system.

The nascent capabilities of the F-35 are already combining with fourth generation fighters, and current command and control architecture in support of Combatant Commanders around the world. I recognize it is crucial that I provide my independent and objective evaluation of the F-35 to inform future combat employment.

The Joint Strike Fighter Operational Test Team (JOTT) is making significant progress in evaluating the operational capabilities of the F-35 while safely conducting the IOT&E test plan. As of April 30, 2019, the JOTT has completed over 65 percent of all IOT&E open-air trials and weapon events. Operational testing to date has included cybersecurity and open-air test trials which incorporated F-35 deployments and weapons employment. The test team has compared the F-35 to fourth generation fighters, against both legacy and modern peer threats that have been fielded over the last decade. As prescribed in the 2017 NDAA, comparison testing to examine the capabilities of the F-35A and A-10C completed in March of this year.

F-35 IOT&E started in January 2018, 11 months ahead of the revised schedule, by my incremental approval of approximately 40 percent of the test trials and weapon delivery events that were ready for operational testing. The first increment began with a deployment to Alaska for cold weather testing. Subsequently, I approved the second increment in April 2018, including missions in permissive threat environments, weapons, cybersecurity, and deployments to ships and austere operating locations. The mission trials were primarily two-aircraft elements, designed to evaluate the F-35 in the roles of Close Air Support, Forward Air Controller (Airborne), Strike Coordination and Reconnaissance, Combat Search and Rescue, and Aerial Reconnaissance. Additionally, 22 air-to-air missile shots and 33 air-to-ground munitions events have been completed in operationally realistic scenarios to assess the lethality

of the platform. The test teams also conducted deployments to the USS *Abraham Lincoln* with the F-35C; to Volk Field, Wisconsin, with the F-35A; and to Marine Corps Air Station Yuma, Arizona, with the F-35B.

In December 2018, with nearly 40 percent of the mission trials and weapon events complete, I approved the start of formal IOT&E when the remaining entrance criteria were met. The JOTT is conducting the most demanding open-air trials designed to evaluate the F-35 in the roles of Offensive and Defensive Counter Air, including Cruise Missile Defense, Suppression/Destruction of Enemy Air Defenses, and Air-to-Surface Attack. Periodic operational cybersecurity testing is ongoing for the Autonomic Logistics Information System (ALIS), the training systems, the U.S. Reprogramming Laboratory, and component-level of the air vehicle. The existing test plan specifies the final two phases of IOT&E, which I will approve when the JOTT and the test support environments are ready, are open-air electronic warfare trials against robust surface-to-air threats and simulation of dense, modern surface and air threats in the Joint Simulation Environment (JSE).

The JSE is essential to completing IOT&E and is critical for evaluating the F-35 since open-air testing limitations do not permit a robust and adequate test of the aircraft against the density and diversity of modern threat systems currently fielded by near-peer adversaries as defined in the May 2018 test plan. The JSE is also critical to support development and testing of the next generation F-35 Block 4 capabilities and future block upgrades. However, JSE development is behind schedule, and its readiness to support testing is a concern.

Currently, IOT&E test results are not publically releasable because the tests and data analysis are either not complete or results are preliminary, and because of security protection requirements. I anticipate completing open-air testing this fall and subsequently conducting test trials in the JSE to stress the F-35 against validated models of advaneed real-world

threats. The current schedule projects IOT&E completion later this year followed by the Beyond Low-Rate Initial Production Report.

Block 4 development is already underway, and DOT&E is working with the Program Office, Services, and OTAs to assist with planning and identifying the necessary test infrastructure support requirements. The objective is to use an iterative incremental development approach to testing such as Development Security Operations (DevSecOps) to meet operational testing objectives and accelerate the acquisition process. We will continue periodic cybersecurity and suitability testing that will align with the annual ALIS release cycle. The planned cybersecurity testing will further assess the air vehicle, enterprise-wide ALIS, and the supply chain.

The Block 4 software upgrade test schedule will be challenging. The proposed schedule is based on a 6-month development, testing, and fielding cycle. This cycle relies on an agile approach using modeling and simulation (M&S) to improve capability delivery processes. A similar approach was partially used during F-35 System Development Demonstration (SDD), resulting in multiple unplanned software releases, increased flight testing, and a 16-month delay to complete SDD of Block 3F. For Block 4, the operational test teams are working to ensure adequate testing of each software release.

Recent Test Activity for Tactical Air and Mobility Programs

KC-46A. The Air Force grounded the KC-46A fleet at McConnell Air Force Base (AFB), Kansas, in late February 2019 due to the discovery of Foreign Object Debris (FOD) in KC-46A aircraft at the Boeing Military Delivery Center, Paine Field, Seattle, Washington. A Boeing FOD inspection team deployed to McConnell AFB to inspect all four Air Force aircraft for FOD. The team discovered debris in multiple areas of the aircraft, consisting of wires, nuts, bolts, and fasteners. The team completed its inspection, and the McConnell AFB

KC-46A fleet returned to flight on February 28, 2019.

Aircrew and maintenance familiarization (FAM) training is ongoing at McConnell AFB in preparation for the start of operational test. The FAM training is moving at a slower pace than originally anticipated due to flight cancellations because of poor weather and the non-availability of parts to complete necessary maintenance activities. The FAM training is scheduled for 75 days of KC-46A operations.

Operational flight testing was anticipated to begin May 14, 2019. It will likely slip due to the FOD problem and FAM schedule delays. The F-16 and C-17 have been certified by their Major Command (MAJCOM) to support KC-46A operational test activities. Additional receivers (i.e., F-15, B- 52, and F-35) will begin participating in operational test activities once they have been qualified for air refueling by the Air Force developmental test community and certified by the receiver Major Command (MAJCOM).

The Under Secretary of Defense for Researeh and Engineering has reported on two areas of significant concern as the KC-46A transitions to operational testing. First, the developmental test community assessed the Remote Visual System (RVS) as unsatisfactory for air refueling in all operationally relevant environments. Operational testing will likely confirm the RVS performance demonstrated in developmental testing. Visual acuity needs improvement, which will likely require hardware and software modifications. Second, although developmental testing found that the telescoping design loads for the KC-46A air refueling boom met contract specification, the loads are between 2 and 5 times greater than the KC-10 and KC-135. The increased loads, in turn, increase the workload for the receiver pilot. Operational testing will characterize the operational mission effects that these deficiencies have on the operational effectiveness and suitability of the air refueling system.

VH-92A Presidential Helicopter Replacement. Marine Helicopter Squadron One

(HMX-1) conducted operational assessment testing from March 1 – 28, 2019. Testing consisted of 16 sorties on 2 VH-92A Experimental Development Model (EDM) aircraft. The operational assessment's purpose was to evaluate the communications, landing zone suitability, Presidential transport, pilot vehicle interface capabilities, and the cybersecurity posture of the VH-92A. The Live Fire Test and Evaluation (LFT&E) program completed testing in August 2018, and I anticipate the final vulnerability assessment later this year. DOT&E is currently analyzing test data, the results of which will be incorporated in my report to inform a Milestone C decision scheduled for late May 2019.

AC-130J. On January 10, 2019, the Air Force Special Operations Command (AFSOC) completed a Follow-on Operational Test and Evaluation (FOT&E) of the AC-130J Block 20+ Upgrade designed to support precision strike, close air support, and air interdiction requirements. AFSOC conducted this evaluation in two phases. Phase 1 consisted of four full mission profiles flown in and around the Eglin Test and Training Complex, Florida. These profiles tasked the crew to direct high-complexity precision strike, close air support, air interdiction, and personnel recovery missions while incorporating datalinks and aircraft defensive systems. Phase 2 consisted of three live-fire missions flown at White Sands Missile Range, New Mexico, to evaluate the ability to employ the Air-to-Ground Missile-114R2 HELLFIRE and Guided Bomb Unit-69 Small Glide Munition. Testing demonstrated the AC-130J Block 20+ modification is capable of supporting AFSOC's precision strike, close air support, and air interdiction requirements, but with minor discrepancies or acceptable workarounds.

Research, engineering, and risk reduction efforts to develop a high-energy laser for the AC-130J are ongoing. This is an example of the emerging requirement to evolve and implement Directed Energy weapon systems. My office and the Program Office have begun to develop the test processes, procedures, and measurement tools to characterize the weapon's effectiveness,

suitability, and lethality.

C-130J. The Air Force completed IOT&E for the block upgrade 8.1 configuration in March 2019. This software and hardware upgrade makes the C-130J compliant with global airspace mandates through the addition of Link 16, Civil Data Link, new GPS receivers, Automatic Dependent Surveillance Broadcast Out, and Mode 5 Identification Friend or Foe (IFF). This navigation and flight management system will likely become the baseline C-130J across Combat Air Force, AFSOC, and the Department of the Navy.

As more software is incorporated into weapon systems, their vulnerability to cyber-attacks increases. The cybersecurity Adversarial Assessment on the C-130J will provide the first data to establish the cybersecurity posture of the baseline C-130J. All other C-130J variants will leverage these data and will resource and assess cybersecurity of future capabilities separately.

F-22 Raptor. The program is fielding increment 3.2B capability this summer after the modification of operational aircraft with new hardware for stores management and a dual-use computer. The F-22 program must address several outstanding actions prior to fielding as identified in my August 2018 classified 3.2B BLRIP Report.

Developmental testing of Update 6 software and associated capabilities is ongoing and forecast to complete this summer. These capabilities include KOV-20 crypto modernization required to maintain National Security Agency certification, Link 16 interoperability, and tactical secure voice encryption algorithms.

Raptor Agile Capabilities Release (RACR) 1 testing is currently scheduled to begin in fall 2019 and will continue for approximately 1 year. RACR 1 will include initial Link 16 transmit of a limited number of messages and Mode 5 IFF transponder capabilities.

Light Attack Aircraft (LAA). The LAA program continues to conduct the planned FY19 LFT&E activities on both the A-29 and AT-6C aircraft. Fuel cell survivability testing,

including live fire of incendiary rounds into the wing fuel tanks and surrounding structure is ongoing. Live fire testing should be complete by the end of FY19 with my LFT&E report to follow. In December 2018, the Air Force decided to delay their Request for Proposals announcement. At this time, the LAA program remains on oversight, and we will support the Service's agile acquisition efforts and future LAA program testing.

Small Diameter Bomb II (SDB II). The Air Force continues the first phase of SDB II operational testing on the F-15E. Testing this year is scheduled at White Sands Missile Range for live fire and GPS jamming tests, Eglin AFB for overwater range tests against small boat targets, and the Utah Test and Training Range for Joint Terminal Attack Controller (JTAC) controlled tests. Phase 1 flight testing is projected to complete in June 2019. In general, testing has demonstrated that system performance is satisfactory. Currently, datalink reliability due to incorrect cryptographic keys is the most noteworthy deficiency, which is not specifically related to the SDB II weapon system.

M&S data validation and Integrated Flight Simulation (IFS) accreditation is ongoing but it lags flight testing. This will delay my reporting of SDB II effectiveness, which relies upon having an accredited IFS. The tentative schedule estimates March 2020 as the most severe delay date.

Cyber testing will continue through September 2019. I anticipate reporting on the results in December 2019.

F/A-18 Infrared Search and Track (IRST). The Navy completed testing of the F/A-18 IRST Block 1 that incorporates an improved processor in support of a limited early fielding. This will inform the Block 2 IOT&E scheduled for 2021. The Navy conducted a total of four flights on February 12 and March 19, 2019, resulting in early fielding at Naval Air Station Lemoore, California, on March 26, 2019, with Carrier Air Wing Seventeen.

F/A-18 H-14. The H-14 aircraft software testing began in October 2018. In March 2019, a combined test detachment from VX-1 and VX-9 supported by VX-31 conducted numerous fire control missions in an electronic attack environment at Point Mugu, Sea Test Range. This detachment included F/A-18 E/F, EA-18G, and E-2D aircraft testing several programs simultaneously. Live fire testing designed to demonstrate the integration between aircraft missile systems and the F/A-18 E/F H14 and E-2D Delta System/Software is scheduled for July 2019. Additional testing includes overland fire control scenarios at Naval Air Station Fallon, Nevada, in April 2019 and large force exercise participation in Alaska in May 2019.

AIM-120C7 Advanced Electronic Protection Improvement Program (AEPIP). The Air Force completed AEPIP Tape 2 testing in December 2018 and intends to field in April 2019. Testing demonstrated that the AEPIP Tape 2 is operationally effective and suitable.

AN/TPS-80 Ground/Air Task Oriented Radar (G/ATOR). The Marine Corps completed IOT&E in December 2018. Additional operational testing will conclude the first week of May 2019. I intend to provide these test results along with IOT&E test results to inform the Block 1 and Block 2 FRP Decision scheduled for late May 2019.

Test and Evaluation Infrastructure

Emergent technologies will drive the need for new concepts of operations and test infrastructure requirements. Technologies, such as hypersonic weapon systems will require advancements in data collection, long-range tracking capability, and safety procedures. The Department will have to develop safe and effective flight test corridors that can accommodate the high speeds and long distances these weapon systems can fly to ensure they are effective under operationally realistic conditions. Weapon systems using artificial intelligence and machine learning will require new measurement methods that can determine whether a computer will make the right decisions in combat environments. More fundamentally, we need to understand

why an artificial intelligence system did what it did.

Flight testing in an operationally realistic environment is limited by the availability of test assets, a limited test infrastructure, the lack of lethality testing against modern threats, range safety complexity, high test costs, and operational security concerns. Independently accredited M&S, anchored by flight test data, will be needed to evaluate the effectiveness of these future systems. I believe the development of such M&S capability should be a priority for the Department.

Regarding M&S, DOT&E and the Test Resource Management Center (TRMC) are working with the test and intelligence communities to develop credible infrared and radio frequency models of advanced threats to support laboratory testing and augment open-air testing. Additionally, DOT&E has invested in advanced OT&E threat environment models for B-2, B-21, and similar systems that will affect numerous advanced tactical air and land programs.

These efforts, along with the F-35's JSE, facilitate future testing in operationally complex, realistic, and relevant threat scenarios that an open-air range cannot duplicate. The JSE is critical to the future of air warfare systems development.

Today, the JSE is located at Naval Air Station Patuxent River, Maryland. The Air Force intends to build two future sites at Nellis AFB, Nevada, and Edwards AFB, California. The Nellis AFB facility will be used primarily for operational testing, training, and high-end tactics development that will include F-35, F-22, and other advanced platforms in later phases. The Edwards AFB facility will focus on developmental test and will also connect to the Benefield anechoic chamber facility, supporting mission-level hardware-in-the-loop testing. Both will be used for experimentation of new technologies.

DOT&E and TRMC have partnered with the Air Force, Navy, and the Army Threat

Systems Management Office to develop and acquire Radar Signal Emulators (RSEs) as part of the DOD's Electronic Warfare Infrastructure Improvement Program (EWIIP) efforts to improve open-air range testing. This effort has delivered 16 mobile systems, capable of emulating advanced ground threat weapon systems. These RSEs are currently an integral part of F-35 open-air testing and will provide a significant test capability for numerous other weapon systems in the future. Currently, RSEs are deployed on the Nevada Test and Training Range. The assets will deploy to the Point Mugu Sea Test Range for planned F-35 test events later this summer.

The Department has a current shortfall of operationally representative, full-scale fifth generation test targets for advanced weapons systems such as the F-35. The Department must develop and acquire a full-scale, threat-representative fifth generation aerial target to ensure that our advanced weapon systems are tested against a very credible threat in an operationally realistic environment. This will provide Combatant Commanders with a detailed understanding of an advanced weapon system's lethality and mission effects to support their operational employment decisions. At least 15 current and near-future DOD programs have requirements against fifth generation adversaries, to include three air-to-air missiles, three fighters, two surface-to-air missiles, and seven command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) systems. An unmanned, affordable, full-scale fifth generation target with the requisite electronic attack capability, radar cross section, and flight envelope performance supports the lethality evaluation of advanced weapon systems against fifth generation threat-representative targets.

Another shortfall that the Army will work internally to address is funding required for the development of the Tactical Engagement Simulation with Real Time Casualty Assessment (TES/RTCA). This funding is currently not included in the proposed 2020 budget; the Army will reassess whether this program should take priority over others during the FY 2021 Budget

cycle. The TES/RTCA systems are essential to creating a complex and evolving battlefield environment for ground force-on-force test and training. Sustained investment and regular upgrades in TES/RTCA capabilities are necessary to ensure that the survivability and lethality characteristics of new and upgraded combat systems are accurately represented during operational testing. This funding line is critical to meet the lethality goals set by the 2018 National Defense Strategy and the Army's modernization plans.

Software and Cybersecurity

Today, we live in a software-defined world, and our weapon systems are no different. This reliance on ever-increasing sophisticated and complex software has a dark side. The dark side is the susceptibility of software, and the networks that host the software, to cyber-attacks. The more software, the more complexity; the more complexity, the more vulnerabilities.

Today a key way to harden our systems against cyber-attacks is to attack them ourselves using "cyber Red Teams" that act like an adversary. DOD's cyber Red Teams are very capable, but as countries like Russia and China continue to improve their cyber capabilities, the gap between the Department's cyber Red Team capabilities and those of our adversaries is widening. My organization is working with the Department's Red Teams to close that gap by helping them acquire additional personnel, more advanced tools and training. However, there is a need for more resources in this area to keep pace with the ever-growing cyber threats. Money alone will not solve this problem; it will be solved with intellect. Our software and cyber scientists must be smarter than the adversary's. To address this issue, the Department should secure seed funding for a select group of Service academies, private companies, universities, and national laboratories to grow the DOD cybersecurity test workforce and capabilities. In order to provide additional test capacity, the skills of cyber testers needs augmenting with advanced, automated, and autonomous cybersecurity test tools. Scholarly panels, such as the Defense Science Board,

remind us of important vulnerabilities requiring attention beyond just the Internet Protocol (IP) network assessments that currently consume most of our time and resources. Some of these "beyond IP" vulnerabilities include supply chain, software, and electromagnetic spectrum, and require addressing cybersecurity test shortfalls as soon as possible.

2016 NDAA Section 804 Acquisition Update

With the enactment of the 2016 NDAA Section 804, my office has fully supported the Services' implementing middle-tier acquisition programs, while ensuring that adequate operational testing is conducted prior to fielding. I am collaborating with the Office of the Under Secretary of Defense for Acquisition and Sustainment to develop Department-wide guidance for middle-tier acquisition programs.

My office is fully supporting the Services' processes to implement middle-tier acquisition for the following 10 air and land and expeditionary warfare programs.

- **Air-launched Rapid Response Weapon (ARRW).** The ARRW is a rapid prototyping effort. The program is developing their initial test strategy in collaboration with DOT&E and will begin flight testing in 2021 at the earliest.
- **Hypersonic Conventional Strike Weapon (HCSW).** The HCSW is a rapid prototyping effort. The program is developing their initial test strategy in collaboration with DOT&E and will begin flight testing in 2021 at the earliest.
- **B-52 Commercial Engine Replacement Program (CERP).** The B-52 CERP is a rapid prototyping program. The Air Force will modify and deliver up to two prototype aircraft for initial performance and flying quality testing followed by an operational capability demonstration in FY25. The B-52 CERP will transition from a rapid prototyping phase to a production program in FY26. The Air Force will then conduct a tailored IOT&E with production low-rate initial production aircraft and

trained operational crews in FY28 in advance of large-scale fielding. DOT&E is currently collaborating with the Air Force to develop a streamlined and tailored test strategy for this program. DOT&E approval of the program test strategy is anticipated this summer.

- **Air Operations Center – Weapon System Modification (AOC-WS Mod).** The AOC-WS Mod program is utilizing rapid fielding for the existing portfolio and the planned expansion of the portfolio. DOT&E is collaborating with the Air Force Operational Test and Evaluation Center to develop operational test plans that support agile software development and rapid fielding of new capabilities.
- **F-22A Raptor Agile Capability Release (RACR).** The F-22A program will continue to deliver combat capability while transitioning to the RACR construct this fall, after completion of the next software release. The RACR delivery cycle process begins this year and is forecast to continue through the Future Years Defense Plan, with each software release on an annual basis. In FY20, RACR 1 will undergo a Force Development Evaluation (FDE) conducted by the 53rd Wing.
- **Next Generation Combat Vehicle (NGCV) Optionally Manned Fighting Vehicle (OMFV).** NGCV OMFV is a new system that transports soldiers to advantageous positions on the battlefield to engage in close combat. The NGCV-OMFV is expected to replace the Bradley Fighting Vehicle, and may potentially include mission roles for scouts, fire support teams, and engineers in Armored Brigade Combat Teams. Testing of rapid prototypes begins in FY20. DOT&E is collaborating with the Program Office to conduct an operational assessment in FY22. The acquisition strategy transitions to a Major Defense Acquisition Program (MDAP) after the operational assessment and selection of a single vendor at

Milestone C in FY23.

- **Next Generation Squad Weapons (NGSW).** The NGSW program consists of the NGSW-Automatic Rifle (AR) and the NGSW-Rifle, and is intended to increase small unit lethality. The NGSW-AR is the planned replacement for the M249 Squad Automatic Weapon; the NGSW-Rifle would replace the M4 Rifle for frontline combat units. Both the AR and Rifle will fire a newly developed 6.8 millimeter caliber bullet. Multiple vendors will produce prototypes in FY20. DOT&E is collaborating with the Program Office and the Cross Functional Team to ensure soldier feedback throughout the prototype phase, culminating in an operational test in FY22.
- **Integrated Visual Augmentation System (IVAS).** IVAS is a conformal head mounted digital sensor system with an immersive display designed to improve soldiers' aim, navigation, and training. IVAS integrates with the Nett Warrior system providing network enabled situational awareness and command and control. Government furnished low light and thermal sensors will enable wide field of view high performance sensors. IVAS will receive frequent soldier feedback during development. Each feedback event will reflect an increase in size and scenario complexity to better shape IVAS capabilities. The four progressive capability sets will be evaluated by my office over the next 24 months. The first of these feedback events completed in March 2019 with commercial assets; squad-sized soldier elements conducted small-scale unit operations and live fire events.
- **Extended Range Cannon Artillery (ERCA).** ERCA incorporates a new cannon and ammunition upgrades with the existing M109A7 Paladin chassis to increase firing rates and maximum range. ERCA includes a modified cab, gun mount, cannon, and breech resulting in a 30 to 52 kilometer increased range. The program plans to deliver ERCA prototypes in FY22 with testing to follow. DOT&E is collaborating with the Program Office and the Cross Functional Teams to conduct

both the operational and live fire test events in FY22.

- **Mobile Protected Firepower (MPF).** The MPF is a new armored, tracked vehicle intended to provide enhanced firepower to infantry units. The Army picked two vendors to build prototypes for test and evaluation. Rapid prototyping activities will include developmental testing and soldier feedback of up to two different unit sets of prototypes followed by an operational assessment in FY20-21. My office is involved with the planning for both events in collaboration with the Program Office and the Cross Functional Team. The MPF plans to transition to an MDAP for low-rate initial production in FY22.

DOT&E Focus for FY20

As I execute my statutory responsibilities to ensure our warfighters are prepared for combat equipped with secure and credible weapon systems, and trained to use them effectively and decisively, I am most impressed with the spirit of collaboration between OSD and the military Services. I remain committed to increasing collaboration between DOT&E and other agencies within the defense community and to facilitate more rapid development and deployment of weapon systems without sacrificing the integrity or independence of the T&E community. My initiatives for FY20 focus on the key areas of software-intensive systems and cybersecurity, collaborating with developmental test and evaluation (DT&E) to conduct OT&E earlier in the system development and acquisition process, adapting T&E for emergent technologies, and improving our testing environments while enhancing the required T&E workforce.

As always, my staff and I stand ready to address any questions or concerns you may have on this testimony.

The Honorable Robert F. Behler
Director of Operational Test and Evaluation
Office of the Secretary of Defense

Robert F. Behler was sworn in as Director of Operational Test and Evaluation on December 11, 2017. A Presidential appointee confirmed by the United States Senate, he serves as the senior advisor to the Secretary of Defense on operational and live fire test and evaluation of Department of Defense weapon systems.

Prior to his appointment, he was the Chief Operating Officer and Deputy Director of the Carnegie Mellon University Software Engineering Institute (SEI), a Federally Funded Research and Development Center. SEI is a global leader in advancing software development and cybersecurity to solve the nation's toughest problems through focused research, development, and transition to the broader software engineering community.

Before joining the SEI, Mr. Behler was the President and CEO of SRC, Inc. (formerly the Syracuse Research Corporation). SRC is a not-for-profit research and development corporation with a for- profit manufacturing subsidiary that focuses on radar, electronic warfare and cybersecurity technologies. Prior to working at SRC, Mr. Behler was the General Manager and Senior Vice President of the MITRE Corp where he provided leadership to more than 2,500 technical staff in 65 worldwide locations. He joined MITRE from the Johns Hopkins University Applied Physics Laboratory where he was a General Manager for more than 350 scientists and engineers as they made significant contributions to critical Department of Defense (DOD) precision engagement challenges.

General Behler served 31 years in the United States Air Force, retiring as a Major General in 2003. During his military career, he was the Principal Adviser for Command and Control, Intelligence, Surveillance and Reconnaissance (C2ISR) to the Secretary and Chief of Staff of the U.S. Air Force (USAF). International assignments as a general officer included the Deputy Commander for NATO's Joint Headquarters North in Stavanger, Norway. He was the Director of the Senate Liaison Office for the USAF during the 104th congress. Mr. Behler also served as the assistant for strategic systems to the Director of Operational Test and Evaluation. As an experimental test pilot, he flew more than 65 aircraft types. Operationally he flew worldwide reconnaissance missions in the fastest aircraft in the world, the SR-71 Blackbird.

Mr. Behler is a Fellow of the Society of Experimental Test Pilots and an Associate Fellow of the American Institute of Aeronautics and Astronautics.

He is a graduate of the University of Oklahoma where he received a B.S. and M.S. in aerospace engineering, has a MBA from Marymount University and was a National Security Fellow at the JFK School of Government at Harvard University.

Mr. Behler has recently been on several National Research Council studies for the National Academy of Sciences including: "Critical Code," "Software Producibility, Achieving Effective Acquisition of Information Technology in the Department of Defense" and "Development Planning: A Strategic Approach to Future Air Force Capabilities."

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THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES
U.S. HOUSE OF REPRESENTATIVS

PAIRS CASE #2019-C-0350

DEPARTMENT OF THE AIR FORCE

PRESENTATION TO THE
HOUSE ARMED SERVICES COMMITTEE
TACTICAL AIR AND LAND FORCES SUBCOMMITTEE
U.S. HOUSE OF REPRESENTATIVES

SUBJECT: Department of the Air Force Acquisition and Modernization Programs in the Fiscal Year 2020 National Defense Authorization President's Budget Request

STATEMENT OF: Vice Admiral Mathias Winter
Program Executive Officer
F-35 Lightning Ii Program

MAY 2, 2019

NOT FOR PUBLICATION UNTIL RELEASED BY
THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES
U.S. HOUSE OF REPRESENTATIVS

I Introduction

Chairman Norcross, Ranking Member Hartzler, and distinguished Members of the Subcommittee, thank you for the opportunity to discuss with you today how the F-35 has contributed to modernization of tactical aircraft in the Department of the Air Force. As adversaries across the globe continue to develop advanced capabilities of their own, this conversation serves as an opportunity to align programmatic expectations and goals while discussing the operational accomplishments that are redefining the battlespace through the acquisition of the world's most advanced fifth-generation strike fighter. This year's President's Budget enables the F-35 Air System and my team to fully support the National Defense Strategy through our role in building a more lethal joint force and through our work to strengthen our alliances and build new partnerships.

The F-35 Joint Program Office (JPO) is leading a continued transformation of the F-35 Enterprise by embracing true agile acquisition processes and transitioning from a developmental and initial production environment to a full-rate production and continuous modernization environment, while sustaining the substantial growth of global operations.

With more than 400 fielded aircraft operating from sixteen sites within the U.S. and abroad, F-35 warfighters are beginning to experience the true game changing capabilities the F-35 brings to bear as well as identifying challenges that need to be addressed. Through these efforts, along with the aggressive implementation of cost-saving initiatives, the F-35 will be more survivable, supportable, lethal, and affordable than ever before and will ensure our expectation for decades of continued U.S. air superiority is reaffirmed.

II Department of the Air Force Modernization

The F-35 is more than a fighter jet; it is the "quarterback for the joint force." The F-35's ability to collect, analyze and share data is a force multiplier that enhances all assets in the battlespace. With stealth technology, advanced sensors, weapons capacity and range, the F-35 is the most lethal, survivable, connected and interoperable fighter aircraft ever built. This is true for our U.S. Services, International Partners, and Foreign Military Sales (FMS) customers, and the U.S. Air Force is no exception.

The conventional takeoff and landing (CTOL) F-35A is the latest fifth-generation fighter of the U.S. Air Force and is planned to operate alongside the U.S. Air Force's other 5th Gen/4th Gen aviation capabilities. The F-35A offers unrivaled battlespace awareness and lethality and is ready to take the fight to the adversary and win. With advanced integrated avionics, the F-35A provides next-generation stealth, enhanced situational awareness, and reduced vulnerability for the U.S., its International Partners, and its FMS customers.

The advanced sensor package of the F-35A is designed to gather, fuse, and distribute more information than any legacy aircraft, giving operators decisive advantages over their adversaries. Its processing power, open architecture, sophisticated sensors, information fusion, and flexible communication links make the F-35A an indispensable tool for all who operate it.

III Program Successes and Accomplishments

Throughout 2018 and into 2019, the F-35 Program continued to progress across the lines of effort of Development, Production, and Sustainment. Of particular note in the area of development, the Program delivered Block 3F capability last June, completed a series of

successful pre-Initial Operational Test and Evaluation (IOT&E) events from January to September 2018 followed by a successful Operational Test and Readiness Review (OTRR) in early October 2018 all of which culminated with the start of IOT&E in December 2018. In parallel our Block 4 Modernization efforts continued to ensure that requirements for delivering new capabilities are focused on maintaining operational superiority and meet our Warfighter's needs. Our production team saw equal progress with the award of the Lot 11 engine contract in May, the award of the U.S. Services' Economic Order Quantity (EOQ) contract for Lots 12, 13, and 14 hardware in June 2018, and the award of Lot 11 Air Vehicle contract in October 2018. These efforts brought down the unit cost of the F-35A to $89 million, the lowest price to date for the program, and we continue to aggressively come down the cost curve. Ninety-one F-35s were delivered during calendar year 2018, a nearly 40% increase from the previous year. In the area of sustainment, the Enterprise has made great strides to support the F-35 fleet. Specifically, Reliability and Maintainability (R&M) improvements have increased Air Vehicle Availability (AVA) by [~3%] during calendar year 2018. Phase 2 of the Global Supply Solution (GSS) Capability and Capacity stand-up for 2020-2022 has been completed, and the Hybrid Product Support Integrator (HPSI) has supported the rapidly-growing fleet, driving improvements in availability, mission capability, and deployments. Additionally, the Program initiated stand-up of the first Outside-the-Continental-United-States (OCONUS) Air Vehicle Depot in Italy, which inducted its first aircraft in July 2018. These accomplishments, and more, are made possible by the strong partnerships that exist within the F-35 Program, both across the U.S. Services and among our International Partners and FMS customers.

Across the F-35 Enterprise, these accomplishments demonstrate the Program's commitment to provide an affordable, lethal, supportable, and survivable air system to the warfighter. As the fleet continues to grow and the Air System's capabilities are enhanced, it is crucial that the Enterprise remains focused on fleet readiness to ensure these capabilities are available to the warfighter. In 2018, the F-35 program completed the most comprehensive, rigorous and safe developmental flight test program in aviation history. More than 9,200 sorties, 17,000 flight hours, and 65,000 test points were achieved to verify the design, durability, software, sensors, weapons capability, and performance for all three F-35 variants.

GOALS for 2019:

In 2019, F-35 flight tests will continue in support of phased capability improvements and modernization of the F-35 Air System. This agile framework, known as Continuous Capability Development and Delivery (C2D2), provides timely, affordable, incremental warfighting capability improvements to maintain air dominance against evolving threats to the United States and our allies.

More than 400 F-35s are currently in the global fleet, which will increase to nearly 500 by the end of 2019 with the planned delivery of 133 aircraft this year (131 for LRIP 11, and 2 from LRIP 10). Production ramp-up will continue as operational testing concludes in the fall of 2019, when the program will also enter full-rate production. To prepare for increased quantities, production experts from across the United States Government are working with our industry partners to deliver quality parts on time and at affordable costs. To achieve efficiencies, the Program has incorporated a number of performance initiatives and incentives across the entire

supply chain to support F-35 production lines in Italy, Japan, and the United States. The program is also targeting a threshold On-Time Delivery (OTD) rate of 95%, with an objective of 100% OTD of aircraft to contract. We also plan to award the Lot 12 Air System contract with options for Lots 13 and 14 in June 2019 and Lot 12 Engine contract in July 2019, in addition to working efforts to further streamline contract negotiations timelines.

Driving down cost is critical to the success of this program and, for the eleventh consecutive year, the average cost of an F-35 was lowered. As production ramps up, we are working with industry to implement additional cost saving initiatives. We are also on track to reduce the cost of the F-35A to less than $80 million by 2020—equal to or less than legacy aircraft—while providing 5th Generation warfighting capability.

In order to sustain such a growing fleet, the enterprise is targeting an 80 percent Mission Capable (80% MC) rate by the end of September 2019 for operational units. Additionally, the Program is working to achieve Full Operating Capability (FOC) of its Hybrid Product Support Integrator (HPSI) to sustain a future global fleet operating from twenty-one bases, six countries, four amphibious assault ships (LHDs), and one aircraft carrier (CVN) in 2020. Globally, the enterprise intends to achieve a minimum of eleven depot locations strategically positioned around the world, in order to be able to support a minimum demand rate of repairs as needed.

IV Development

While each line of effort is vital to the long-term success of our warfighter, our work to deliver the F-35 weapon system begins with Development. The F-35 continues to establish itself as a vital part of our nation's defense. The Program is currently undergoing Initial Operational

Test and Evaluation (IOT&E) and embracing an agile framework for the Continuous Capability Development and Delivery (C2D2) of Block 4 capabilities which will modernize how we rapidly and effectively deliver technically feasible and operationally relevant capability to the warfighter.

SDD Close out: The F-35 Joint Program Office is working towards closure of System Development and Demonstration (SDD) by the end of Calendar Year 2019. This milestone is defined as:

- Delivery of Block 3F capability – completed in June of 2018,
- Completion of IOT&E – projected for 4th Quarter of CY2019, and
- Full Rate Production approval – also projected for 4th Quarter of CY2019, shortly following completion of IOT&E.

Initial Operational Test and Evaluation: On 5 December 2018, following completion of Operational Test Readiness Review, the F-35 Program entered Initial Operational Test and Evaluation (IOT&E) with Block 3F configuration which provides full SDD warfighting capability. The cooperation between the Operational Test community and the F-35 Program has been very positive and productive. The Director, DOT&E has taken a prudent, phased approach to implementing the operationally representative IOT&E testing. As of April 2019, 199 trials have been completed, with 64 trials remaining. Operational Test Trials will continue through this summer and conclude with reporting in late 2019.

Continuous Capability Development and Delivery (C2D2) – F-35 Block 4: The F-35 Program is modernizing how it develops and delivers capability to the warfighter with the construct of C2D2. This approach is a departure from the traditional acquisition framework and delivery of large capability blocks, and implements select agile-based processes that will result in the predictable and timely delivery of software and hardware for rapid modernization,

enhancement, and improvement of F-35 capabilities. C2D2 is the method by which Block 4 capabilities will be delivered. Block 4 capabilities are delivered through software upgrades, enabling hardware modifications, integration of new weapons, and upgrades to off-board systems. Operational Flight Program (OFP) software updates will be developed on a 6 month cadence and will include incremental delivery of hardware development timelines. Block 4 capabilities will require new Electronic Warfare (EW) and Communications, Navigation, and Identification (CNI), hardware configurations, increased computing capacity provided by Tech Refresh 3 (TR-3) hardware, and Air Vehicle changes to the weapons bay and cooling system. Each of the Block 4 upgrades addresses advancing threats while expanding and improving mission capabilities.

Beginning in Calendar Year 2022, Block 4 capabilities will require modernization of existing development aircraft currently configured with TR-2 legacy hardware to TR-3. TR-3 replaces the legacy Integrated Core Processor (ICP), Panoramic Cockpit Display (PCD), and Aircraft Memory System (AMS) providing the necessary processing and storage capabilities to realize the full benefit of all Block 4 capabilities while allowing growth for added future capabilities. The production cut-in of TR-3 will occur during Lot 15 in Calendar Year 2023.

The F-35 Program is working to transition to C2D2 faster, more flexibly, and more affordably by breaking down and delivering in smaller increments, ultimately reducing our cost of doing business. There are three aspects to reducing this cost of doing business – agile delivery, capability verification, and open systems. Agile delivery utilizes smaller increments and capabilities so we improve the quality, understand more, earlier, and are able to deliver that

capability to the warfighter. Capability Verification utilizes a combined developmental test and operational test perspective in order to shorten cycle times and get the capability testing from flight test into modelling simulation and labs. Open Systems, specifically regarding TR-3, will allow earlier and easier integration in the near term to get new capabilities on the airplane, and benefit from additional competition. The desired outcome from the C2D2 approach, to Block 4 and into the future, is to deliver technically feasible and operationally relevant capability to the warfighter.

Physiological Events and Mitigation Strategy: Since May of 2017, the F-35 JPO has been conducting a multi-Service, multi-Partner investigation and resolution effort to mitigate Physiological Events (PE) in all variants of the F-35. As of April 2019, a total of thirty-eight PEs (thirty-one in flight and seven on-ground) have occurred across all variants of the F-35, resulting in an in-flight incident rate of approximately twenty PEs per 100,000 flight-hours, similar to other Department of Defense platforms.

While a specific root cause for these events in the F-35 has yet to be identified, specific actions have been carried out in order to reduce and mitigate these PEs, including modifying and improving the On Board Oxygen Generation System (OBOGS), improving the breathing regulator, or Seat Portion Assembly (SPA), and developing a carbon monoxide filter. The first mitigation strategy, modification to the F-35 OBOGS, will provide a more consistent oxygen concentration to the pilot. Initial development has been completed and testing is being conducted. Starting in 2019, new production aircraft will include this capability and retrofit schedules are in work. The second mitigation strategy, improving the SPA, which controls the

pressure of pilot breathing air, will reduce Work of Breathing in back-up mode and fleet fielding schedules are in work at this time. The third mitigation strategy, incorporation of a Carbon Monoxide Catalyst (COCAT), will filter carbon monoxide from pilot breathing air and is slated to begin fielding in fleet aircraft in 2020.

In addition, the Program is making changes to aircrew education and training to better respond to these events. These training changes include updating check lists to identify and implement corrective actions and development of a physiological trainer that simulates the conditions (i.e. pressure, volume, Work of Breathing, etc.) that a pilot would experience with various failures in the F-35 Life Support System.

V Production

Aircraft production continues to accelerate while the Program aggressively drives costs out of the production line. Efforts such as economic order quantity (EOQ) contracting, and Government-direct purchasing continue to ensure the F-35 is not only lethal, survivable, and supportable, but affordable as well. With suppliers in forty-five states and eleven countries (Figure 1), these are truly global production efforts. Together, with each of our International Partners and FMS Customers, the F-35 Program continues to realize progress and achieve results in terms of delivery performance, pricing, and contracting.

Figure 1: F-35 International Global Supply Base

Delivery Performance: In order to meet increasing schedule demands, the Program will continue to ramp up production while focused on improving quality to support cost and delivery targets. During CY2018, the Program delivered 91 aircraft and achieved the planned delivery goal for the year. As of April 2019, more than 400 aircraft have been delivered and all LRIP Lot 10 deliveries are now complete. The Program continues to ramp up with the planned delivery of 131 aircraft. As of April 2019, 29 of the 131 aircraft for 2019 had been delivered. As for LRIP Lot 11 contract deliveries, 30 of the 141 Lot 11 aircraft have been delivered.

F-35 LRIP Pricing: The price of F-35 aircraft continues to decline. Specifically, the price (including airframe, engine, and contractor fee) of LRIP Lot 11 F-35A ($89.2 million) is approximately 5.4% less than a LRIP Lot 10 aircraft.

Over the course of the LRIP contracts, timeliness of aircraft deliveries has historically been a challenge. However, in recent years, while production quantities have increased, the Program has seen improvement in the timeliness of aircraft deliveries. Although getting better, the Program is not satisfied with any delays. To date in 2019, all but one of the LRIP Lot 11 aircraft have been delivered on time.

Air Vehicle Production Contracting: While the U.S. Services continue to contract annually for LRIP Lots 12, 13, and 14, some F-35 Partners and FMS customers have initiated a Block Buy contracting strategy for LRIP Lots 12, 13 and 14. This strategy gives F-35 International Partners and FMS customers the flexibility to purchase all aircraft in a single procurement for LRIP Lot 12 or to procure aircraft and engines in a multiple lot format for LRIP Lots 12 through 14. The U.S. Services are procuring LRIP Lots 12, 13, and 14 as single-year procurements and have requested congressional approval to award a single contract to procure two year advanced material and equipment for FY 2019 and FY 2020. There is no multi-year commitment for U.S. Services' aircraft and engines, which will continue to be bought on an annual basis for LRIP Lots 12 through 14 and preserves congressional annual discretion.

The risk of the Partners' and FMS customers' Block Buy for Lots 12, 13, and 14 is considered low, given the stability of the weapon system's design. All F-35 variants have completed second life (8,000 hours full life) durability testing. Additionally, 99.9% of all hardware and subsystems qualifications are completed, and Block 3F capability began delivery in 2018. For the U.S. Services and Congress, the risk is even lower as the commitment is limited to the purchase of a two-year supply of parts in a single EOQ procurement (FY 2019 and FY 2020).

In November 2018, the F-35 JPO awarded a Contract Action to Lockheed Martin for LRIP Lot 12 F-35s for U.S. Services and several International customers. The contract action obligated $6 billion ($3.5 U.S., $2.5 billion International) in funding from the U.S. Services, our International Partners and our FMS customers for a total of 255 F-35 aircraft. F-35 aircraft

allocation includes:

- 106 F-35s for the U.S. Services
  - Includes Lot 12 program of record plus FY18/FY19 aircraft quantity congressional adds
- 89 F-35s for International Partners
- 60 F-35s for Foreign Military Sales Customers

This award established a $22.7 billon not-to-exceed contract threshold and contract framework to produce Lot 12 aircraft. This enables the continued production of F-35s while government and industry teams work to reach final contract agreement definitization targeted for mid-June 2019. Contract deliveries of LRIP 12 are scheduled to begin in January 2020.

This Lot 12 framework leveraged our Lot 11 agreement and includes targeted Production Line Performance and Supplier Cost incentive areas. These incentives, when realized, will position the Program to achieve the required increased production ramp and align industry performance to achieve our required outcomes in reducing costs, increasing quality and meeting delivery timelines.

Engine Production: In May 2018, the F-35 JPO awarded the Lot 11 Propulsion contract valued at $2.02 billion. This contract covers 135 propulsion systems for all three variants of the F-35 Lightning II, as well as production installs, tooling, program administrative labor, and Partner unique items. The Unit Recurring Flyaway (URF) price for the LRIP Lot 11 Conventional Take Off and Landing (CTOL) propulsion system is $12.66M, a reduction of less than half a percent from LRIP Lot 10 URF. This value is below Pratt & Whitney's *War on Cost* commitments. However, the JPO is not satisfied with the small percent decrease from Lot 10 and, as such, is engaging with Pratt & Whitney to review the next wave of *War on Cost*

initiatives to further drive cost out of these propulsion systems. Negotiations for LRIP Lot 12 are ongoing and are expected to complete in summer 2019.

Upcoming Actions: The F-35 JPO is on track to release a request for proposal for our Lot 15-17 production buys this summer using a base plus two-option years contracting strategy. We are continuing to look for ways to implement a Multi-Year procurement strategy based on the F-35's stable design and steady production rate. To date, the return-on-investment provided by our industry partner in regards to a Multi-Year procurement does not support proceeding with this acquisition approach. We fully believe such a multi-year strategy is ultimately the best way for industry to make long-term agreements with suppliers and bring down overall production costs while improving on-time deliveries. Therefore, we will continue to work with our industry partner and Department leadership to pursue a multi-year strategy as we move forward so that we can optimize our production program and continue the trend of reducing costs across all F-35 variants.

ALIS: The F-35 Autonomic Logistics Information System (ALIS) is the operations and maintenance infrastructure for the F-35. This complex system supports operations, mission planning, supply-chain management, and maintenance. These are all functions necessary to support flight operations. ALIS also supports the three U.S. Services, eight Partner Nations, and four FMS customers that have purchased the F-35 through the Foreign Military Sales program.

The current ALIS strategy includes three lines of effort: Current ALIS, ALIS Re-architecture (called ALIS-Next), and an Agile Development Operations (DEVOPS) software development pilot. The Current ALIS focus is to stabilize and enhance the current fielded ALIS

system, which supports all flight operations of the F-35 today. The F-35 JPO will sustain and continue to enhance the current system as well as maintain cyber security standards to meet warfighter needs.

The second line of effort includes modernizing the ALIS architecture to current industry standards. The F-35 JPO has teamed with MIT-Lincoln Labs and other government agencies to re-architect ALIS, (an effort known as ALIS-Next), to provide a government owned technical baseline of the ALIS system. The objective of this effort is to reduce cost, improve supportability, enhance cyber security, and provide additional wartime resiliency. ALIS-Next will be based on the latest industry Information Technology (IT) standards and principles. During 2019, the F-35 Enterprise will develop the ALIS-Next architecture prototype and establish a transition plan to begin the incremental transition to the modernized system in FY20.

The F-35 JPO, in coordination with software experts from Hanscom Air Force Base in Massachusetts, is executing an Agile DEVOPS software development pilot on ALIS software. This pilot program is also known as the "Mad Hatter Project." The project is led by the U.S. Air Force in a software development cell called "Kessel Run." This team includes software developers from the 309th Software Engineering Group, Lockheed Martin, and leading industry IT contractors, and is working closely with the test squadron at Nellis Air Force Base in Nevada to rapidly address some of the most pressing issues affecting the operational maintainers. The goal of the pilot is to provide rapid, user centric improvements to the software and to identify specific acquisition and software development process improvements that will be transitioned to the JPO within the next twelve to eighteen months.

Planning is underway to merge the current ALIS effort, ALIS re-architecture, and Agile DEVOPS software development pilot into a unified long-term strategy. This plan will ensure we continue to provide the warfighters with necessary capabilities and support for current global F-35 operations, begin an incremental transition to the new architecture ensuring no disruptions to ongoing flight operations, and leverage lessons learned from the Agile DEVOPS software development pilot to provide a flexible, affordable, supportable, and secure ALIS environment to support the global F-35 fleet.

Ejection Seat Modernization: The F-35 program introduced the final standard of the US16E ejection seat in LRIP 10 in May of 2017. This configuration of ejection seat incorporates a pilot weight selection capability and a fabric panel on the parachute risers to control head motion. These features work together with a lightened helmet to allow the full weight range of 103 to 245 pound pilots to safely eject from the F-35. These most recent seat improvements join other state of the art technologies previously incorporated into the F-35 escape system, including:

- F-35B auto-eject system (the first use of an auto-eject system in U.S. aircraft)
- Arm restraint system (the first in the U.S. Navy)
- Leg restraint system (the first passive system used in the U.S. Navy and Air Force)
- Single point water activated parachute harness release system on the F-35 seat (the first of its kind used worldwide)
- Inflatable airbag head support (also the first of its kind used on any ejection seat worldwide)

The F- 35 program has used modern technology to meet safety requirements more stringent than those used on any preceding tactical aircraft program. Upgrade of the F-35 fleet to the final standard US16E seat is underway and is scheduled to complete in 2020.

VI Sustainment

While development and production efforts of the F-35 Program are central to the creation of the aircraft, they must be matched with equally robust capacity for aircraft sustainment. The F-35 Enterprise continues to work towards improving and maintaining a high-rate of mission capability across the fleet, and is radically pivoting our approach to software development and sustainment.

80 percent Mission Capable Rate: As the F-35 fleet grows, we must also modernize how we support such a fleet. In order to enable the F-35 Enterprise to achieve the mandated 80% MC rate by September 2019, the F-35 JPO, is working with the three U.S. Services and eight International Partners and has established a four phase plan to achieve and sustain the readiness rates listed in Table 2.

THE ROAD TO 80% MC				
	Phase 1 Sep 19	**Phase 2 Feb 20**	**Phase 3 Jun 20**	**Phase 4 Sep 20**
Operations	80%	80%	80%	80%
Training	15-18 UTE	60%	80%	
LRIP 5+	50%	60%	70%	

Table 2

Phase one is to achieve 80% MC of Combat Coded aircraft and improve training to a utilization rate (UTE) of 15-18 (monthly). Phase two will maintain Combat Coded aircraft at 80% MC and continue to improve training to 60% MC. Phase three will get all Lot 6 and follow aircraft to 80% MC. Phase four will be to achieve 80% MC across the entire fleet.

In order to achieve each of these phases the program has embarked on executing four Main Enablers, each with discrete actions. These enablers are in sync with the broader sustainment

plan to improve readiness and reduce costs laid out in the updated F-35 Life Cycle Sustainment Plan. Enabler one is to improve supply chain performance, which will be accomplished by increasing repair capability, accelerating depot repair capability, and accelerating material delivery. Enabler two is to return aircraft to MC status, which will be accomplished by reducing depot modification span times and eliminating long term down aircraft (31+ days since last flown). Enabler three is to accelerate modifications, which will be accomplished by completing Block 3F modifications and retrofits and accelerating reliability and maintainability retrofits. Enabler four is to optimize unit level maintenance, which will be accomplished with organization level maintenance plan changes.

Depot Activation: Two air vehicle depots have been stood up within the United States. One is located at the Ogden Air Logistics Complex, Hill Air Force Base (AFB) in Utah and the other is located at the Fleet Readiness Center East, Marine Corps Air Station Cherry Point in North Carolina. A third is located OCONUS in Cameri, Italy. In July 2018, the Cameri depot inducted its first F-35. In 2019, three additional OCONUS depots will activate, located in Williamtown, Australia; Nagoya, Japan; and Iwakuni, Japan.

In addition to the air vehicle depots, one propulsion depot has been stood up at the Oklahoma City Air Logistics Complex, Tinker AFB in Oklahoma and established initial repair capability in 2014. This depot has matured in both capability and capacity to meet the growing fleet demand, and now has capacity to meet U.S. Title 10 workload through 2028. The program is also actively engaged in standing up of five additional propulsion depots outside the United States. These

depots will be stood up in Australia, Turkey, and the Netherlands during 2020, Norway during 2021, and Japan during 2023.

In addition to the above depots, component depot capability is integral to the readiness of the fleet as it will support the F-35 global supply chain with ready-for-issue components at a rate on par with fleet demand. Currently, the F-35 Program has established Initial Depot Capability (IDC) for twenty-six of sixty-eight designated Line Replaceable Component (LRC) workloads at U.S. organic depots. IDC consists predominately of fault isolation and "repair by replacement" of subcomponents, and takes approximately four years to complete. Organic depot repair capability will continue to mature over the next eight to ten years until the JPO achieves "repair by repair of subcomponents" capability known as Full Depot Capability. By 2024, U.S. depots will have a "demand-rate" repair capability for all sixty-eight workloads to include adequate facilities, trained labor, current technical data, and repair material on hand to effect efficient repairs. Sequencing of workload activations has been prioritized to have the highest positive impact on known readiness issues, accounting for pending engineering changes and other reliability improvement initiatives.

In June 2018, the Program placed Lockheed Martin (LM) on contract to activate thirteen additional workloads at Military Service Depots (MSD) over the next three years. As more funding is made available within the Program, additional workloads currently scheduled for a 2020 contract action will be pulled into 2019. By the end of 2020, all identified F-35 component workloads will be on contract with LM to activate with an estimated IDC completion of 2024. In parallel to the LRC activation effort, the JPO is initiating activities to develop Shop Replaceable

Component (SRC) capability starting in 2019. It is estimated SRC capability establishment will take six to eight years. The JPO will then work with LM and the MSDs to ensure capacity is available to meet fleet demands. This analysis will occur on a two-year cycle beginning in 2019.

Software Modernization: The F-35 Program is pivoting how we view software, creating an effective hybrid of historically separate efforts for Software Development and Sustainment, that we are calling Software Modernization. Over the past few years, it has become clear that focusing on the traditional ways of supporting the software for the program was not supportable and would result in duplicative work and increased costs. The sustainment of the full air system, with its software intensive elements is the long-term Achilles heel of the sustainment effort. As the operational tempo has continued to increase, the requirements of the fleet have evolved, and the continuous update cycle for the Air System has driven the need for a strategy to stay ahead of the threat to our warfighters. We must embrace innovation in software modernization, which will result in continuous updates and provide a marked increase in capability, at speeds that have never been seen before.

The Program's goal is to use an affordable Integrated Software Delivery Capability, which combines government organic and industry best performers, creating an integrated partnership between government and industry. This partnership will avoid duplication of effort and resources across development and sustainment, bringing them together technically in order to reduce the amount of touch to software modules and get the capability to the warfighter. Ultimately, this new approach shifts towards viewing the development of software as a service rather than a product that is delivered.

Although challenging, this is an exciting opportunity to deliver capability to the warfighter at a pace that has not yet been seen in other programs. The Program also recognizes the need to continue to consider new ways of working and is looking to have a vision for cloud-based global sustainment. The aim is not to reallocate work, or take work from one area to another, but to work together to maximize the strengths of all the players to bring corrections and new capability as rapidly as possible to our warfighters.

VII U.S. Services, International Partners and FMS Customer Operations

The U.S. Services, our International Partners, and FMS customers experienced numerous successes and major milestones throughout 2018, and have continued in 2019. Major accomplishments in 2018 for the U.S. Services included deployment of tbe first U.S. Marine Corps (USMC) F-35B aboard the USS WASP (LHD 1), deployment of F-35As in a Theatre Support Package to Kadena Air Base in Japan, deployment of F-35Cs aboard the USS ABRAHAM LINCOLN (CVN 72) and tbe first F-35B combat strike operations in support of Operation Freedom Sentinel in Afghanistan aboard the USS ESSEX (LHD 2).

Milestones for our International Partners in 2018 included: First Aircraft Arrivals (FAA) for the United Kingdom, Japan, and Australia; declarations of Initial Operating Capability (IOC) for the United Kingdom and Italy; declaration of Initial Depot Capability for the Heavy Airframe MRO&U in Italy; in addition to First of Class Flight Trials conducted aboard the HMS Queen Elizabeth with the F-35B. Also in 2018, training for both Turkish and Korean Maintenance personnel began in January at Eglin AFB in Florida; and training for Turkish pilots began in July at Luke AFB in Arizona. The Israeli Air Force conducted operations with the F-35A. And

Belgium became the fourth and newest FMS customer of the F-35 enterprise, signing its Letter of Offer and Acceptance in October 2018.

In 2019, the F-35 Enterprise has already achieved major milestones including declaration of IOC for the U.S. Navy in February 2019. Additionally, in March 2019, our Japanese Partners stood up their first operational squadron, the 302nd Tactical Fighter Squadron, and Korea received its first aircraft. Many more accomplishments and milestones are expected this year, including ship activation for the USS AMERICA (LHA 6) which will arrive in Japan later this year (2019); completion of the third U.S. Air Force (USAF) operational squadron standup at Hill AFB in Utah; and FAA and initial standup of USAF 158th Fighter Wing in Vermont.

Milestones for our International Partners in 2019 include: Denmark and Australia were selected in February as additional locations for MRO&U facilities for components; FAA in country for the Netherlands and Turkey; declaration of IOC for Norway and Korea; and Canada is expected to release the full Request for Proposal (RFP) for its Future Fighter in mid-2019. As mentioned, ship activations will increase, as well as depot expansions around the world. In evidence of this, the Netherlands will open their first multi-use Regional Warehouse, receive their first aircraft at Leeuwarden Air Base, and receive delivery of the first Netherlands aircraft assembled at the Italian FACO. Italy is also scheduled to begin pooled training of F-35Bs with the USMC. The F-35 FMS Team is also focused on responding to formal Requests for Proposals from both Finland and Switzerland, with U.S. Government response expected in August and November, respectively. In December 2018, the Government of Japan also formally announced its plans to purchase an additional 105 aircraft (63 F-35As, and 42 STOVL aircraft). With this

anticipated purchase, Japan will be the largest international customer of F-35s with 147 planned aircraft.

Future potential FMS customers include Singapore, Greece, Romania, Spain, and Poland with the JPO responding to all official inquiries. The coming year promises to be another of substantial growth and progress across the global F-35 Enterprise.

VIII Conclusion

Thus far, 2019 has already been, and will continue to be, another fast-paced and unrelenting year for the F-35 JPO. The Program continues to make steady and measured modernization, acceleration, and growth efforts across all three lines of effort – Development, Production, and Sustainment – and continues to aggressively tackle known challenges. We are ready for our shift from a development/low rate production environment to a full rate production/modernization-sustainment-full operations environment. Lastly, we will continue to remain focused, with a true sense of urgency, to solve challenges and provide a clear status and data needed to assist our Congressional stakeholders as well as senior DOD and International leadership with upcoming tough priority decisions.

Vice Admiral Mathias W. "Mat" Winter
Director, Joint Strike Fighter Program, Office of the Secretary of Defense

Vice Adm. Mat Winter is a 1984 graduate of the University of Notre Dame with a Bachelor of Science in Mechanical Engineering. He received his commission through the Naval Reserve Officers Training Corps and was designated a naval flight officer in 1985. Winter holds a Master's in Computer Science from the Naval Postgraduate School and a Master's in National Resource Strategy from National Defense University's Industrial College of the Armed Forces. He also received a Level III certification in Program Management and Test & Evaluation from the Defense System Management College.

Winter served operational tours as an A-6E Intruder Bombardier/navigator with Attack Squadrons 42, 85 and 34 making multiple deployments aboard aircraft carriers USS Saratoga (CV 60), USS America (CV 66), USS Dwight D. Eisenhower (CVN 69) and USS George Washington (CVN 73).

Winter's major acquisition tours include assistant deputy program manager for the Joint Standoff Weapon System; chief engineer for Joint Strike Fighter Integrated Flight and Propulsion Control; deputy program manager for the Tactical Tomahawk cruise missile program; and his major acquisition command tour as the Precision Strike Weapons (PMA-201) program manager.

Winter has served flag tours as commander, Naval Air Warfare Center Weapons Division, China Lake/Point Mugu, California; assistant commander for Test and Evaluation, Naval Air Systems Command; PEO for Unmanned Aviation and Strike Weapons; director, Innovation Technology Requirements, and Test and Evaluation; the 24th chief of naval research and deputy program executive officer for the F-35 Lightning II Joint Program Office. In May 2017, he became the program executive officer for the F-35 Lightning II Joint Program Office, leading the Department of Defense's largest acquisition enterprise that is responsible for developing and acquiring the F-35, the most advanced next- generation strike aircraft weapon system for the Navy, Air Force, Marines and many allied nations.

His personal awards include the Navy Distinguished Service Medal, Legion of Merit (three awards), Defense Meritorious Service Medal (two awards), Navy Meritorious Service Medal (two awards), Navy and Marine Corps Commendation Medal (four awards), Joint Service Achievement Medal (two awards), Navy and Marine Corps Achievement Medal, Air Force Acquisition Excellence Award, Southwest Asia Service Medal, Kuwait Liberation Medal and various unit and sea service awards.

Updated: 3 January 2019

WITNESS RESPONSES TO QUESTIONS ASKED DURING THE HEARING

MAY 2, 2019

RESPONSE TO QUESTION SUBMITTED BY MR. GALLEGO

Secretary ROPER. We project the 173 A–10s that recently received new wing sets, as well as those that will receive new wing sets via the recently awarded re-winging contract, will have a wing-service-life that extends to 2030 and beyond depending on mission demands. [See page 18.]

RESPONSE TO QUESTION SUBMITTED BY MR. CARBAJAL

Admiral WINTER. The F–35 Joint Program Office (JPO) completed its supplier capacity analysis via a Special Tooling and Test Equipment (STATE) initiative in March 2019. This initiative assessed F–35 production and sustainment "new build" demands for the next seven years across the fleet to address parts shortfalls and supply chain challenges. During this process, the JPO engaged with all 114 of its major suppliers. Of these 114 suppliers, 92 (80.7%) suppliers were determined to have no capacity constraints while 22 (19.3%) were deemed to have capacity constraints. Additional validation occurred for these 22 suppliers by conducting joint technical reviews for alignment to meet required demand. This initiative aligns with the new Life Cycle Sustainment Plan approved in January and moves toward a more agile and accelerated supply chain to meet the fleet demand as dictated. Delivering STATE to our production line and fleet, following contract award, is the metric of success. Contract award is currently scheduled for third quarter 2019 with delivery to follow 18 to 24 months after (approximately 2021). [See page 29.]

QUESTIONS SUBMITTED BY MEMBERS POST HEARING

MAY 2, 2019

QUESTIONS SUBMITTED BY MR. NORCROSS

Mr. NORCROSS. The subcommittee understands that the analysis of alternatives (AOA) for ABMS is not formally considering Ground Moving Target Indicator (GMTI) as a requirement. Rather, the service intends to count the GMTI requirements analysis done under the prior JSTARS recap AOA as part of the ABMS analysis. If the ABMS AOA isn't actually examining GMTI, how will you ensure that the requirement is fully considered and addressed?

Secretary ROPER. The National Defense Strategy (NDS) directs a renewed emphasis on operating in and developing capabilities for unfriendly and contested environments. Potential adversaries are fielding capabilities with the intention of keeping U.S. platforms away from the fight so that they are unable to achieve their operational mission. Within this contested environment, they are also fielding capabilities over large areas that can hide and move quickly with the intention of increasing the difficulty of finding, tracking, and negating potential targets. Therefore in accordance with the NDS, ABMS is a family of systems that aims to address these challenges and achieve multi-domain command and control. GMTI is a critical component of these capabilities and is included in our ongoing analysis.

Mr. NORCROSS. The subcommittee understands that Combat Rescue Helicopter is scheduled for first flight later this month and a Milestone C decision at the end of FY19. FY20 budget briefings indicate that the Air Force intends to make two low rate initial production awards in the next 12 months, one immediately after Milestone C and the other in April 2020. That would bring the total LRIP buy to 22 aircraft in a six-month period. Please describe how the service and the program are going to manage any risk associated with this aggressive LRIP procurement and what measures are in place to ensure production milestones are met? Is the program capable of executing to this plan?

Secretary ROPER. Yes, the Air Force is confident we can execute our plan for the Combat Rescue Helicopter program. The Air Force program office works closely with Sikorsky and the Defense Contract Management Agency to manage program development and production risk, and will continue to do so during production. The planned low rate initial production (LRIP) award schedule reduces risk due to supplier base performance and is based on their lead time requirements. Each production lot will deliver sequentially in accordance with appropriation law.

Mr. NORCROSS. The subcommittee understands that Combat Rescue Helicopter is scheduled for first flight later this month and a Milestone C decision at the end of FY19. FY20 budget briefings indicate that the Air Force intends to make two low rate initial production awards in the next 12 months, one immediately after Milestone C and the other in April 2020. That would bring the total LRIP buy to 22 aircraft in a six-month period. Please describe how the service and the program are going to manage any risk associated with this aggressive LRIP procurement and what measures are in place to ensure production milestones are met? Is the program capable of executing to this plan?

General NAHOM. Yes, the Air Force is confident we can execute our plan for the Combat Rescue Helicopter program. The Air Force program office works closely with Sikorsky and the Defense Contract Management Agency to manage program development and production risk, and will continue to do so during production. The planned low rate initial production (LRIP) award schedule reduces risk due to supplier base performance and is based on their lead time requirements. Each production lot will deliver sequentially in accordance with appropriation law.

The Air Force's planned LRIP schedule minimizes production gaps and is based on production lot lead times to ensure timely delivery of combat search and rescue capability. The Combat Rescue Helicopter contract contains pre-negotiated fixed priced options for the low rate production, each with a unique production lead time to allow the prime contractor to contract with its supplier base for that lot's material. To avoid a gap for supplier and Sikorsky production, LRIP lot 2 (FY20) needs to be exercised seven months after LRIP lot 1.

QUESTIONS SUBMITTED BY MRS. HARTZLER

Mrs. HARTZLER. The EPAWSS electronic warfare suite upgrades were originally planned for the F–15C and F–15E. The Air Force now plans to purchase F–15EX aircraft to replace the F–15C, and no longer intends to upgrade the F–15C with EPAWSS. If the current acquisition strategy to purchase F–15EX is not realized, what is the Air Force's plan to ensure F–15C aircraft receive needed upgrades such as EPAWSS to ensure the Air Force receives capabilities that the F–15EX would otherwise provide?

Secretary ROPER. If the current force structure strategy to procure F–15EX is not realized, the Air Force would re-evaluate plans regarding the sustainment and modernization of the F–15C/D fleet. If the Air Force determines the F–15C/D fleet would have to be retained, then the decision to not fund the Service Life Extension Program Longeron and Service Life Extension Program Wings upgrades would have to be reconsidered. Furthermore, significant and invasive re-wiring upgrades, environmental control system modifications, and the addition of dual Enhanced Global Positioning System/Inertial Navigation Systems would have to be reconsidered. Additionally the Air Force would have to decide whether to fund Eagle Passive/Active Warning Survivability System, Active Electrically Scanned Array radars, Advanced Display Core Processor II, Multifunctional Information Distribution System –Joint Tactical Radio System, Mobile User Objective System radios, ALQ–128v2 electronic warfare countermeasure receiver, and other capability upgrades planned to be resident in the F–15EX such as large area displays and new high capacity data transfer modules. These plans would have to account for significant aircraft downtime due to the extensive modification/installations required if the plan is to bring the F–15C/D fleet to an F–15EX-like configuration. Finally, the Air Force would have to continue the full scale fatigue testing to identify what other sustainment upgrades would be required to keep the F–15C/D fleet in service and operationally effective. Current estimate to SLEP and modernize the F–15C/D fleet to a configuration that is nearly comparable to the expected F–15EX aircraft is approximately $11B.

Mrs. HARTZLER. It's my understanding that the F–15X aircraft in this year's budget are intended to replace legacy F–15C aircraft that are rapidly aging out. The F–15C fleet is flown by Air National Guard units around the country. In testimony earlier this year to the Senate Appropriations Committee, the Chief of Staff of the Air Force, General Goldfein noted that transitioning units across "like-type" aircraft—in other words, from one model of F–15 to another—takes advantage of common infrastructure, parts and equipment.

Would you elaborate on this and how do unit readiness and mission conversion costs and schedules factor into this F–15X decision? For example:

What is your estimate of the cost and time required to convert an F–15C unit to F–15EX?

What is your estimate of the cost and time required to convert an F–15C unit to an F–35 mission?

General HOLMES. Conversion costs vary between locations. The costs are less when converting units across "like-type" aircraft vs converting different aircraft with different mission sets. For example, we estimate that the readiness conversion for the F–15 C/D to F–15X would be months, whereas it would be three years for an F–15C/D unit to convert a unit to another weapon system like the F–35. As for the cost, the F–15X should be able to use approximately 90% of the F–15 C/D infrastructure and support equipment, and approximately 70% common F–15 parts. We would expect minimal use of operations and maintenance (O&M) funds in the range of $10M–$20M and this would be refined during the site surveys.

Converting an F–15C/D unit to an F–35 unit will require both military construction (MILCON) and O&M funding in the $50M–$70M range. A large part of the cost is constructing a 4-bay simulator, modifications to squadron operations and aircraft maintenance unit buildings, and power conversions in the hangars.

Mrs. HARTZLER. How does the Air Force intend to field the new F–15EXs? Will they be fielded across both the Active and Guard Components? Which do you expect to receive aircraft first?

General HOLMES. The AF intends to field the new F–15EX by recapitalization of the F–15 C/D fleet across both Active and Guard components. The first eight aircraft will go to test and to the Formal Training Unit at Klamath Falls (Air National Guard); timing depends on what is authorized in the National Defense Authorization Act. The first three operational units will go to both Active Duty and the Air National Guard. The exact bases will be determined through SecAF's Strategic Basing Process.

Mrs. HARTZLER. What steps should the F–35 program office take to ensure that it continues to improve the air system's R&M performance and meet the R&M metrics targeted performance levels?

Mr. SULLIVAN. In April 2019, we recommended that the Secretary of Defense should ensure that the F–35 program office take the following steps to improve the air system's R&M performance; 1. assess whether the Operational Requirements Document's (ORD) R&M targets are still feasible and revise the ORD accordingly, 2. as it revises its R&M Improvement Program (RMIP), identify specific and measurable R&M objectives in its RMIP guidance, 3. as it revises its RMIP, identify and document which RMIP projects will achieve the identified objectives of the RMIP guidance, and 4. prioritize funding for the RMIP. DOD concurred with the recommendations. The F–35 program office is addressing the first recommendation by reviewing requirements with applicable stakeholders. Officials stated that they may revise the ORD or lower-level documents. The program is also currently in the process of revising its RMIP and has considered including more specific objectives, including a focus on improving aircraft availability and mission capability. To continue to improve the air systems' R&M performance, the F–35 program office should implement the other recommendations as well.

Mrs. HARTZLER. You have reported that the Block 4 effort should be designated as a major defense acquisition (MDAP) program in its own right and that it is at risk of experiencing similar cost and schedule growth that the F–35 baseline program saw during initial development. Should the program be designated as an MDAP and what does the program need to do to avoid similar cost and schedule growth on Block 4?

Mr. SULLIVAN. Yes, the F–35 program's Block 4 should be designated as an MDAP for better transparency and oversight. In April 2016, we reported that DOD was not planning to manage its Block 4 effort as a separate MDAP, and that this approach does not align with weapon system acquisition best practices, which would likely hinder transparency and oversight. As a result, we recommended that the Secretary of Defense hold a Milestone B review and manage the F–35 Block 4 as a separate and distinct MDAP with its own acquisition program baseline and regular cost, schedule, and performance reports to Congress. DOD did not concur with the recommendation, citing that it views Block 4 as a continuation of the existing F–35 acquisition program, its most closely managed system. Furthermore, DOD stated that it plans to use existing F–35 oversight mechanisms, like regularly scheduled high-level acquisition reviews, to manage its Block 4 efforts. We continue to stand by our recommendation.

To avoid additional cost and schedule growth, the program should complete its Block 4 business case, including an independent technology readiness assessment, an independent cost estimate, and an approved test and evaluation master plan, before making additional development contract awards planned for May 2019. In April 2019, we recommended that the Secretary of Defense take these actions, but DOD did not concur. In its response to our recommendations, DOD stated that the F–35 program office has adequate cost, schedule, and technical maturity knowledge to begin the development of initial Block 4 capabilities. Given our findings on DOD's management of MDAPs over the last 17 years, we continue to stand by this recommendation. Specifically, we have found that when programs enter development with insufficient knowledge, negative effects often cascade throughout the acquisition cycle. The F–35 Block 4 program has already awarded development contracts without a full understanding of cost, schedule, and technical risks associated with new development efforts. For example, without an independent technology readiness assessment, the program has not identified potential critical technology elements and, as a result, may be at risk of delaying the delivery of new capabilities.

QUESTION SUBMITTED BY MR. WITTMAN

Mr. WITTMAN. As Congress evaluates the Department's proposal to buy new F–15EXs, there has been a lot of discussion about the costs of operating and sustaining the F–15EX vs. the F–35A. Some within the Department are claiming F–35 sustainment costs are so high that we won't be able to afford an all fifth-gen fleet, and therefore we must begin purchasing F–15EXs. However, it is my understanding that F–35 sustainment costs are coming down, and that all parties involved, including DOD, have signed a plan to get the F–35A to a $25,000 Cost per Flight Hour by 2025. General Holmes, in your estimation, do you think there would be a significant difference in the sustainment costs of these two fleets (F–35A and F–15EX) as we approach 2025 and beyond?

General HOLMES. The F–35 Joint Program Office (JPO) and Cost Analysis and Program Evaluation (CAPE) have estimated a target F–35 Cost Per Flying Hour (CPFH) of $35K in FY24. That would be an improvement over current F–35A CPFH. CAPE has provided an initial estimated F–15E/X CPFH of $29K. Once F–15EX is procured and more data becomes available the CPFH can be further examined to bring CPFH below the initial CAPE estimate.

QUESTIONS SUBMITTED BY MR. SCOTT

Mr. SCOTT. The Chief of Staff of the Air Force, General Goldfein, in his testimony before the Senate Armed Services Committee (SASC) last month, referred to the crews of the Air Force's Joint Surveillance and Target Attack Radar System (JSTARS) Wings as "our Ph.D.'s of Battle Management." He went on to say they are "the doctors of battle management that we need to lead us into the future." Those "doctors of battle management" have done an outstanding job of transforming the JSTARS weapon from its original "Fulda Gap scenario" solution into the most capable airborne battle management system in the inventory today that can handle any situation "from Stakeout to Shootout" as the operators like to say. With their demonstrated aptitude to rapidly field new capabilities, please tell me how you are going to leverage the significant investment in technology and human capital resident at the 461st and 116th Air Control Wings and the JSTARS weapon system to field and exercise new advanced battle management capabilities in order to maintain its warfighting relevance as you move toward your longer term objective Advanced Battle Management System (ABMS) solution?

Secretary ROPER. I want to thank both Wings for what they do each day to help protect our nation and for their willingness to partner together to create and field the future. Early warfighter involvement is critical to the success of achieving multi-domain command and control and ABMS. We are reaching across the traditional and non-traditional technical innovation base as well as the operational community to ensure the best operationally viable capabilities are provided to our airmen as expeditiously as possible. We have developed a strong partnership with Team Robins and the two Air Control Wings, including establishing an innovation team across both Wings to help catalyze new concepts and leverage the team's valuable expertise and creativity. Our Chief Architect has met with the team down in Georgia and most recently in Nevada as part of the Air Force Weapons School Integration Exercise. As potential adversaries pursue capabilities intended to deny our freedom of maneuver and proximity as well as present dispersed potential targets over large geographic areas, we expect our partnership to grow as we work together to make the Air Force both ready and lethal.

Mr. SCOTT. General Holmes, I understand that the latest Service Life Assessment of the E–8C Joint Surveillance and Target Attack Radar System (JSTARS) aircraft now project the aircraft going into the latter half of the 21st century and that the number of aircraft now in Programmed Depot Maintenance (PDM) have returned to the historic average of four aircraft. Thank you for your efforts to ensure that this critical asset remains available throughout the transition to the Advanced Battle Management System (ABMS). Last year the Air Force defined three increments of ABMS, with Initial Operational Capability (IOC) of Increment 2 to occur in 2028. Now we are hearing about retirements of E–8C JSTARS aircraft beginning in 2024, when the FY2018 National Defense Authorization Act (NDAA) prohibits retirement of JSTARS aircraft until IOC of Increment 2 and ABMS is being described as a "strategy." Please describe what sort of breakthroughs have occurred that would allow for a revised timeline, when the ABMS "Architect," Mr. Preston Dunlap, was hired only earlier this year in 2019, the Analysis of Alternatives has not yet been completed, submitted to and verified by Cost Assessment and Program Evaluation (CAPE) within the Office of the Secretary of Defense, and how the Air Force Budget Requests put forth so far would replace the capability and capacity of the JSTARS weapon system in just five years from today.

General HOLMES. The Air Force ensured all E–8C aircraft were funded through the FYDP and understands the need to sustain the E–8C JSTARS aircraft well into the future. The E–8C will be an essential part of the Bridge Strategy to Advanced Battle Management System (ABMS), and we are planning sustainment and modernization to that effect. The Air Force has not committed to any timeline yet for JSTARS retirement, but we do not intend for any retirements until we demonstrate the needed capability and capacity.

The National Defense Strategy (NDS) directs a renewed emphasis on operating in and developing capabilities for unfriendly and contested environments. Potential adversaries are fielding capabilities with the intention of keeping U.S. platforms, es-

pecially larger and slower platforms, away from the fight so that they are unable to achieve their operational mission. Within this contested environment, they are also dispersing capabilities over large areas where they can hide and move quickly with the intention of increasing the difficulty of finding, tracking, and negating potential targets. Further, we have the opportunity to achieve significant gains by combining the power of integration and interoperability with the application of modern technology and algorithms. Therefore in accordance with the NDS, ABMS is a family of systems that aims to address these challenges and realize multi-domain command and control.

ABMS will be a family of capabilities, not a single platform or program. The Chief Architect is conducting a family of systems review to develop the ABMS architecture and is tasked with horizontally integrating the various domains and families of systems and identifying and pursuing areas that need further development or enhancement. We are pursuing continuous agile technology development and fielding on multiple parallel paths, in order to deliver capability faster. That makes an Initial Operational Capacity designation problematic, but I think we will all be able to agree in the future when we have provided the needed capability and capacity.

We have already funded some battle management command and control capabilities and are developing others that will field within the next few years. For example, one of our main efforts will be to modify the Control and Reporting Centers (CRC), a ground battle management command and control (BMC2) asset to receive ground moving target indicator (GMTI) data from airborne assets. We are adding SIPRNet classified connectivity, additional work stations (and manpower) for GMTI operations, and we are making changes to the software that will allow CRC battle managers to generate and use GMTI tracks. We are also building communication links between GMTI operators and Sensor Operators and a link between the CRC, Army, and Marine MTI users. Finally, we are also working a communication link between the CRC and all-source intelligence data at appropriate levels of security so that battle managers can take advantage of the additional power of all-source intelligence data in their mission. In support of these efforts, we are planning facility upgrades to incorporate even higher classification data into the CRC and modifications to deployable CRC BMC2 suites.

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