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HEARING

ON

NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2022

AND

OVERSIGHT OF PREVIOUSLY AUTHORIZED PROGRAMS

BEFORE THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

ONE HUNDRED SEVENTEENTH CONGRESS

FIRST SESSION

SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES HEARING

ON

FISCAL YEAR 2022 BUDGET REQUEST OF THE DEPARTMENT OF DEFENSE FOR FIXED–WING TACTICAL AND TRAINING AIRCRAFT PROGRAMS

HEARING HELD
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FISCAL YEAR 2022 BUDGET REQUEST OF THE DEPARTMENT OF DEFENSE FOR FIXED–WING TACTICAL AND TRAINING AIRCRAFT PROGRAMS

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES,
Washington, DC, Tuesday, July 13, 2021.

The subcommittee met, pursuant to call, at 3:02 p.m., via Webex, 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. Well, I would like to call this hearing to order.

I would like to welcome everyone to our hearing, and to my good friend, Mrs. Hartzler from Missouri, and—for her participation in putting this hearing together.

This is the mandatory remote hearing script that you have all heard many times, and we will repeat it today.

I welcome all the members remotely joining today's hearing. Members participating must be visible on screen for the purposes of identifying and verification, establishing and maintaining a quorum, participating in proceedings, and voting.

Members must continue to use the software platform video function the entire time while they are in attendance, unless experiencing connectivity issues or other technical problems that render them unable to participate on camera.

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Members may use the software platform chat feature to mute—to communicate with staff regarding only technical or logistic support issues. I have designated a committee staff member to, if necessary, mute unrecognized members' microphones to cancel any inadvertent background noise that may disrupt the proceedings.

With that, I would like to turn to my opening statement.

Again, to welcome our distinguished panel of witnesses for joining us today for the fiscal 2022 budget request of the Department of Defense for fixed-wing tactical and training aircraft programs.

Today's hearing on tactical aviation is certainly one of the most important annual oversight events we hold in this subcommittee. This year, the hearing, even though complicated by the transition of a new administration, to the extreme lateness of the budget submission, and our committee's tight timeline for building this year's defense authorization bill, certainly more important than ever.

This afternoon, we will be receiving remote testimony from a very large panel, nine senior acquisition aviation leaders from across the Department of Defense. We will also hear from GAO [Government Accountability Office] representative, our independent agency helping us evaluate investment decisions and execution of challenging, particularly the F–35 program.

Overall, we are at a critical inflection point and time for the tactical fighter aviation requiring the subcommittee's consideration, deliberation, and certainly decision making. Each military service before us today has proposed significant initiatives in this budget that will begin to reshape the tactical fighter air forces to achieve what they describe as capabilities required to meet the challenges to deter and, if necessary, act against a near-peer threat of the future.

But what concerns me about DOD's [Department of Defense's] current appearance is a deliberate indifference that the steady state, rotational requirements that our continuing global military presence, responding to contingencies below the level of highly contested warfare, are no longer applicable, and I certainly would disagree with that.

DOD currently equates the term "legacy" to mean old, irrelevant, dangerous, unacceptable in meeting our current or future requirements. I certainly disagree with this. I would offer that "legacy" should instead be replaced by "existing," and that we should reference current force structure as existing force structure. And when assessing the existing force structure, it should be evaluated against a particular mission set for its relevancy or irrelevancy supporting that particular mission or strategic or operational risk associated with any gap in its availability or capacity.

I believe that our aircraft capabilities do need to evolve and keep pace with our global competitors, which is a wide spectrum depending on which competitor we are trying to influence to achieve our national defense strategic objectives. I also believe that we need to maintain and achieve a proper effective ratio of existing and next-generation aircraft capabilities to meet those diverse missions and a level of risk that is well defined, clearly explained, and truly acceptable.

Further, we cannot fiscally afford to divest in any existing aircraft in favor of buying the next-generation high-end capabilities and cannot fiscally afford having our next-generation high-end aircraft supporting the enduring steady state presence or lesser contingency operation of our combatant commanders.

The current design and capability of the F–15EX is not the same as the F–15C that rolled out back in the seventies. The current de-

sign capabilities of the F/A–18 Block III Super Hornet is not the same as the original F/A–18 Hornet that rolled out back in the eighties. The F–35 and F–22 are perfect cases in this point as it relates to realistic affordability and planning to buy large numbers of advanced next-generation aircraft.

Those two aircraft, very capable and sophisticated when they work as designed, but neither currently works as intended often enough, and both are extremely expensive to own and operate. This requires us to understand how both the Air Force and Navy next-generation air dominance programs plan to avoid and mitigate the development and affordability pitfalls of the F–22 and the F–35 that experience or are experiencing as this case may be for the F–35.

For this hearing, we need to understand the path that each of the services is on to achieve that relevant mix of both combat and training aircraft capabilities while maintaining affordability and acceptable risk informed by our fiscal realities.

Speaking of the F–35, we had a very productive hearing already back on April 22 this year. I don't want to rehash all those issues that we know so well today.

For the record, I still maintain the same concerns that were raised at that April 22 meeting, and, therefore, the subcommittee today expects to receive F–35 program updates on the status of resolving current maintenance and availability issues regarding the F135 propulsion system power modules; the current status of TR–3/Block 4 developments and testing; and how the F–35 is progressing to achieve the cost-per-tail-per-year affordability goals set by each of the services, particularly as it relates to the adaptive engine transition program technology will be finished and integrated into the F–35A and C models. This will help reduce the skyrocketing sustainment cost and improve combat capability.

Certainly a lot on our plate with many distinguished speakers, but first I would like to recognize our ranking member of the TAC Forces [Tactical Air and Land Forces Subcommittee], Mrs. Hartzler, for her opening remarks.

Vicky.

[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. Yes. Thank you, Mr. Chairman.

I want to thank each of our witnesses for their dedicated service to this Nation, for your support of our service men and women and each of their families, and for being here to provide testimony on the budget request for fixed-wing tactical and training aircraft modernization programs.

Recognizing the hard decisions and challenges imposed on all of you by the President's proposed budget top line, I look forward to working together to determine what is the right balance to prioritize and fund both current tactical readiness and modernization investments required for future capabilities.

It is critical that our tactical fighter aircraft force is capable of keeping pace, deterring, and, if necessary—[inaudible] and lethality of your fighter aircraft fleets. And I look forward to the discussion [inaudible]——

Mr. NORCROSS. Excuse me one moment.

Mrs. HARTZLER [continuing]. Are capable and ready to deter our adversaries in the near term as well.

From a strategic and operational risk management perspective, I expect the witnesses to address how their future [inaudible] plans are impacting the current readiness and sustainment of existing tactical aircraft capabilities. I have consistently expressed my concerns that the Navy's decision to end procurement of the F/A–18 Super Hornet beginning in fiscal year 2022 creates too much operational risk in the near term given the Navy's current shortfall of 49 aircraft.

I want a full assessment from today's military witnesses of the risks, specifically in terms of potential aircraft shortfalls, gaps in capabilities, industrial base impacts, and future costs each of the military services is accepting within its existing tactical air programs in order to develop and buy the fighter aircraft fleets of the future.

This information is critical for myself and members of the subcommittee as we review the military services' plans for divestments, decreasing fleet sizes, squadron relocations, and significant unfunded priority requests, and to make decisions for this year's Defense Authorization Act.

So I thank the chairman for organizing this important hearing, and I yield back.

Mr. NORCROSS. Thank you.

I am not sure if I was the only one that was not hearing your full testimony, but I believe I am looking at others that are having difficulty, Vicky, just to give you a heads-up.

With that, I would like to turn to our panel of nine witnesses who are joining us today.

First, we have Ms. Darlene Costello, Acting Assistant Secretary of the Air Force for Acquisition, Technology and Logistics; Lieutenant General David Nahom, Deputy Chief of Staff for the Air Force for Plans and Programs; Mr. Jay Stefany, Acting Assistant Secretary of the Navy for Research, Development and Acquisition; Lieutenant General Mark Wise, Deputy Commandant of the Marine Corps for Aviation; Rear Admiral Andrew Loiselle, Director of Navy's Air Warfare Division; Dr. Raymond O'Toole, Jr., Acting Director of Operational Test and Evaluation for Department of Defense; Mr. Joseph Nogueira, Acting Director of Cost Assessment and Program Evaluation for the Department of Defense; Lieutenant General Eric Fick, F–35 Program Executive Officer; and Mr. Jon Ludwigson, Director of Contracting and National Support—Security Acquisition for the GAO, the Government Accounting Office.

With that, we would ask each of our witnesses to try to adhere to the 3-minute opening remark. And we will go right down the order as I just introduced you, starting with Ms. Darlene Costello.

STATEMENT OF DARLENE COSTELLO, ACTING ASSISTANT SECRETARY OF THE AIR FORCE FOR ACQUISITION, TECHNOLOGY AND LOGISTICS

Ms. COSTELLO. Good afternoon. Chairman Norcross, Ranking Member Hartzler, and distinguished members of the subcommittee, thank you for having us here today to provide testimony of the Department of the Air Force's fiscal year 2022 budget request for fixed-wing tactical and training aircraft programs.

Additionally, I want to thank you for your continued leadership and dedication to the United States military and Department of the Air Force.

Air superiority is essential for military operations and protection of joint forces, and it has been our asymmetric advantage for more than 70 years. To keep pace with emerging threats, we must refresh our fighter fleet with a mix of fourth-generation and fifth-generation aircraft as well as selectively modernizing our existing aircraft to ensure the right capacity and capability to fully implement the National Defense Strategy.

In the fiscal year 2022 budget request, the Air Force TACAIR [tactical aircraft] portfolio of approximately $12.2 billion includes procurement of 48 F–35s, 12 F–15EXs, key modifications to both our F–22 and fourth-generation fleets, and investment in technologies for our next-generation air dominance efforts.

In addition, we have requested $2.7 billion to not only continue procurement of some of our key munitions, but also to invest in munition technologies to counter future peer threats in highly contested environments.

The F–35A will be the cornerstone of the Air Force fighter fleet for decades. We are fully committed to the F–35 and its fifth-generation capabilities. While sustainment costs have come down, they are still not where we need them to be. We are evaluating opportunities to further reduce the cost of material and manpower and will continue to work with the Joint Program Office and industry to address affordability.

The A–10 remains an effective close air support platform for the current fight, rewinging the A–10's most significant modernization effort, and we have purchased wings to outfit a fleet of 218 aircraft. In fiscal year 2022, we will continue executing fiscal year 2021 funding to begin installs and support engineering change orders and other government costs that are typically required to execute major modification efforts.

Our investment in next-generation air dominance technologies is critical to ensuring air dominance within the emerging threat environment for future joint operations. In this program, we are incorporating agile and digital acquisition practices that are yielding favorable results and providing greater value for the taxpayer.

In terms of propulsion, in the extensive prototype ground testing, we continue to demonstrate and validate the benefits of adaptive engines. These include increases in fuel efficiency, thrust, thermal management capacity, all of which can translate to the warfighter as increased range, more air time, and aircraft capability.

Again, thank you for your leadership and support of the Department of the Air Force. Lieutenant General Nahom and I look forward to answering any questions you may have for us.

Thank you.

[The joint prepared statement of Ms. Costello and General Nahom can be found in the Appendix on page 48.]

Mr. NORCROSS. Thank you.

Lieutenant General.

STATEMENT OF LT GEN DAVID S. NAHOM, USAF, DEPUTY CHIEF OF STAFF FOR PLANS AND PROGRAMS, UNITED STATES AIR FORCE

General NAHOM. Chairman Norcross, Ranking Member Hartzler, and distinguished members of this subcommittee, thank you for having us here today to provide testimony on our fiscal year 2022 budget request for the Department of Defense for fixed-wing tactical and training programs.

Additionally, thank you for your continued leadership and dedication to the United States military and the Department of the Air Force's 689,000 total force airmen serving around the world today.

As you know, our Nation faces a complex set of current and future security challenges that require we think and act differently and with urgency. Our citizens face threats from a variety of actors in physical and digital arenas, and our competitors continue aggressive efforts to negate our longstanding warfighting advantages.

As we continue to work with each of you, it is becoming apparent that our collective understanding of the threat is increasing, and we are waking up to this challenge. Together, under this committee's oversight and leadership, along with our industry partners, and innovative airmen, we remain a preeminent power projection force in the world today.

In light of this, I would like to briefly outline some core elements in our tactical and training portfolio that we regard as of specific interest to you.

Extensive wargaming and analysis make it clear that we must reassess our future fighter force mix and adjust investment priorities to provide the capability and capacity and affordability required to meet the peer threat. Modernization programs cannot transform our fourth-generation fighters into fifth-generation or fifth-generation fighters into the next-generation air dominance.

In concert with the Office of Secretary of Defense, the Air Force is in the final stages of a comprehensive tactical air study that will help inform our decision to build the correct mix of capability and quantity that our Nation needs to win against near-peer competitors. We have recently reviewed some of the preliminary findings from these studies, and we will gladly share the results once we have finished our final analysis.

Regarding the F–35, it is a cornerstone of a future fighter fleet, but it is still—is still complementary to other capabilities required for a winged force mix. While the F–35 today is a formidable platform, it faces challenges to ensure it stays dominant against an evolving future threat.

To keep pace with the threat in future contested scenarios, follow-on modernization efforts centered on Block 4 enabled by Tech Refresh 3 hardware must be affordably realized on competition-relevant timelines.

The F–35 operating costs, as currently projected, and long-term sustainment costs are areas of concern and need to be continued—need continued focus to work to address affordability.

For the remainder of our fighter force, the Air Force is building complementary capabilities with the F–15EX, adding next-generation air dominance. The F–15EX will provide a role in critical infrastructure defense and the ability to employ outsized weapons. NGAD, or next-generation air dominance, which benefits from full digital engineering and production, is a revolutionary leap forward in capability that will help us ensure air superiority for the joint force in any future scenario.

I am honored to serve on the same team as Ms. Costello, and we look forward to answering all your questions regarding our tactical and training aircraft programs.

Mr. NORCROSS. [Inaudible] you are recognized.

STATEMENT OF FREDERICK J. STEFANY, ACTING ASSISTANT SECRETARY OF THE NAVY FOR RESEARCH, DEVELOPMENT AND ACQUISITION

Mr. STEFANY. Oh, thank you, sir.

Chairman Norcross, Ranking Member Hartzler, distinguished members of the subcommittee, thank you for the opportunity to appear before you today to discuss the Department of Navy's tactical aviation programs.

Sustaining our naval TACAIR superiority is critical to engaging in competition now and winning the high-end fight if necessary. We thank Congress and this committee for your support over these programs.

Department of Navy is committed to investing in the aviation and strike weapon programs we need to support our national security priorities. In fiscal year 2021, we will deliver 54 new manned aircraft and 4 unmanned aircraft to Navy and Marine Corps units. These aircraft will improve our aviation capabilities to address the pacing threat.

To fulfill our Nation's commitment now and our strategic investments in the future, the fiscal year 2022 budget request includes funding to procure 48 new fixed-wing aircraft. Most of these aircraft are fifth-generation Joint Strike Fighters, including 20 F–35C carrier variants and 17 F–35B short takeoff and vertical landing variants. The budget request also maintains consistent aviation depot funding and increased flying hours funding, both of which will improve our aviation readiness.

To address a couple items in your invitation letter, during the fiscal year 2022 budget development process, the Navy identified an opportunity to drive efficiencies into our operational test squadrons. The Department will maintain full operational test capability of F–35, F/A–18E through Gs, and other high-end systems, including our Next Generation Jammers and IRST [Infrared Search and Track].

However, with aviation capitalization nearing completion, in fiscal year 2022, we will execute some manning reassignments from our operational test squadrons while maintaining the rigor and sufficiency required to—for effective weapons system operational tests

through the combined use of developmental testing and fleet squadron assets.

As the service—as the current service acquisition executive for the Joint Strike Fighter program, I am working closely with all three U.S. services, the Office of Secretary of Defense, Joint Strike Fighter Program Office, and our industry partners, to continue reducing the program's costs and ensuring timely warfighting capability upgrades, all while implementing a sustainment strategy that meets the fleet's needs. That starts with having predictable schedules and realistic cost estimates for all development and sustainment efforts, and that has been my focus this year.

For example, after much discovery and cost [inaudible] last year, the tech refresh development effort has been on budget for the last two quarters and is tracking to meet the required Lot 15 cut-in of that capability.

We are also working closely with our industry and the Joint Strike Fighter organic engine heavy maintenance facility at Tinker Air Force Base on the depot repair recovery efforts. These efforts focus on increasing power module throughput by reducing the technical assistance timelines; standing up a second shift at the depot; accelerating the planned stand-up of additional enterprise depot capacity at various locations, such as FRC [Fleet Readiness Center] Southeast; and increasing engine time on wing through module and mini module sparing.

Overall, this budget represents the deliberate and informed development of a modernized—sorry—modernized, integrated, all-domain naval force for the future fight to meet an uncertain and complex security environment.

Thank you once again for the opportunity to appear before your subcommittee today, and we all look forward to your questions.

[The joint prepared statement of Mr. Stefany, General Wise, and Admiral Loiselle can be found in the Appendix on page 73.]

Mr. NORCROSS. Thank you.

Lieutenant General Mark Wise, you are now recognized.

STATEMENT OF LTGEN MARK R. WISE, USMC, DEPUTY COMMANDANT FOR AVIATION, UNITED STATES MARINE CORPS

General WISE. Yes, sir.

Chairman Norcross, Ranking Member Hartzler, and distinguished members of the subcommittee, thank you for the opportunity to appear before you and discuss the Marine Corps plan for tactical aviation.

First, I will address our existing TACAIR capabilities. The F/A–18 Hornet and the AV–8B Harrier have served us well and are now the Marine Corps bridging platforms for our transition to fifth-generation fighter aircraft. They have benefited from continuous readiness and sustainment investments we initiated in fiscal year 2017. Both platforms are capable and ready but require continuous modernization to maintain lethality, survivability, and fifth-generation interoperability.

Programs to extend the service life of the Hornet, such as the high flight hour and center barrel replacement efforts, have extended the service life up to 10,000 hours. The aircraft will operate until fiscal year 2030.

The AV–8B effort, called reclamation in lieu of production, provides F402 engines to account for planned attrition through the Harrier sundown at the end of fiscal year 2027.

Next, as we address our peer and near-peer competitors in today's great power competition, we continue to broaden and deepen our understanding and experience with the F–35 Lightning II.

The F–35C will integrate and deploy for all Marine Corps global force commitments, to include carrier air wings as part of TACAIR integration with the Navy. The F–35B, which can land vertically, will deploy with Marine expeditionary units and elsewhere.

As we continue our transition to F–35, we have two fleet replacement training squadrons, six operational line squadrons, and have provided aircraft to one operational test squadron.

Operationally, the Marine Corps F–35Bs are deployed currently with the 31st Marine Expeditionary Unit in the INDOPACOM [U.S. Indo-Pacific Command] area of responsibility. Additionally, 10 F–35Bs are deployed aboard Her Majesty's Ship *Queen Elizabeth* as part of the Carrier Strike Group 21 joint deployment of the United Kingdom, United States, and the Netherlands.

With respect to force posture related to our Commandant's Force Design 2030, the Marine Corps contracted with Johns Hopkins University in 2020 to study our TACAIR transition plan and force posture. Completed this spring, this study, along with ongoing wargaming and experimentation, will help determine the appropriate number and size of Marine Corps F–35 squadrons in support of force design priorities. Currently, the F–35 program of record remains at 420 total aircraft, 353 Bs and 67 Cs.

As we look to the future, continued investment in the survivability and lethality of the Lightning II and of its current and future suite of weapons will ensure we are able to counter and defeat our peer adversaries and others if asked to do so. Marine Corps tactical aviation is ready, it is lethal, and it is fully integrated into operations with our partners of the United States Navy, the joint force, and is interoperable with our international partners.

Enabled through continued congressional support, the Navy-Marine Corps team is deployed forward and postured to address threats around the clock and around the world.

I look forward to your questions.

Mr. NORCROSS. Thank you.

Rear Admiral Loiselle, you are now recognized.

STATEMENT OF RADM ANDREW LOISELLE, USN, DIRECTOR, AIR WARFARE DIVISION (OPNAV/N98), UNITED STATES NAVY

Admiral LOISELLE. Chairman Norcross, Ranking Member Hartzler, and distinguished members of the subcommittee, thank you for the opportunity to appear today and discuss the Department of the Navy's tactical aviation programs.

TACAIR's striking power within our carrier air wing, delivered from the 11 most survivable airfields in the world, the nuclear aircraft carrier, is vital to controlling the seas and providing long-range fires necessary to win the high-end fight. As we modernize the carrier air wing to pace the threat, we continue to balance the correct mix of fourth- and fifth-generation fighter aircraft.

Today, the Navy is managing F/A–18 inventory requirements through service life modification, SLM, and previously authorized procurement, and F–35C requirements through continued procurement. This month marks the maiden deployment of the Navy's first F–35C squadron, VFA–147, embarked in USS *Carl Vinson* with Carrier Air Wing Two.

The F–35C transition plan is predicated on the stable procurement profile and on-time delivery. The Navy is committed to Tech Refresh 3 and Block 4 upgrades for all aircraft in the Navy's inventory in order to reduce long-term sustainment costs associated with maintaining both TR–2 and TR–3 configurations.

The Navy will continue to learn and better quantify costs, mission capable rates, and operations of the F–35C as we conduct our first deployment and continue transitioning to our fourth- and fifth-generation mix.

Our operational test squadrons will continue to provide critical test support to ensure all fixed-wing aircraft are poised and ready for high-end requirements. Delivering these transformational capabilities to frontline forces as soon as possible remains our top priority.

The President's budget 2022 continues the positive trend in arresting our strike fighter shortfall. F/A–18 SLM, combined with changes to the master air plan, changes to the Navy adversary roadmap, and returning 28 Super Hornets from long-term down status has allowed our strike fighter shortfall to be eliminated by 2025, according to current annual analysis.

Strike fighter shortfall will be controlled in future years with the 78 new production F/A–18s that will continue to come off the line through 2025 and varying the SLM induction rate as required. Our focus on increased aircraft availability with a commitment to appropriate mission capable rates allows us to manage the correct footprint of tactical aircraft across the naval aviation enterprise.

We are laying the groundwork for the highly networked air wing of the future with the next-generation air dominance family of systems that leverages manned/unmanned teaming and will deliver overwhelming firepower in contested spaces in the years ahead. We are prioritizing funding to accelerate development of the sixth-generation capability and other key aviation wholeness investments to ensure the carrier air wing will maintain dominant strike fighter capability and capacity to pace the most stressing threat through the 2030s and beyond.

We are developing methods to achieve the required training and readiness, utilizing tactical surrogates, live virtual constructive range integration to improve training fidelity at a reduced cost.

As the naval aviation enterprise manages fiscal constraints, we thank Congress and this subcommittee for your continued support of important aviation priorities, including flight hour funding, critical aircraft upgrades, and investment in future capabilities.

I look forward to your questions.

Mr. NORCROSS. Thank you.

Dr. O'Toole, you are now recognized.

STATEMENT OF DR. RAYMOND D. O'TOOLE, JR., ACTING DIRECTOR, OPERATIONAL TEST AND EVALUATION, OFFICE OF THE SECRETARY OF DEFENSE

Dr. O'TOOLE. Chairman Norcross, Ranking Member Hartzler, and distinguished members of the committee, thank you very much for the opportunity to testify today.

I have submitted a formal statement for the record and would like to offer just a few introductory comments.

While a majority of the F–35 initial operational tests and evaluation, including open-air testing, is complete, one essential element of the T&E [test and evaluation] program remains: trials in the Joint Simulation Environment, or JSE for short.

The JSE is the only means, other than actual combat against a peer adversary, to assess the F–35 against the threat types, density, and operational scenarios we expect it to face. DOT&E [Director, Operational Test and Evaluation] therefore cannot issue its IOT&E [initial operational test and evaluation] report without the data the JSE would gather from executing the planned 64 trials.

I cannot yet comment on the F–35's operational effectiveness, though I can provide, in a closed session, the results of the F–35/A–10 comparative testing. Suitability metrics showed signs of slow improvement over time, but in many areas, still falls short of required thresholds. I cannot address F–35's survivability in an open forum.

F–35 Block 4 program already is underway. The current development process, known as Continuous Capability Development and Delivery, or C2D2, is supposed to deliver a new tested and verified increment of software every 6 months. However, each increment has been flawed, more flawed than expected.

Further, software changes intended to add new capabilities or fix deficiencies have instead introduced stability problems that adversely affected certain existing F–35 functionality. I am cautiously hopeful that the program office's decision to move to a 12-month software cycle will mitigate some of these issues, but I remain concerned about the ability to conduct adequate operational T&E of Block 4.

More broadly, DOD's T&E enterprise is now at a crossroads. DOD's mission success and our national security reflect a quality of the operational tests and evaluation we perform. A large number of new and complex technologies are in the development and acquisition pipeline, and our adversaries continue to advance their capabilities.

To be able to properly test the systems we intend to buy against the threats we expect to face, DOD must invest today in creating a robust T&E infrastructure with both live and synthetic environments equipped with cutting-edge tools and staffed by people with deep expertise. Simply put, we cannot determine a system's combat credibility, nor thoroughly prepare our warfighters, if our test and training capabilities are not kept up to date.

DOT&E appreciates the committee's continued emphasis on the value of T&E and allocation of the resources necessary to deliver combat-credible systems.

Again, I appreciate the opportunity to be part of this panel today. As always, I would be happy to meet with any of you or your staff for a more detailed discussion.

I look forward to your questions.

[The prepared statement of Dr. O'Toole can be found in the Appendix on page 91.]

Mr. NORCROSS. Thank you.

Mr. Nogueira, you are now recognized.

STATEMENT OF JOSEPH NOGUEIRA, ACTING DIRECTOR, COST ASSESSMENT AND PROGRAM EVALUATION, OFFICE OF THE SECRETARY OF DEFENSE

Mr. NOGUEIRA. Thank you.

Chairman Norcross, Ranking Member Hartzler, distinguished members of the subcommittee, thank you for the opportunity to discuss the Department of Defense's collaborative effort to develop, acquire, and operate an appropriate mix of tactical aircraft. These efforts prioritize China as the pacing challenge while addressing threats emanating from Russia, Iran, and North Korea.

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.

In the interest of time, I would like to succinctly address your three questions to CAPE [Cost Assessment and Program Evaluation].

First, in support of the fiscal year 2022 budget request, CAPE conducted several analytic efforts assessing the capability, capacity, and readiness of the Department's tactical aircraft. Several of these studies were directed by Congress, to include the 2020 independent cost estimate for the F–35 program, and the 2021 assessment of F/A–18E/F service life modifications. To support major defense acquisition program milestones, CAPE generated independent cost estimates for the F–15 Eagle Passive/Active Warning and Survivability System program, and the Next Generation Jammer low and mid-band programs. In addition, CAPE oversaw the joint TACAIR Synthetic Training Analysis of Alternatives and both the Air Force and Navy Next-Generation Air Dominance Analysis of Alternatives.

CAPE also conducted other internal analyses directed by Department leadership to investigate TACAIR survivability, lethality, overall affordability, and novel concepts of operation to support combatant commander needs. Taken together, this work provided critical decision support to the Secretary and Deputy Secretary in making final decisions in this portfolio.

Second, as part of the fiscal year 2021 National Defense Authorization Act, Congress tasked CAPE to complete analyses on the service acquisition strategies for sixth-generation aircraft, as well as a nonadvocate review of the Air Force Digital Century Series business case. Both studies are currently underway, and CAPE is engaged in detailed discussions with the program offices, contractors, and other stakeholders to gain the necessary data and insight to inform the Department's evolving acquisition approach and satisfy congressional reporting requirements. The Digital Century Series business case review should be complete in August, and I expect to send it to you shortly thereafter.

Third, there are a number of separate but closely related analytical efforts underway across the Department to determine the appropriate balance of sixth-, fifth-, and fourth-generation capabilities. CAPE is leading analysis focused on TACAIR affordability and the key tradeoffs between capability and capacity.

The Joint Staff, in coordination with the combatant commands, is leading the Department's thinking on how TACAIR should be employed in a future conflict. Finally, the Air Force and Navy are conducting TACAIR studies focused on assessing both near- and long-term requirements. The results of these efforts will inform the National Defense Strategy and decisions to be captured in the President's fiscal year 2023 budget submission and associated Future Years Defense Program.

Thank you again for this opportunity, and I look forward to your questions today and a continuing dialogue about TACAIR investments.

[The prepared statement of Mr. Nogueira can be found in the Appendix on page 99.]

Mr. NORCROSS. Thank you.

Lieutenant General Fick, you are now recognized.

STATEMENT OF LT GEN ERIC FICK, USAF, PROGRAM EXECUTIVE OFFICER, F–35 JOINT PROGRAM OFFICE

General FICK. Thank you very much.

Chairman Norcross, Ranking Member Hartzler, and distinguished members of the subcommittee, thank you for this opportunity to discuss the F–35 Lightning II program and for allowing me to address how the F–35 is bringing its exceptional capabilities to the services' tactical aviation portfolios.

This program continues its dedicated focus on capability, affordability, and availability, and we will continue to work with the services to ensure we meet their warfighting requirements at a price our taxpayers can afford.

Since appearing before this committee in April, F–35s have continued to deploy and operate worldwide in support of the United States and our international teammates. In addition to the INDOPACOM embarkation mentioned by Lieutenant General Wise, a U.S. Marine Corps F–35B squadron is deployed today with our U.K. [United Kingdom] allies aboard the HMS *Queen Elizabeth,* showcasing the value of the F–35 partnership as well as the capability and interoperability of this amazing air system. At the same time, the USS *Carl Vinson* has embarked on the Navy's first operational deployment with the F–35C. These deployments complement those previously conducted by the U.S. Air Force and the home station and deployed combat operations of our warfighting customers around the world.

In these environments, around the world and around the clock, the F–35 continues to deliver war-winning combat capabilities. More powerful than the hardware itself, however, these combined operations telegraph impactful messages of partnership and teaming to our adversaries around the globe.

In our tireless pursuit of affordability, I am pleased to announce that late last month, the program reached a handshake agreement with Lockheed Martin on a [fiscal year] 21–23 air vehicle sustain-

ment contract that emphasizes improved aircraft full mission capable rates and continues cost reductions for all our services, partners, and customers.

Over the last 90 days, our TR–3 and Block 4 progress has stabilized. And while we are not out of the woods yet, I am encouraged by the team's improved performance in capability, development, and delivery.

I am similarly pleased with the progress the team is making on our F–35 logistics systems, including the progress we are making fielding upgraded ODIN [Operational Data Integrated Network] hardware and planning for the new ODIN data environment and software.

Finally, I will share that on 2 June 2021, we completed our final open-air initial operational test and evaluation trial. And thanks to the independent assessment of the Joint Simulation Environment and the successful execution of our May full-mission threat event, I am increasingly confident we will be able to continue and complete development of the JSE in order to execute the final 64 runs of IOT&E.

We will update the Defense Acquisition Executive on our projected timeline in August, which will inform our acquisition program baseline and the timing for milestone C and our full-rate production decision.

The F–35 continues delivering incredible capability to our warfighters today. The operational value of this air system will only improve as we continue to drive cost out of the program, expand our global sustainment enterprise, and deliver future increments of capability that will outpace our enemies and serve as the foundation of the multidomain integrated warfighting concepts and development now across the Department.

Thank you for your time today. I look forward to your questions.

[The prepared statement of General Fick can be found in the Appendix on page 104.]

Mr. NORCROSS. Thank you.

Mr. Ludwigson, you are now recognized.

STATEMENT OF JON LUDWIGSON, DIRECTOR, CONTRACTING AND NATIONAL SECURITY ACQUISITIONS, GOVERNMENT ACCOUNTABILITY OFFICE

Mr. LUDWIGSON. Chairman Norcross, Ranking Member Hartzler, and members of the subcommittee, thank you for the opportunity to discuss GAO's F–35 acquisition work.

The F–35 remains DOD's most expensive acquisition, intended to provide decades of air power superiority, replacing a large portion of our tactical fleet, and serving critical roles in the fleets of our allies.

GAO has examined the F–35 since inception. The program has not always followed [inaudible] acquisition leading practices. It has moved ahead despite recurring challenges. Our earlier reports raised concerns about technology maturity, high levels of concurrency, unrealistic cost and schedule estimates, and the prospect of deferred capabilities.

Much has been done at great cost to turn the idea of the F–35 into an operational aircraft. The baseline development program is nearly complete, but as I will discuss, key challenges remain.

With regard to the baseline program, a few recent findings included, despite 13 years building the plane, many manufacturing processes were not meeting metrics for production consistency. Recurring supply chain challenges, including late deliveries and shortages, were compounded by the need to replace Turkish suppliers of over a thousand parts. Several reliability and maintainability metrics were still not being met. While many deficiencies were closed, those still open remain high, 864 deficiencies, including 8 critical. And, finally, the program has again not completed the simulator, which, in turn, has delayed the full-rate production decision.

Our recent Block 4 modernization findings are similar to earlier baseline program findings. In 2018, we reported that the Block 4 effort began without a business case, technology readiness assessment, cost and schedule estimate, test and evaluation plan, and an improved acquisition strategy. Last year, we found that the Block 4 cost estimate previously provided to Congress did not reflect all development costs.

And, finally, this year, we reported that some Block 4 capabilities had been deferred; the schedule was not realistic given the recent development pace; and the contractor had not followed its own software development process, leading to late discovery of defects.

Over the years, we have made many recommendations. For example, we recommended that prior to moving into full-rate production, the program should resolve all critical deficiencies, meet all R&M [reliability and maintainability] metrics, or formally reassess those metrics, and provide Congress information on production risks remaining with plans to mitigate them, including those in the supply chain and the production processes.

Clearly, the F–35 has followed its own path and has already built a high percentage of aircraft under low-rate initial production. However, we maintain that the full-rate production decision is a critical point for weapons system development.

The myriad challenges with the F–35 confound U.S. efforts to modernize its tactical fleet in order to face near-peer adversaries and modern threats. Delays and high cost of the F–35 could impact the size and composition of the tactical fleet. Nonetheless, the challenges remaining with testing, production, supply chain, and the Block 4 effort, along with sustainment and affordability issues, raise questions about how many aircraft can realistically be produced on time in the near term, while supporting fielded aircraft, and heighten the need for continued congressional oversight.

Chairman Norcross, Ranking Member Hartzler, this concludes my statement. I would be happy to answer any questions the subcommittee members may have.

[The prepared statement of Mr. Ludwigson can be found in the Appendix on page 123.]

Mr. NORCROSS. I would like to thank all of the witnesses for their statement, and we will now transition to some questions. Certainly a huge portfolio in front of us today, but I would like to start out

with following up on some of the statements that a few of the witnesses talked about.

So let's start out with General Nahom and Mr. Nogueira.

The Air Force, Joint Staff have currently undertaken those studies that each of you have mentioned, but I want to dig down a little bit more. Can you provide us with—you talked about the status—but the scope and the timing that we can expect that full report, but more importantly for today and the discussion, some of the early insights and findings and possible recommendations, understanding that the full report isn't finished?

Also, were the Marines and the Navy involved in any of these studies?

Let's start with you, General Nahom.

General NAHOM. Thank you, Chairman Norcross, for the question. And I will—for the broader DOD studies, I will defer over to Joe Nogueira for clarification there. I will try to keep my remarks specific to the Air Force's service study.

It really looks at our fighter fleet where we sit right now. You know, with seven distinct fighter fleets we sit on right now, we have a fleet average this year approaching 30 years old. We have—we have some problems with our fighter fleets, and we are trying to arrest that and actually modernize the fleet, as well as make it more lethal and make it match up to the threat that is here today and the threat that is coming with near-peer competition. And you have heard the chief talk about seven to four-plus-one, and that is certainly part of our TACAIR study.

For the timing, our TACAIR study, we are just finishing it up now. I have seen some preliminary results on it. We are doing some final analysis. We are hoping to have that available for conversation by the end of the summer, and right now, we are just working through the final approvals on that too.

You are hearing the chief——

Mr. NORCROSS. Is there something you can share with us at this point?

General NAHOM. Well, see, I would say the big thing is a seven of four—seven to four-plus-one, which really gets at what is our fighter fleet going to look like in 10 to 15 years. And we see four fighter fleets, one at the very high end, the next-gen air dominance.

The next is the F–35, as we have talked about for a long time, as a cornerstone of our fighter fleet, that fighter that can do things that our F–16s and A–10s do today but do those things in contested environments.

And then we think there is a place for the F–15EX and—excuse me—carrying those outsized weapons as well as its ability to do critical infrastructure defense.

And then—and then the fourth. Very important, the Air Force is tasked with a lot of capacity missions around the world. I call—I call it affordable capacity, that sitting in Afghanistan for a long time, which no longer there, but where is that next location? The homeland defense CAPs [combat air patrols], all the things that we don't need F–35s and F–22s doing but we as an Air Force must do.

The F–16 does it very cheap and does it very well. What does that look like in the future? Right now, the good thing is we have F–16 post block, the newer F–16s out for the next 15 to 18 years,

and we are going to take advantage of those. Those may someday get replaced by F–35s. We don't know that yet, but we do know we need that affordable capacity.

And the last is the plus one. We have A–10s. We would like to go down to a fleet of seven operational squadrons, 218 airplanes. We have them for the next period of time that we can use for those lower-end missions. So that is that plus one.

So that is a big broad stroke of where you are going to see this TACAIR study going. It is going to drill down with a lot of analysis on how this looks, sir.

Mr. NORCROSS. Well, thank you. Very good at covering the end story, and I look forward to that.

Mr. Nogueira, can you share some of your insights on what we have so far and where we might be going?

Mr. NOGUEIRA. Yes, sir. Thank you, Mr. Chairman. Right now, we are really setting up the analysis, working closely with the Joint Staff as well. Our work is really—we are taking a look at a variety of strategic and operational concepts trying to set up the models themselves so we can do a number of different analytic looks to support the National Defense Strategy review that is underway right now.

So we have aimed our work to come to fruition towards the middle of the fall to support program budget review decisions by the Secretary and the Deputy Secretary. That is in line with what the Joint Staff's TACAIR mix. So these are sort of very compatible and complementary studies, if you will, that we will bring these together, as I said, towards I think the September-October timeframe, sir.

Mr. NORCROSS. So to the degree you can have that conversation in an open forum, obviously when F–35 started 20-plus years ago to the point that we—it becomes fully capable, 25 to 30 years, certainly when the program began, some of the developments that our near-peer competitors are able to look at us with were not around.

The F–35 is a very capable aircraft and will continue to be used. But when we start to make these critical decisions moving forward, is there anything you can share with us at this meeting before a year from now that would help enlighten us to try to focus on that mix that we are talking about in our——

Mr. NOGUEIRA. Yes, sir. I think the evolving nature of the threat, which has been happening quite rapidly in the last 2 or 3 years—you might recall CAPE led a TACAIR mixed study that went to Congress in 2017. There has been a lot of change in the threat the last few years. And as we have watched that happen, we are starting to see the need even more so for the F–35 and its full Block 4 capabilities. That is critical to being able to execute the emerging operational concepts that we see coming out of all the services and emerging from the Joint Staff itself.

Because of those needs, we also see, in assessing the two analyses of alternatives that the Air Force and the Navy did on next-generation air dominance, we fully understand and expect that those kinds of requirements and technologies, not necessarily the platform itself, but think of the technologies writ large, and the weapons, which is critical that we actually have the weapons pro-

duce and arrive on time, that that is what we need for the 2030s, mid-2035 timeframe.

So the programs that are in the fiscal year 2022 request are exactly the kinds of things that we are starting to see early indications of in the analysis we have done. It is consistent with past analysis. But as we have seen the threat evolve rapidly, it is even more critical that we get those as we expect them to, and as you know, sir, that we have experienced some issues with that.

Mr. NORCROSS. And certainly in the timeframe we need it.

Mr. NOGUEIRA. Yes, sir.

Mr. NORCROSS. I will get another round after we go through, but first let me turn it over to my ranking member, Mrs. Hartzler.

Vicky.

Mrs. HARTZLER. Hi. We will try here. I have switched to my phone, so hopefully—can you hear me now pretty good? All right. Very good.

Mr. NORCROSS. Good.

Mrs. HARTZLER. So last year, the Navy briefed the committee that it predicted a strike fighter shortfall of 49 aircraft in fiscal year 2021 and a shortfall of 12 aircraft in fiscal year 2024. Furthermore, the Navy was not forecast to achieve its strike fighter aircraft inventory goal until 2030. But now, for fiscal year 2022 planning, the Navy asserts that the strike fighter inventory shortfall will be resolved to zero in fiscal year 2025, which is 5 years earlier than planned.

Absent a revised FYDP [Future Years Defense Program] or additional explanation, the committee is uncertain of the accuracy of the Navy's new analysis. Since the fiscal year 2021 budget submission, the Navy has delayed the fielding of its planned F/A–XX aircraft over what was planned last year; two, removed 104 F/A–18E/F Block II aircraft from the planned service life modification, or SLM program; and, three, failed to raise the F–35C procurement quantity to the 24 aircraft per year that the Navy has previously testified was necessary to bring down the strike fighter shortfall over the next decade.

It seems that these factors would exacerbate the shortfall rather than expedite the resolution of the shortfall prior to fiscal year 2030.

So, Mr. Stefany, specifically the budget request for the Navy did not request any funding for continued procurement of F/A–18E/F Super Hornet aircraft, an aircraft the Navy calls its workhorse. And it decreased the procurement numbers for F–35C from the fiscal year 2021 projected 20 aircraft to only 15 aircraft.

Noting that the next-generation air dominance program has just begun defining aircraft requirements and development concepts, how does the Navy plan to manage tactical aircraft inventory risk and reduce the current strike fighter inventory shortfall absent continued procurement of the F/A–18E/F Super Hornet aircraft and increased procurement of F–35C above plans?

Mr. STEFANY. Yes, ma'am. Thank you for that question. So, first of all, the F/A–18, a very good aircraft. We really support that aircraft as well as the F–35. But a number of things have changed in the last year as far as the use—the ability of us to meet that

shortfall. And while the points you brought up are very accurate, we also have a different mix of aircraft in the fleet going forward.

And I would really like to turn it over to Admiral Loiselle, because he actually has the detail. We will come over without the FYDP—we need to come over and actually brief you, ma'am, all the way through the process so you can see it all the way through.

But at the top level, Admiral, would you kind of go through the things that have changed in the last year?

Admiral LOISELLE. Absolutely, sir.

So, ma'am, we have made several changes to the map, so we have taken the F–35C portion of our 44 strike fighters and reduced that from two squadrons of F–35s down to a single squadron, but then increased the number of tails in that squadron from 10 to 4. So we had adversary requirements for our fleet out at Fallon and in our Reserve squadrons. And so in our previous plan, those were F/A–18s. And now, in Fallon, we have taken some F–16s from the Air Force and Air National Guard to relieve that requirement, and we bought F–5s from Switzerland to relieve another squadron's work of Reserve F/A–18 requirements.

And our NAMCE [Naval Aviation Maintenance Center for Excellence] population of professional maintainers have been able to return 28 Super Hornets from long-term down status and put those back in the fleet.

So we believe that the combination of those improvements has reduced our strike fighter shortfall to zero by 2025 based on current year analysis. This is an analysis that we repeat on an annual basis and based on current budget projections.

We believe that the SLM lines—we have two lines operating—will have the additional capacity during the—at the 2025 period in question to take additional SLM tails. Should our current analysis be revised and we require that additional capacity, we believe the infrastructure will support additional modification to the Block III status.

Mrs. HARTZLER. So, unfortunately, there was a little bit of a delay, and I wasn't able to quite hear all of that answer. But regarding the SLM lines, these aircraft are coming in with a lot more salt damage than originally thought and it is going to take longer to be able to produce them.

So how are you able to say that you think we are going to get additional aircraft through SLM with the condition of these aircraft?

Admiral LOISELLE. Yes, ma'am. Take that, sir? Okay.

So all of our Block II aircraft that we are planning for SLM, we intended for our first 30 aircraft—and we are about halfway through that now—to be a learning platform. So agree 100 percent that there was damage beyond expectation from a corrosion perspective on some of the initial aircraft. However, Boeing is seeing significantly improved condition in the aircraft that we are now submitting for SLM.

So with the number of Block II Super Hornets in our current inventory, compared to the number of Block II Super Hornets that we intend to conduct SLM on, that allows us some selectivity in those tails that we put through the modification line. And so we are learning in this process and we are now conducting inspections

prior to induction that are looking at these hard areas, to identify whether or not the corrosion that is present in those aircraft justifies inclusion in our SLM process, or whether or not we might look at a different aircraft to conduct that on.

But right now we are continuing to learn and we are continuing to bring down the time associated with getting an aircraft through the SLM process. And we anticipate that by the 2025 timeframe, we should be in full swing on two lines at 1 year per SLM aircraft at that point in time in 2023 and after, coming off the line and a full 10,000-hour modification in full Block III configuration

Mrs. HARTZLER. So if there is a lot of corrosion, it sounds like you won't be bringing them in for the induction into the SLM program, but just by—I don't see how that is going to help, because if they are in such poor condition that they can't enter the program, won't that just further delay a very bad situation and make it even worse when you do bring it in?

Admiral LOISELLE. So, ma'am, those first aircraft that we are looking at are aircraft that are right up against their 6,000-hour service life. And so much of that corrosion is mitigatable at the Navy's level. And, so, to reduce costs, we are looking at employing our own artisans to go in there and conduct those repairs prior to bringing it to Boeing. And if it is anything that is structural in that nature, then we have our engineers that take a look at those particular corrosion spots and make determinations as to the repair level that is necessary for that particular aircraft to get it through its remaining service life.

Mrs. HARTZLER. Okay. You talked about adversary support in moving a lot of these new aircraft over to play the role of the adversary, but there is also the issue of the Navy Reserve's only remaining strike fighter squadron, the VFA–204, they are currently available for contingency deployment, and they routinely conduct carrier qualifications, which is not possible for F–16s. If I understand right, you are going to be giving them F–16s instead of the F–18s.

So Admiral Loiselle, is the Navy planning to walk away from that mission, the ability for VFA–204 to activate in a time of crisis?

Admiral LOISELLE. So, ma'am, the sole Reserve squadron that will retain F–18 capability is VFA–12 in Oceana. And so that decision was made in order to single-site the Super Hornet maintenance at either Oceana or Lemoore. And so, VFA–204 is planned to go to F–5s because they are the closest to our other VFA squadron down in Key West and they provide the predominant level of support to our FRS [Fleet Replacement Squadron] training squadrons out of both the New Orleans ranges and the Key West ranges.

The F–16s I mentioned are all going to be in Fallon where we are currently operating F–16s and we already have that maintenance support in place there. So we right now we will have a single Reserve squadron flying Super Hornets.

Mrs. HARTZLER. Okay. Very good. Well, I have some additional questions, but I will yield back and allow other members to go ahead and ask their questions.

Thank you.

Mr. NORCROSS. Thank you. So we have on deck Mr. Carbajal, Turner, Horsford, and Wittman to give you a little bit of indications coming up.

We now recognize Mr. Carbajal for 5 minutes.

Mr. CARBAJAL. Thank you, Chairman Norcross and Ranking Member Hartzler. And I appreciate the witnesses joining us today. When this subcommittee had a hearing on the F–35 in November 2019, I asked about the Department's effort to develop an intellectual property [IP] strategy, and the issue of DOD's inability to obtain IP and technical data across the entire F–35 supply chain. Then-Under Secretary Lord and General Fick said that the DOD was in the process of doing a fundamental rewrite of all acquisition policy.

General Fick, what steps has the JPO [Joint Program Office] and the Department taken since that hearing to address IP concerns in the F–35 supply chain and to develop the IP strategy?

General FICK. Thank you for the question. In the time that has elapsed since the fall of 2019, we have continued to work to ensure that we have the appropriate intellectual property and technical data required to execute the mission of the F–35 and of the F–35 enterprise to include the establishment and the stand-up of the component repair depots, each of which comes with the appropriate technical data to allow us to do so.

We have established an intellectual property strategy that we are actively executing with a number of underlying guiding principles that lead us to conduct cost-benefit analysis of whether we should challenge a technical data assertion or intellectual property assertion, or whether we should consider simply purchasing or securing the use of the intellectual property based upon our desired and required end state.

So, in short, it is not—we talked about this a little bit in April. It is not about going out and getting all of the data because getting all of the data, purchasing all of the data, or challenging Lockheed or Pratt to their ownership of the data would be counterproductive. We can't afford to buy all of that, but we need to go after the data that is required to allow us to do the things that we need to do.

One of the places that we talked about in April had to do with our intention of expanding the authorities of maintainers on the flight line. Back in the beginning of the program, a maintenance concept was developed, and as we have worked to move forward and execute changes to our maintenance philosophy, our maintenance strategy, we have had to secure technical data associated with the steps required to perform those kind of tasks.

We have, over time, and this is actually since 2014, so not just since 2019, but we have assessed 447 different maintenance data changes. We have approved 207 of them, and we have actually completed 105 of them and we anticipate the net savings associated with the stand-up of that increased organic maintenance capacity to save us about $1.9 billion over cost of the F–35 life cycle.

So what we are executing, in my mind, is a broad initiative targeted at getting the data we need to do the things we need to do, and not wasting time and money on things that are superfluous to that requirement.

Mr. CARBAJAL. Thank you, General. My second question, my colleague, Mr. Gallego, is unable to attend our subcommittee hearing today, so I am asking the following question on his behalf.

Lieutenant General Nahom, should Congress prohibit divestment of the A–10 fleet once again? I would like to make sure the Air Force has made plans to keep the full fleet sustained and modernized. Perhaps the most critical is the need to finish wing replacement across the fleet as aircraft that do not have new wings are rapidly approaching the hours limit on their original wings. Last year, the Air Force requested $100 million to purchase 24 wing sets, and Congress fully authorized and appropriated this funding while also prohibiting divestment.

So far, the Air Force has only placed orders for two wing sets with this funding counter to congressional intent. Will you commit that should Congress prohibit divestment of the A–10 fleet, once again, the Air Force will quickly move to place at least 22 more wing sets on contract?

And if Congress provides additional wing replacement funding, the Air Force will execute that expeditiously as well?

General NAHOM. Congressman, I will start out for the wing set and I am going to lean on Ms. Costello next to me, but thank you for the question.

The Air Force is not divesting—is divesting out of the A–10 mission. Our intention with this year's President's budget is to reduce our A–10s from 281 down to 218. That is nine operational squadrons of A–10s down to seven, and this is part of the transformation of our Air Force. The A–10 is a wonderful airplane. It has done incredible things for our Nation, but we have to start repurposing some of the resources on the A–10 into some modern capabilities, specifically manpower. If we don't reduce the A–10 slightly this year, we run into extreme problems——

Mr. NORCROSS. General, if I could, the gentleman's time expired. I gave 30 seconds extra. If we can, we will come back to that in next round. Obviously that was a fairly tough question to answer in 17 seconds. So if you could allow the witnesses enough time as you ask your questions.

With that, we will turn to Mr. Turner, you are now recognized.

Mr. TURNER. Thank you, Mr. Chairman. General Fick, engines for the F–35 represent a significant cost, both in operation, maintenance, and in production. And the GAO report that we had showed that there is significant concern about the effects of the current engines for the F–35 and its effect on production with the GAO report saying that less than 4 percent of the engines are delivered on time.

As we look to trying to lower the overall costs for operations and maintenance, engines certainly are an area where we could pick up both in lowering our overall maintenance costs, increasing our operational capabilities, and I was wondering what our current status is in looking at alternative engine configurations or future engine opportunities for the F–35 that can increase flight time, range, and lower overall operational costs.

General Fick.

General FICK. Sir, thank you for your question. First, relative to the 4 percent delivered on time metric, I don't challenge your data

in any way, shape, or form. I believe that that is actually correct, but I do know that we have not delivered an aircraft late due to a late engine delivery, to my knowledge, in my time on the program which dates back to 2017.

So while I will agree that there have been some late deliveries, by and large——

Mr. TURNER. It is in the GAO report cited in the——

General FICK. Thank you. I will note also that, despite the impact of COVID in 2020, Pratt did, in fact, deliver all of the engines that they had on contract plus one extra. So they actually did pretty good, but with that said, engine costs in sustainment are challenging. And as we rapidly approach the 2,000-hour, first scheduled engine removal, those—we will start to bear those costs in the sustainment of the air system, and we also know that we have begun to reach a flat or a flatter spot in the learning curve relative to the overall cost of production engines.

When I couple that with the notion that post the current Block 4 content, we will likely need increased power and increased thermal management capability from our propulsion system, I think the need to look for our options from a propulsion system perspective is present. I will tell you I was in—I went to GE [General Electric Aviation] in Evendale [OH] about 6 weeks ago. I toured the line. I saw the work they are doing on AETP [Adaptive Engine Transition Program] and candidly, I was impressed.

But there is a lot of work to be done before that becomes a production engine, before that becomes a reality for the F–35 program perhaps. But, sir, I will pledge to work with my Air Force, Navy, and Marine Corps services as we work to explore options and alternatives to addressing the F–35 propulsion issues moving forward.

Mr. TURNER. Great. Thank you.

General Nahom, as the Air Force looks to retire aircraft, certainly the C–130H is on the block. In Mansfield, Ohio, there is a Guard base, which they operate, that could be affected significantly as a result of the decreased number of planes; there will need to be transitions for that facility and other facilities across the country. Could you please give us some information as to what the current plans are or planning that is being undertaken [inaudible] to future [inaudible] for facilities that might be losing the C–130H?

General NAHOM. Congressman, thank you for the question. We have said we would like to—our stretch goal is to reduce the C–130 inventory from 300 down to 255. Those 45 C–130Hs would be approximately 5 units. We have also said we stand by that we will not reduce any units with that unless we can find a mutually agreeable replacement mission. So we are working very closely with units that have C–130s to see if there is something out there that we can agree on. We have done this recently with Maxwell, the Air Reserve unit there, transitioning them to the MH–139, our newest helicopter, and we are looking for other options. One of the opportunities out there is cyber, and we are actually looking for a unit that is interested in taking on a cyber wing because it is something we are going to need as we look at peer competition.

But, again, we are only going to look if we can find something mutually agreeable with the unit and the State.

Mr. TURNER. Great, well General, I know that there is a number of people that would be very interested in that. So I look forward to additional discussion as to how you are progressing.

General NAHOM. Yes, sir.

Mr. TURNER. Thank you.

Mr. Chairman, I yield back my time.

Mr. NORCROSS. Thank you.

Mr. Horsford, you are now recognized.

Mr. HORSFORD. Thank you, Mr. Chairman. And thank you also to our witnesses for your service and your testimony to date. I was very pleased that the Air Force recently selected Nellis Air Force Base, located in my district, as its fifth-generation center of excellence. This selection not only reinforces Nellis' critical role in Air Force modernization, but also means that a substantial number of new fifth-generation aircraft will soon be coming to Nellis.

Lieutenant Nahom, very briefly, can you speak to any potential impacts on F–35 and F–22 basing decisions if the Air Force is prevented from divesting the requested 42 A–10 aircraft?

General NAHOM. Yes, sir. Thanks for the question. That is, we are obviously working very closely to make sure we can reduce the A–10 ultimately over 2 years to 63. In the 2022 PB [President's budget], it is 42 aircraft. You correctly say that. And it is important to reduce those because it very much relates to Nellis Air Force Base and the fifth-gen center of excellence because part of the problem at Nellis over the last 10 years is we have continually poured stuff into Nellis, really without check. And now we have an overcrowding there, not only in the dormitories for the airmen, certainly in the airspace, certainly on the ramp. So pulling out some of the non-fifth-gen-related items at Nellis Air Force Base to make room for more F–35s is very important.

And one of the things we would like to pull out of there is the rescue capability. Not only the weapon school and the rescue test, but also the operational rescue, and pull that down to Davis-Monthan. What that does is that frees up space at Nellis for those fifth-gen assets that come in. The place they are going to go down at Davis-Monthan is where some of the A–10 footprint is down there right now. And, so, by reducing the A–10, it allows us to open up this room for that fifth-gen center of excellence as you discuss.

So if we do not reduce those A–10s, we are just going to have to go back and take further analysis and see what we can do. Right now it will be problematic, though, if we keep all the A–10s as are in the system right now.

Mr. HORSFORD. Thank you. I would like to move to a broader national security issue. In the past weeks, we have seen the Taliban make territorial gains at a pace that was unimaginable just a couple of months ago. It is increasingly clear that we will need to rely exclusively on our over-the-horizon intelligence assets, like the MQ–9 Reaper, to ensure that Afghanistan does not, again, become a safe haven for terrorist groups like al-Qaida. Last week, Secretary Austin said that while the effort to station ISR [intelligence, surveillance, and reconnaissance] assets in neighboring countries was still a work in progress, ISR missions were already being flown from countries in the Gulf.

General McKenzie told this committee last month that his number one unfunded priority for Central Command was additional funding for the MQ–9 program. He assessed that planned reductions to the MQ–9 fleet would endanger both deployed and re-deploying forces. This assessment was deeply concerning to me and other members, and I believe better reflects the reality on the ground as we complete our withdraw.

The risk assumptions surrounding MQ–9 procurement made by the Air Force when developing their budget request were based on a starkly different reality in Afghanistan, one in which the Taliban had not rapidly captured nearly one-third of Afghanistan's territory. The loss of control over broader regions is especially concerning to me, and I think it is a fair assumption that we will soon see a proliferation of anti-air assets in the country that could place many of our manned and unmanned aircraft at risk.

I was pleased to see that the House Appropriations Committee plans to include funding for 12 new MQ–9s in the 2020 appropriations bill, and I firmly believe that we should follow suit to ensure that the program meets the needs of our forces on the ground, and considers possible attrition of the aircraft.

Ms. Costello, can you give any specific reasons why this committee should not authorize the procurement of these 12 MQ–9s and what steps the Air Force has taken to reassess the risks of ending MQ–9 procurement given the rapidly deteriorating situation in Afghanistan?

Mr. NORCROSS. In 4 seconds, so if you could——

General NAHOM. We are not reducing the MQ–9 fleet. We have 300-plus airplanes that will give us MQ–9s out into the mid-2030s if we had the fleet we have right now. We are not reducing any airmen that fly or fix those airplanes. We are actually just reducing some of the combat lines which are very, very manpower intensive. The MQ–9 is very valuable, but also, it has very much limitations. It is not an asset we are going to be taking into the South China Sea or in any kind of contested environment. So we have to have a good balance of our assets across the Air Force.

Mr. NORCROSS. Thank you. The gentleman's time expired.

So on deck we have Mr. Wittman, Ms. Sherrill, Jackson, Kahele, DesJarlais, and Mr. Brown.

So with that, Mr. Wittman, you are now recognized. Is Mr. Wittman there?

Not hearing from Mr. Wittman, let's go to Mr. Jackson.

Mr. WITTMAN. Wait a second. Here we are.

Mr. NORCROSS. There they are.

Mr. WITTMAN. It helps when I press the mute button. Thank you, Mr. Chairman.

Lieutenant General Nahom, I wanted to begin with talking about what we have been through now essentially for the last 6 years, and that is, the need for modernization and the balance between generating current readiness and modernization. And what we are seeing is that there are anticipated projections where conflicts brought over by certain flashpoints around the world, like Taiwan, may be upon us faster than what we had ever imagined, and, essentially, looking at this balance, we have a couple of options, actually three options, I believe, in front of us.

We can increase the top line, we can compromise near-term readiness to fund modernization, or we can continue to pay the appreciating cost of aging platforms. So these are all challenges that we face. In seapower, we are talking about the bathtub the Navy's going through in retiring legacy systems and bringing on new systems. The problem is, is all of the dreams about modernization come outside the Future Years Defense Plan better known as the FYDP. So we are going to do all these great things, yet we go through a bathtub of losing capability.

And when I look at the Air Force's proposed divestments, I see that there are 48 F–15s, we are going to require 47 F–16s, and 8 C–130s, and I have to ask, if you will let us know what is the Air Force going to do to address this bathtub that you are going to find yourselves in with retiring all these assets as you try to take these savings and plow them into future assets, but many times, those aren't going to be available for at least 5 years-plus out in the future?

General NAHOM. Well, Congressman, thank you for the question. I would say also over the last couple years, we have brought on in excess of 300 F–35s now. And we have actually reduced very few fighters in that timeframe. So we actually have to start getting rid of some of our older planes so these F–35s that we are bringing on, we have the resource, the manpower. I will tell you right now, we are really short on manpower, especially maintainers, because we continue to buy, you know, 48 F–35s this year, 48 F–35s plus 12 F–15EXs. We have got to retire some older airplanes so we can make room in the resources.

And you are absolutely right. We have got to compromise, we have got to have that balance between that modernization and some of the aging platforms so we can continue the capacity that COCOMs [combatant commands] need today from their Air Force.

Mr. WITTMAN. Very good. Thank you, General Nahom.

Lieutenant General Fick, let me ask you: Several months ago there was testimony about engines for F–35s, about supply chain issues with parts for the engines. At that time, we were sure that the supply chain issues were going to be taken care of. It has been roughly 3 months, I said 2 months, but it has roughly been 3 months since that hearing. Can you give us an update on where we are with supply chain issues concerning the F–35 engine?

General FICK. Yes, sir, I can. Thank you for your question. So in the 90 days that have passed since our last conversation on this topic, we have continued to execute the three-prong plan that we described there, the first of which is to increase our throughput at the heavy maintenance center at Tinker Air Force Base. I am working very, very closely with Lieutenant General Gene Kirkland, the sustainment center commander out there, and with Matthew Bromberg, the president of Pratt & Whitney military engines, to put a number of initiatives in place to including increasing tooling, reducing engineering disposition turn times, stand-up of a second shift, the establishment of a rotable pool of mini modules that will increase capacity there, as well as the burndown of defects in the technical data. That work is going very well. We have actually seen over the course of our time there at Tinker that the turn time go

from 240 days down to about 183, and our target by the end of this calendar year is 120 days.

Since that time, we have also continued to work to stand up a capacity at other locations and, of course, the third lever that we are pulling on is doing things to keep the engines on wing longer. We are actually actively investigating the CMAS [calcium–magnesium–alumino-silicate] issue that was leading to the coating degradation that we talked about when I was last before you, and we are exploring ways to potentially leave those engines on the wing longer, based upon increased understanding of those mechanisms. The big picture result is we believe that now this number has changed since we last spoke. Supply will equal demand from an engine power module throughput perspective in 2024, and we anticipate being recovered to the zero backlog by about 2029.

Mr. WITTMAN. Thank you. Thank you, Lieutenant General Fick.

I want to get to Mr. Stefany real quick. Simple one-word answer. If looking at the window of potential conflict with China over Taiwan, if that were to happen before 2025, when you talk about the shortfall of strike fighters, does that shortfall today introduce unacceptable risk if that conflict scenario has moved to the left?

Mr. STEFANY. Sir, that is not a one-word answer, but I think our COCOMs have seen it as a risk that they understand and would be able to address.

Mr. WITTMAN. Okay. Very good. Thank you, Mr. Chairman.

I yield back.

Mr. NORCROSS. Thank you. Ms. Sherrill, you are now recognized for 5 minutes.

Ms. SHERRILL. Thank you, Mr. Norcross. And thank you, gentlemen, for being here, and Madam. I want to start with Mr. Nogueira. Given both the current cost overruns with the F–35, as well as the long-term operation and sustainment cost which to meet current acquisition requirements will require the Air Force to come up with a 43 percent sustainment cost reduction and the Marine Corps to come up with a 24 percent cost reduction. I am curious what other systems we are missing out on as a result of fielding these aircraft which didn't perform well in recent strategic games countering our pacing threat of China in the Pacific?

Mr. NOGUEIRA. Thank you, ma'am. We have gone back and looked to try to find systems that have had to realize these kinds of cost savings, and we have not found anything in the previous cost estimates that we have done that have shown that. So I think you are right. Our cost estimate, our last ICE [independent cost estimate] that we sent over in 2020 clearly lays out the challenges of bringing down the sustainment costs, and I think Lieutenant General Fick can speak to those specific steps that the JPO and the services are undertaking, but we agree with you, it is clearly challenging to reduce those costs.

Ms. SHERRILL. And, so, you are not worried about some of the other systems we may be missing out on because of those continued greater-than-expected costs?

Mr. NOGUEIRA. Ma'am, at this point, in terms of a capability that we think the Department needs to meet the future threat, the F–35 fully deployed with Block 4 is really the capability that the Department needs in this portfolio. So the challenge becomes then

not so much, you know, a combination of things, how do we bring those costs down to make sure that we can deploy the F–35 as expected because that, as I said, that capability is critical that we have seen thus far in the modeling that we have done.

Ms. SHERRILL. So Lieutenant General Nahom, over the past several weeks, you know, I have had several concerning conversations with former acquisition and sustainment officials about the amount of risk we are taking on with other modernization priorities by continuing to shore up the F–35 program. I guess as a thought exercise if tomorrow Congress stopped funding the F–35 program to get at this another way, what we are missing out on, what would your plan be to modernize our aircraft and perform the required missions?

General NAHOM. Well, ma'am, thanks for the question. Obviously, we are very concerned, too. In the F–35, our chief has recently said that it is a very good aircraft, and the crews that fly it very much like what it does. But unfortunately, we are paying for outstanding and we are not getting outstanding. So we actually—if you look at the F–35, although our numbers of F–35s have come down over the years what we are purchasing, our level of funding has not changed, and it has continually gone up.

So it is concerning to us in the Air Force of the increasing cost, especially in a modernization, as well as the O&S, the operation and sustainment, costs have not come down to the level where we would like. And I think you have heard that and our chief recently saying that right now, we are filling in the holes for some of those capacity missions around the world with F–16s and A–10s. Well, eventually, we said years ago that we were going to replace all F–16s and A–10s with the F–35. I am not sure we are at that point yet where we can say that right now. Because unless the F–35 comes down in its O&S cost, we will not be able to afford an entire fleet of fighter aircraft in the Air Force at that level. That is why the chief said there may be something else later on if we cannot get these costs down. So it is certainly a concern with the Air Force.

Ms. SHERRILL. And Lieutenant General Hinote recently noted that much of our current fleet was not effective actually in the simulated conflict against China in the Pacific and in June, he mentioned a need for dispersed vertical lift capability for logistics. Do you see a vertical takeoff and landing capability as a future requirement for our fighter fleet, and if so, how do you see this changing your requirements in the coming years?

General NAHOM. We do. And we are watching the technology very closely. Certainly our Army friends are involved with future vertical lift and other technologies that are out there. You are seeing us with things like our Agility Prime and some of our other R&D [research and development] efforts right now. If you look—it would have to get back into a classified setting to really get into this conversation. But if you look at the places where we think you are going to need logistics, there could be limited runway or no runway. So there will be a need for a vertical takeoff and land type of capability in the future.

I do believe that tactical lift, as we see it today, will change and it is something we are certainly keeping an eye on, watching the

technology very, very closely. And I would love to come back in a classified setting to talk more about this, ma'am

Ms. SHERRILL. I would appreciate that. Thanks so much.

And I yield back.

Mr. NORCROSS. Mr. Jackson, you are now recognized for 5 minutes.

Dr. JACKSON. Thank you, Mr. Chairman and Ranking Member Hartzler, for holding the hearing today. Also want to thank each of our distinguished witnesses for being here. I have been pleased to see the Department investing in technologies to build systems that are both lethal and survivable against a peer threat and move on from some of our outdated and costly platforms. One of these investments that I want to focus on is the Advanced Pilot Training program and the new T–7 Alpha Red Hawk which will replace the aging T–38 fleet that is flown in my district at Sheppard Air Force Base.

This year's budget request contained a decrease in funding relative to what previous years' budgets had projected that we would need. Last month, I asked the Chief of Staff for the Air Force, General Brown, about this decrease in funding. He told me it was caused by technical issues with the program that I think were related to a missed milestone. I understand there have been supply chain issues that have caused delays.

Regardless, General Brown reaffirmed the Air Force's commitment to the T–7, which I was glad to hear, because we absolutely need to update our trainer fleet. The theme of supply chain issues has seemed to be a common trend across many different programs. With the T–7 specifically, I am told that we are having trouble with sourcing and establishing critical parts from the global supply chain.

Ms. Costello, can you speak to some of the supply chain issues that the T–7 has faced? Also, do these supply chain issues have any link to reliance on a peer competitor such as China?

Ms. COSTELLO. Thank you very much for the question. So you reference supply chain issues, and that is something that we are seeing globally right now. COVID only exacerbated that across our entire industrial base, and the T–7 program is one of the many who is experiencing some of that. Unprecedented supply chain challenges, Boeing and T–7 is no different than anybody else. The tail assembly is one example in the T–7 program that is affected because of reliance on international supply partners. The real—we have to get through the COVID pandemic recovery efforts, and really, then, we can get back to where we were before, but every company is dealing with it a little bit differently and every country is, actually.

We are committed to the T–7 program. That is one of the factors that led to the milestone C delay from first quarter to fourth quarter of 2023, but it is not the only issue but it was a contributing factor. And we will continue to work with Boeing and our industry partners to address and try to mitigate any of the supply chain challenges. We believe Boeing is working very carefully and we have confidence we will be able to mitigate that effect for T–7 specifically.

Dr. JACKSON. Yes ma'm, and are there any things in the supply chain that are related to China, in particular?

Ms. COSTELLO. I can't say right now if there is any that are specific to China, but our entire force is intended to satisfy that mission requirement. So I can take that for action and come back and let you know, if that would be helpful.

[The information referred to can be found in the Appendix on page 151.]

Dr. JACKSON. Yes, ma'am. Thank you. And my next question is, some of the T–38s being flown in my district are over 50 years old obviously. We can all agree that training in an aircraft built in the 1970s is not going to be adequate for training pilots for an F–22, F–35, or a future fighter aircraft.

Ms. Costello, as we have seen the T–38 in service for many decades, what is the projected timeline that we can expect to see the T–7 being used for pilot training?

Ms. COSTELLO. So where we are looking at an IOC [initial operating capability] for T–7 of 2024, so our plan is to start transitioning at that point in time. The rate at which, of course, will be based on the deliveries. And, of course, we do agree it is time to replace the T–38, which is why we have the T–7 aircraft and it is very important that we get those in place on time.

Dr. JACKSON. Yes, ma'am. Thank you.

My last question I would like to speak about the decrease in funding for the program and the delays that we face. I understand why the funding request is at a level that it is, but I think I speak for all my colleagues when we say that we need to significantly reduce the number of delays that we are seeing in major acquisition programs. Many of our industry partners are working in the best interest of the Department and working to help us fill next-generation systems that will allow us to compete with countries like China and Russia.

Ms. Costello, while delays are usually unexpected, do you see any further delays occurring with the T–7, or do you anticipate things being on time from here on out? And further, can you speak to how the Department is working with industry partners to avoid any more delays?

Ms. COSTELLO. So relative to the T–7, we do not project any further delays. We believe Boeing has the supply chain issues being mitigated properly and the particular software design issue that has been identified, the fix has already been identified. We have to go back and finish the testing to demonstrate and validate it, but we believe we can support the schedule based on sliding from first quarter to fourth quarter of 2023.

So we project we can still maintain our IOC and [inaudible] on that particular program. And there are issues across acquisition programs that we work daily with industry in order to mitigate so that we don't have schedule delays. Thank you.

Dr. JACKSON. Thank you, ma'am. I think my time is up.

Mr. Chairman, I yield back.

Mr. NORCROSS. Thank you. Mr. Kahele, you are now recognized for 5 minutes.

Mr. KAHELE. Mahalo, Mr. Chair. And thank you for having this hearing today. My question is for General Nahom. And just for

some background, my question is going to revolve around the C–130 aircraft. Recently, the Air National Guard leadership has called for installation of infrared suppression systems on the legacy C–130 aircraft, which is critical to protect against the MANPAD [man-portable air defense] threat.

On June 23, an Ethiopian Government C–130 was shot down—this was a C–130 that was provided to the Ethiopian Air Force by the United States—by Tigray forces in the ongoing conflict in the region. That aircraft—obviously, it is a U.S. aircraft. It shares the same engines, the same general airframe, and the structure that many of our Air National Guard, Air Force Reserve, and Active Duty C–130Hs have. It is an unfortunate reminder of the constant threat environment facing our legacy tactical airlift fleet, not only from complex missile systems, but also widely proliferated weapons like the man-portable air defense system.

So my question is, in seeking to counter this threat posed by MANPADS, specifically for the Air Guard designated C–130H infrared suppression hardware as a critical need in the 2021 weapons modernization priorities book, given that you previously stated that the Air Force intends to continue fielding C–130H models into the future, do you agree with the Guard's assessment that infrared suppression is a critical need for these aircraft?

Do you also think that additional TTPs—tactics, techniques, and procedures—need to be modified for the MANPAD threat for a mobility aircraft like the C–130, potentially C–5/C–17? And can you describe how the Air Force is addressing this critical need in its budget submission, and given the lack of a future years defense programming this year, how this program will be implemented over the next few years?

General NAHOM. Well, Congressman, thanks for the question. And I just looked around at my team, too. We—I don't currently have anything in my book right now where we are with C–130 counter MANPAD. I will have to take that for the record and get back to you. I do agree, though, that the MANPAD threat is proliferating, it is everywhere, it is something we are very concerned with, especially with low-flying relatively slow airplanes, like a C–130. And I know as we look at our modifications across all mobility platforms, I know this is something that the modifications in mobility platforms are very expensive. And I know working very closely with AMC [Air Mobility Command] and the Guard and the Reserve to make sure we prioritize correctly, but let me take that for the record, get back to you, and tell you where we are on that.

[The information referred to can be found in the Appendix on page 151.]

Mr. KAHELE. Okay. Thanks so much, sir. Let me jump over to the ACC [Air Combatant Command] and what most of our conversation has revolved around, which is F–35, F–22, and our tactical fighter training programs. I guess specifically for the F–22, you know, the Hawaii Air National Guard, we have a composite unit out there. We fly F–22s as well. We have F–22s out in Kadena, up in Elmendorf. So the Air Force maintains approximately 186 aircraft in this inventory.

What do you see, sir, as the future of the F–22 as the Air Force NGAD [next-generation air dominance] is developed and is the Air

Force planning to reduce any of its F–22 fleet prior to NGAD being fielded?

General NAHOM. Well, sir, thanks, again, for the question. The F–22 is the dominant fighter of our time, and it needs to be—our Nation needs that dominant fighter right now. We intend to keep it that way in the near term. And if you look at our schedule for our modifications for the F–22 fleet, the 123 operational F–22s, and then the others you mentioned are our test, training, and weapons school. Maintaining that over the near term until we get to the what-next. The what-next is the next-generation air dominance. We can upgrade the F–22s for a certain amount of time and then at some point, the threat we know is going to outpace its capability and that is why NGAD, and getting at NGAD now is so important, because we think the U.S.—what does the Nation expect out of their Air Force? We know that our Nation expects air dominance and that is what the F–22 provides today. That is what the F–22 provide over the next decade or so. And then beyond that, we expect to do that with the next-generation air dominance.

Mr. KAHELE. Do you foresee any potential fighter airframes being based at any future Pacific bases like Andersen or other bases that we may want to base these type of aircraft at to shore up the Pacific Deterrence Initiative and the China threat?

General NAHOM. Sir, for that one, I will be very careful. I really want to come back in a classified setting to tell you, because we are actually very actively talking about what the Pacific as well as the European friendly lay-down is going to be in terms of our fighters. I want to be real careful I don't say something over an open line. So I would like to come back in a classified setting if you don't mind, sir.

Mr. KAHELE. You bet. No problem. Thank you, Mr. Chair.

And I yield back my time.

Mr. NORCROSS. Thank you. As I understand it, Mr. Veasey is last one for first round. So from the home of the F–35, Mr. Veasey, you are now recognized. Mark, are you there?

Mr. VEASEY. Yes, I am here. I apologize.

Mr. NORCROSS. There you are. You are muted, although—can others hear Mr. Veasey?

Mark, we cannot hear you. Mark?

Do we have him muted, because it is showing on my screen that he is unmuted?

Okay. We are going to go to the second round. Let's see if we can get a hold of Mark and work that out. In the meantime, he is going to look up and realize we didn't hear him.

Anyway, so till we get Mark rolling, we are going to start our second round and I would like to start out just a clarification, Mr. Nogueira. I think I heard you say during your testimony that a fully capable F–35 would be there to meet the need against our near-peer competitor, in particular, China. Although very effective, we are looking at the next generation as one to truly be able to penetrate and go up against some of our near-peer competitors.

Isn't that correct, or did I misunderstand what you said?

Mr. NOGUEIRA. So, sir, without getting classified really quickly here, we think the—based on analysis we have done to date, we think the F–35 and its full capabilities, Block 4 capabilities is crit-

ical for the Chinese fight going through, you know, the 2030s. NGAD is also, NGAD also will play a vital role, in particular, as Lieutenant General Nahom mentioned. NGAD for the Air Force is the air dominance platform. I think beyond that, we should come back and talk to you classified to really go through that.

Mr. NORCROSS. We are on the same page. I thought I misunderstood what you said.

Mr. NOGUEIRA. Yes, sir.

Mr. NORCROSS. It wasn't China or Russia—it was someone.

Mark, can you hear me, Mark? You were muted during your question. You still are. So you want to see if you can work that out and then we will recognize you as we go on.

I want to switch back to follow up on some of the questions that Mr. Turner talked about with regards to power module and the F–35 engine and the maintenance issue.

So this would go to Mr. Stefany, Ms. Costello, and General Fick. For the F–35, how many aircraft today do not have engines? Let's start out with that question. And then from there, I want to go into the capacity and repair issues at the F135 heavy maintenance center in Oklahoma. But first, how many aircraft do we have today, 135s without engines?

Mr. STEFANY. Frederick J. Stefany, from the Navy and Marine Corps. The Marine Corps is zero right now, and the Navy, just as you know, we are just starting to field aircrafts. I believe we are at zero, but I would have to take a look at [inaudible].

Ms. COSTELLO. And from the Air Force, as of July 8 of this month, we are 41 F–35s are without an engine, and 56 F135 power modules are in work at the repair facility at Tinker. I think General Fick can speak to the other actions.

General FICK. Yes, sir. I will tell you there is some difference of opinion relative to the total number of MICAP [Mission Impaired Capability Awaiting Parts] engines. I know that in some corners, aircraft that are long-term down are being counted against the MICAP count, but those count sometimes and don't count in others. But to Ms. Costello's point, if I look at the 41 U.S. aircraft, my information as of today says I have 41 U.S. Air Force tails using Ms. Costello's map; I have 3 partner aircraft, I have 1 Marine Corps aircraft, and I have 1 U.S. Navy tail that are MICAP for an engine. Some of those are power modules, some of those are MICAP for other reasons.

Mr. NORCROSS. Well, thank you. And you made a point to suggest, General Fick, that not one delivery of an aircraft was delayed by the engine, which is obviously very important. You know, we have had issues with Turkey. We all know that and set us back a little bit in the pandemic, no question about it, but additionally what I call in some ways a self-inflicted wound is those additional aircraft that we purchase that were not requested, and the idea of rolling them out in new aircraft with an engine while others are sitting, and I am hearing the numbers and we can argue over which ones they are, but are certainly something that is a real concern and, as we have heard in testimony, the idea is to make sure those engines are available just as importantly in the depots.

So let's talk about the F135 heavy maintenance center in Oklahoma. The status of that increasing repair and the capacities.

Where are we today in terms of the operation and the parts that they need to perform?

General FICK. Yes, sir. If I can conflate the two questions relative to Pratt & Whitney's ability to deliver production engines throughout the pandemic, we have actually pulled 6 production engines forward and sent them to the field to take advantage of their ability to continue to deliver, and we have actually pulled 12 power modules forward from calendar year 2022 into calendar year 2021, again, to help leverage some of that capacity to help the fielded fleet.

Relative to the progress at Tinker, we have done a good job of optimizing the maintainers on the floor, really treating them like we treat surgeons in an operating room, finding ways to keep them on the engines longer, on the power modules longer, and make them more effective at what they do, whether it is increased training, increased access to tools. We have moved the needle from a heavy maintenance center production perspective.

Now, conversely, we have also seen, in the time since we last spoke, an increase in the removals of power modules as a byproduct of the same phenomenology that we saw over the summer with the CMAS degradation. These are power modules that should have been found over the course of the last 9 to 12 months, but due to deficiencies in our ability to execute the borescope inspections in the field, they were left on the aircraft longer than usual. We have been working very, very closely with the Air Force to help with the borescope inspection procedures. We have removed those power modules from service, with the exception of a few who are being monitored very, very closely for the progression of damage. We are using this as an opportunity to learn from the aircraft in the field at what the progression of this coating degradation and turbine blade distress looks like.

Mr. NORCROSS. Thank you. What I want to do now is turn it over to Ranking Member Hartzler, and then I understand Mr. Veasey has returned. We will give him another shot, but Vicky, you are now recognized.

Mrs. HARTZLER. Sure. Thank you. I would like to ask a question about the F–15EX. So in addition to the budget request for funding for 12 F–15EX, the Air Force also submitted funding request for an additional 12 F–15EX aircraft in its fiscal year 2022 unfunded requirements list. So could you elaborate, General Nahom, on why the procurement of these additional 12 aircraft are critical in fiscal year 2022?

General NAHOM. Yes, ma'am. Ranking Member Hartzler, thank you for the question. So if you look at our aging aircraft and the F–15C/EX are replacing immediately are very problematic. Right now, the Air National Guard will tell you they have 20 airplanes that are long-term grounded. We have several airplanes, Active Duty and Guard, at our depot that are long-term grounded for cracks. Getting the F–15C that is well past its service life, retired, and getting its replacement as quickly as possible is a concern of ours.

We were only able to put 12 EXs on our original budget for the—if there is additional money, that this would greatly help us in not—getting the F–15Cs replaced and keeping these fighter oper-

ations open. I am worried as the F–15Cs retire, if we retire them on time, about not having enough aircraft in the right places to keep these operations continuous; so the additional airplanes would be very, very helpful. The EX—the reason to put EXs over F–35 is the EXs are ready to go. If F–35s are coming off the line right now with full TR–3 and Block 4, it would be a different discussion, but they are not. So that is why there is EXs there, ma'am.

Mrs. HARTZLER. You bet. Okay, thank you. I also wanted to ask about a different take on the F–35 engine. We know that Congress and the taxpayers have invested over $4 billion in the last decade to mature adaptive cycle engine technology across multiple engine companies. Those programs are culminating this year with testing of full-scale prototypes of engines designed to integrate with the F–35. My understanding is that these can bring transformational capability improvements in aircraft range, acceleration, and thermal management capacity that will be needed to support the Block 4/Tech Refresh 3 enhancements.

So how are you integrating this capability into your long-term F–35 roadmap, and do you intend to capitalize on the significant taxpayer investment that has been made to this point, and transition this capability to our warfighter, and what timing do you think is appropriate?

General NAHOM. Ma'am, thank you for the question. I will start and let Ms. Costello take a hack as well. We are very excited about this technology. And as General Fick said, it is very, very impressive, not only the fact of having an alternative power plant for the F–35, but the capability this brings with it, its efficiency, as well as its increased power greatly enhance the capability of F–35. We are in a struggle, though, as an Air Force to bring this to any kind of operational capability because we got—significant investment as you said to get this technology, but there is another significant investment that is needed to integrate this into the F–35. And right now, given the current top line we have right now, we are going to struggle to get any further with this technology.

Darlene.

Ms. COSTELLO. And as you said, you will have this test information in fiscal year 2022, and we are working closely with the JPO in order for them to understand it and plan it in their future. But we do have fiscal issues we have to consider, too, and integration costs have not been factored at this point in time. Thank you.

Mrs. HARTZLER. You bet. Thank you, and I don't know if Mr. Carbajal is on or not and asked the question for Mr. Gallego about the A–10s, but if he is not, then maybe we can circle back and get some clarity on the wing replacement and the budget and what has been spent and hasn't.

Thank you.

With that, I will yield back, Chairman.

Mr. NORCROSS. Thank you. As I understand it, Mr. Veasey is connected. So Mark, you are now recognized.

Mr. VEASEY. Thank you, Mr. Chairman. Can you hear me okay?

Mr. NORCROSS. Very good.

Mr. VEASEY. Okay. Awesome. Awesome. I wanted to ask, neither the Navy's fiscal year 2022 budget request or its unfunded priorities list included new F–18 Super Hornets, and when asked about

this during the most recent fiscal year 2022 budget hearing, Admiral Gilday testified that the Navy has procured as many F–18 Hornets as it needs. He went on to say we are at the twilight of fourth-generation purchases, and we are picking up the pace on fifth-gen.

I was wondering, do you concur with General Gilday's comments that the Navy is pivoting to fifth-generation fighters, and was just open if you had a comment or thought on that, that that would be—I think that would be interesting.

Mr. STEFANY. Yes, sir. I will start and pass it over. Yes. We have the right transition, the right mix of generation four and generation five aircraft in our air wings going forward. And while we have a shortfall in the near term, by the time any aircraft that would be bought in 2022 would show up, we will have addressed that shortfall for the plan to get by the end of 2024, in 2025, to get that to a zero shortfall.

And with that, I will turn it over to Admiral Loiselle.

Admiral LOISELLE. Yes, sir. Just a little bit more specifics on that. We currently are executing a multiyear procurement of F–18s, 78 total. We have got 70 left to deliver that will deliver between now and fiscal year 2025. So they are continuing to add to our totals of F–18s throughout the next timeframe. That is why I think we can get to SLM in modification the current F–18s after that timeframe. We mentioned the UPL [unfunded priorities list], we have five F–35s on our unfunded priorities list as well to try and accelerate that transition, because the F–35C is the last customer we are—we have the smallest number of tails in the F–35 fleet thus far in the Navy. So we are in the mid-50s right now, and so, that will allow us to accelerate our transition to a fourth-/fifth-gen mix.

Mr. VEASEY. Okay. Good. Good. I think that is really important if that will help pick up the pace as Admiral Gilday pointed out, that that is really good information for the committee.

Lieutenant General Nahom, the Air Force has been procuring F–35s at a rate at nearing full production for the past several years. Air Force leaders have testified that the F–35 is coming off of the production line today, that they have the best break rate in the Air Force. Recently publicized data showed F–35s having the best mission capable rate out of all of the Air Force fighter fleets in 2020, and despite these significant achievements, the Air Force fiscal year 2022 budget proposes reducing F–35s annual procurement below last year's appropriated level while purchasing additional fourth-gen fighters that have not produced at rates for the Air Force in roughly 20-plus years.

As the Air Force tries to mitigate a fighter shortfall, how does this revised acquisition plan not add additional risk and how does the Air Force plan to mitigate this risk?

General NAHOM. Thank you, Congressman, for the question. So, you know, we have 48 aircraft on our budget, and the reason we have put in the UPL is as these aircraft come off their line, these will not be in the Tech Refresh 3/Block 4 configuration.

Every aircraft that the Air Force buys before we get to that point, we are going to have to spend money to retrofit. And so, right now, we are watching that very closely.

As I said before, the F—your stats are right on. The MC [mission capable] rate—the crews who are flying this airplane love it. It is doing great work. It is a very, very good airplane. We are paying for outstanding, though, and we would like to get this aircraft in the configuration we need, which is the Tech Refresh 3 and Block 4 modernization.

We are committed to the F–35, and we truly believe it is the cornerstone of our future fighter fleet.

Mr. VEASEY. Okay. Thank you very much.

General Nahom, in the 25 seconds or so that I have remaining, an article that I saw from just a few days ago, I wanted your quick comment on it. And this—that is the Air Force's F–16 boneyard project that you are working on. Is that going to be something that you all are just going to do just for the F–16 or is that going to be something that can be used for other models, for other platforms?

General NAHOM. And, sir, let me say—and I did read about it. Let me—and you are talking about the digital twin piece that has come out——

Mr. VEASEY. Right. Exactly.

General NAHOM. I think we need to take it for the record.

Ms. COSTELLO. I think we need to take that for the record.

General NAHOM. Yeah. We will take that for the record, sir, and we will come back to you on that, sir.

[The information referred to can be found in the Appendix on page 151.]

Mr. VEASEY. Thank you. Thank you.

Thank you, Mr. Chairman.

Mr. NORCROSS. Absolutely.

Mr. Jackson, if you are still with us, you are recognized.

Mr. Jackson, are you still with us? Going once.

Mr. Horsford, are you there?

Okay. Not hearing any of them, Vicky, we are back to you. You are now recognized until one of the others return.

Mrs. HARTZLER. There you go. Great.

Just if you could finish up and clarify, I believe Mr. Costello—or Ms. Costello—excuse me—you were answering the question [inaudible] about the A–10. You know, the budget request for fiscal year 2021 contained a request for $99.9 million to purchase 24 wing sets, which of course, as you know, Congress fully authorized and appropriated.

So as wing replacement for the entire fleet is a critical element of the fleet sustainment into the 2030s, but we have learned recently that the Department of the Air Force has not yet obligated the vast majority of fiscal year 2021 funding for additional wing sets, and the Chief of Staff of the Air Force stated in congressional testimony—they said in 2021 that the Air Force planned to execute 55 percent of the remaining fiscal year 2021 funds by the end of the fiscal year. So that is obviously not 100 percent of the funds that Congress provided for the wing sets.

So does the Department of the Air Force still intend to obligate the full fiscal year 2021 funding for additional wing sets during this fiscal year consistent with what Congress appropriated and authorized? And, if not, please explain what the Department of Air

Force plans to do with the remaining funds authorized and appropriated for additional wing sets if you are not going to spend them on new wings.

Ms. COSTELLO. Thank you very much for the question and the opportunity to clarify.

So we do have—we have—we have procured all of the wing kits that we are planning to with the fiscal year 2021 funds. The final four wing kits are spares and are going to be on contract in August of 2021. The first article is going to arrive in fourth quarter of 2022. The three other articles are going to arrive at the beginning of 2023, and the full-rate production, fourth quarter. So we are on track for procuring to support our planned fleet size of 218 aircraft.

The balance of that funding is planned to do the installs and continue the work there, and we do plan to have them fully obligated and expended in accordance with our required timelines.

Thank you.

Mrs. HARTZLER. You bet.

Thank you, Mr. Chairman. I yield back.

Mr. NORCROSS. Thank you.

So let me—unless somebody else is still with us, let me just follow up on the F–35 TR/Block 4 development.

Mr. Ludwigson, major risk, where do we foresee the F–35 program and the upgraded—where do you see us going, and what is our largest risk before that comes online? Obviously, you hear about the buys that we are making and trying to wait till that is fully capable before we buy those additional planes. But we can't wait, but we have to be able to plan.

Won't you bring us up to speed from where you sit and what you see with that upgrade.

Mr. LUDWIGSON. Are you asking about the Block 4 upgrade or the risks in general as it relates to the program?

Mr. NORCROSS. The risk to not having TR–3/Block 4 in the timeliness that we need it.

Mr. LUDWIGSON. Well, I think that some of the other—some of the other witnesses have clarified that. They are still aiming for insertion for the Lot 15. The challenge is, as I understand it, they are still conceivably going to be installing TR–2 kits during the production and then retrofitting those tails before they are actually received by DOD. So you have built in this retrofit cost because of the delays that have occurred with relation to final development of the full TR–3 kit.

And I think that the—as a lot of the witnesses have also noted, the Block 4 capabilities are really instrumental to why F–35, right? I mean, F–35 has a lot of characteristics that are pretty helpful, I think, for the warfighter, but the Block 4 capabilities are what you really need in a high-end fight.

Mr. NORCROSS. Thank you. And I am not sure if I am the only one hearing, but your sound is broken up, but I got most of your answer.

So, General Fick, let's talk about ALIS [Autonomic Logistics Information System] and ODIN. And I know it is your favorite subject, right? Certainly, the issues that we were addressing when Mrs. Lord was on board, but that transition to ODIN, quite frankly, would be quicker, easier, and more helpful.

Give us an update on where we are in terms—and this is the difference between Readiness and Chairman Garamendi in the joint meeting that we had, because it is important when we look to the future on what we are going to buy, we need to know where the system is going to be.

So bring us up to speed on ALIS–ODIN and where you think we are going with that.

General FICK. Absolutely, sir. Thank you very much for the question.

We continue to make progress along the ALIS to ODIN transition plan that we discussed back in the April timeframe——

Mr. NORCROSS. Right.

General FICK [continuing]. Which relies upon deliberate and consistent upgrades to the ALIS baseline so that we can both increase the—I am sorry—decrease the pain experienced by the users as they continue to use that system over time, and then put us in a place where we can seamlessly transition into the new ODIN software and capabilities.

Now, remember, ODIN is not just one thing. ODIN is a hardware kit; ODIN is a new software environment; and ODIN is a new underlying data environment. All of those things are being simultaneously developed.

The delivery of the new ODIN base kit is really—really helping the field. As we push it out there, it is 75 percent smaller physically, it is 90 percent smaller in weight, and it is 30 percent cheaper than the legacy hardware that it is replacing. And we are getting great reviews from the team, and we are also getting great reviews from our interactions with the users.

We are—we have established what we call a Joint ALIS Working Group where we actually interact with the units in the field as they work to establish the user agreement and the capability needs statement that we talked about last time, and then to prioritize the fixes that go into ALIS as we work our way into ODIN.

I think that over the course of the last 9 to 12 months, we have decreased the admin workload time by about 40 percent. We have decreased air vehicle flight download time by about 30 percent. We have decreased the air vehicle transfer time from days to minutes. We have increased or enhanced the cybersecurity posture of ALIS by making a transition to Win 10. The team is doing a lot of work both on the near term in fixing ALIS while at the same time ensuring a smooth transition into ODIN.

Mr. NORCROSS. So let me just dig into that a little bit. So you talked about the decreased time, the speed that we are now doing that. And is that with the new hardware, using ALIS, or is that with the new hardware using the ODIN?

So what is the base that those figures are coming from?

General FICK. Yeah. So those decreased download and processing times are using legacy hardware and the upgraded ALIS software. Our next steps are going to be to what we call deprecate or break up——

Mr. NORCROSS. Right.

General FICK [continuing]. The ALIS spaghetti code into discernible chunks that we can then begin to transition in—into ODIN. And whether we use them as-is or whether we change them,

whether we hire someone else to do that work or whether we use Lockheed or a commercial off-the-shelf product to do those functions, those are those next steps that we have to do to allow us to make that transition smoothly and seamlessly.

So the results that we have seen from a software perspective and a processing time perspective are largely ALIS software on legacy hardware. The improved hardware—the target hardware for ODIN, if you will, is showing even better progress.

Mr. NORCROSS. So why all of a sudden is ALIS working better, quite frankly? We collectively made that decision with yourself, Mrs. Lord, that we were going to keep the intellectual property, Lockheed is going to have that, and we are going to have our own ODIN that we, in essence, control. Yet, here, which is good news, all of a sudden, these numbers that you just shared with us are great. Why is ALIS all of a sudden working in a better form and fashion?

General FICK. So, sir, I don't want to leave you with the impression that everything is rainbows and unicorns, right? We still have a lot of work to do with respect to ALIS. But I think that what I have seen over the course of the last year is that my team and the Lockheed team really buckled down and decided that, you know what, we have to do this and we have to do it together.

The environment in the fall of 2019 when we first set about this transition was—I am going to say it was bitter and contested. It was adversarial. It was tough going. As we started down that path and as we learned more about what it would take to actually transition this system in a smooth and seamless way without impacting the user, that we were going to have to team and do this differently.

So I think—I think, in part, the relationship is better. I think the expressed and executed intent to do the quarterly releases based upon solving user pain points has been a huge win for the program as we have been able to focus on those things that make the most difference to maintainers on the flight line. I think those things are all positive as we move forward.

And then, you know, again, the feedback that we are starting to get from the users is, you know what, we like the way you are going. As you transition to ODIN, let's make sure you don't lose all this.

Mr. NORCROSS. Are we still going to transition to ODIN, that original concept that was rolled out almost 2 years ago?

General FICK. Yes, sir. Absolutely.

Mr. NORCROSS. Thank you.

With that, do we have anybody else waiting?

Vicky, do you have any more questions?

Mrs. HARTZLER. No.

Mr. NORCROSS. I can't wait to get back to live. We were obviously having some challenges. But I want to thank all the witnesses. We had a very full agenda, to say the least, and we really appreciate the answers forthwith. And we have a couple of follow-ups.

With that, we are adjourned.

[Whereupon, at 5:14 p.m., the subcommittee was adjourned.]

A P P E N D I X

JULY 13, 2021

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

JULY 13, 2021

Statement of the Honorable Donald Norcross
Chairman, Subcommittee on Tactical Air and Land Forces
"Fiscal Year 2022 Budget Request of the Department of Defense for Fixed-Wing Tactical and Training Aircraft Programs"
July 13, 2021

The hearing will come to order.

I welcome everyone to our hearing, and I thank my good friend and partner on the subcommittee from Missouri for her participation in putting this important hearing together.

I welcome all members remotely joining today's hearing. Members participating must be visible on-screen for the purposes of identity verification, establishing and maintaining a quorum, participating in the proceeding, and voting. Members must continue to use the software platform's video function the entire time while in attendance, unless they experience connectivity issues or other technical problems that render them unable to participate on camera. If a Member experiences technical difficulties they should contact the committee's staff for assistance.

Video of Members' participation on Cisco WebEx is being broadcast via the HASC internet livestream. Members must seek recognition verbally and are asked to mute their microphones when not speaking to eliminate background noise.

Members may leave and rejoin the proceeding. However, if Members depart the hearing for a short while, for reasons other than joining a different proceeding, they should leave the video function on. If Members will be absent for a significant period, or depart to join a different proceeding, they should exit the software platform entirely and then re-join it when they return. Members may use the software platform's chat feature to communicate with staff regarding only technical or logistical support issues.

I have designated a committee staff member to, if necessary, mute unrecognized Members' microphones to cancel any inadvertent background noise that may disrupt the proceeding.

With that, I now turn to my opening statement.

I welcome and thank our distinguished panel of witnesses for joining us today to discuss the fiscal year 2022 budget request of the Department of Defense for fixed-wing tactical and training aircraft programs.

Today's hearing on tactical aviation is one of the most important annual oversight events held by our subcommittee. This year's hearing, even though complicated by the transition to a new administration, the extreme lateness of the budget submission, and our committee's tight timeline for building this year's defense authorization bill, is more important than ever.

This afternoon we will remotely receive testimony from a very large panel of senior acquisition and aviation leaders from across the Department of Defense. We will also hear from the Government Accountability Office representing our

independent agency helping us evaluate investment decisions and execution of the challenging F-35 program.

Overall, we're at a critical inflection point in time for tactical fighter aviation, requiring this subcommittee's thoughtful consideration, deliberation, and important decision-making.

Each military service before us today has proposed significant initiatives in this budget that begin to reshape their tactical fighter aircraft forces to achieve what they describe as the capabilities required to meet the challenges to deter, and if necessary, act against a near-peer threat of the future.

But what concerns me about DOD's current rhetoric is the appearance of a deliberate inference that the steady-state, rotational requirements of our continuing global military presence, and responding to contingencies below the level of "highly contested" warfare, are no longer applicable. I strongly disagree.

DOD currently equates the term "legacy" to mean "old, irrelevant, dangerous, and unacceptable" in meeting current or future requirements. Again, I strongly disagree.

I would offer that "legacy" should instead be replaced with the term "existing," and that we should reference current force structure as "existing" force structure.

And when assessing "existing" force structure, it should be evaluated against a particular mission set for its "relevance" or "irrelevance" supporting that mission and the strategic or operational risk associated with any gap in its availability or capacity.

I believe that our aircraft capabilities do need to evolve and keep pace with our global competitors – which is a wide spectrum depending on which competitor we're trying to influence to achieve our national defense strategic objectives.

I also believe that we need to maintain and achieve a proper and effective ratio of "existing" and next-generation aircraft capabilities to meet those diverse missions at a level of risk that is well-defined, clearly explained, and truly acceptable.

Further, we cannot fiscally afford to divest every "existing" aircraft in favor of buying only next-generation, high-end capabilities, and we cannot fiscally afford having our next-generation, high-end aircraft supporting the enduring steady-state presence and lesser contingency operations of our combatant commanders.

The current design and capability of F-15EX is not the same as the F-15C that rolled out in the 1970s. The current design and capability of the F/A-18 Block-3 Super Hornet is not the same as the original F/A-18 Hornet that rolled out in the early 1980s.

And F-35 and F-22 are perfect cases in point as it relates to realistic affordability in planning to buy large numbers of advanced, next-generation aircraft.

Those two aircraft are very capable and sophisticated when they work as designed. But neither currently works as intended often enough, and both are extremely expensive aircraft to own and operate.

This also requires us to understand how both the Air Force and Navy Next-Generation Air Dominance programs plan to avoid and mitigate the development and affordability pitfalls that F-22 and F-35 experienced or are currently experiencing as the case may be for F-35.

For this hearing, we need to understand the path that each of the services is on to achieve that relevant mix of both combat and training aircraft capabilities, while managing affordability and acceptable risk informed by our fiscal realities.

And speaking of F-35, we had a very productive hearing already on April 22nd of this year, so I won't rehash all those same issues in my opening statement today.

For the record, however, I still maintain the same concerns that I raised at that hearing.

Therefore, the subcommittee today expects to receive F-35 program updates on the status of resolving the current maintenance and availability issues regarding the F135 propulsion system power modules; the current status of TR-3 and Block 4 development and testing; and, how F-35 is progressing to achieve the Cost-Per-Tail-Per-Year affordability goals set by each of the services.

Particularly as it relates to when the Adaptive Engine Transition Program technology will be finished and integrated into the F-35A and F-35C aircraft to reduce skyrocketing sustainment costs and improve combat capability.

With that, I now recognize our Ranking Member of Tactical Air and Land Forces, Mrs. Hartzler for her opening remarks.

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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: July 13, 2021 3:00 P.M.

SUBJECT: Air Force, Force Structure and Modernization Programs

STATEMENT OF:

Ms. Darlene Costello
Acting Assistant Secretary of the Air Force
(Acquisition, Technology & Logistics)

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

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UNITED STATES HOUSE OF REPRESENTATIVES

INTRODUCTION AND STRATEGIC ENVIRONMENT

Chairman Norcross, Ranking Member Hartzler, and distinguished members of the subcommittee, thank you for having us here today to provide testimony on U.S. Air Force modernization. Additionally, thank you for your leadership and dedication to rebuilding the United States military.

Our nation faces a complex set of current and future security challenges requiring that we think and act differently and with urgency. The American homeland is no longer a sanctuary. Our citizens face threats from a variety of actors in both the physical and digital arenas. Competitors, especially China and Russia, continue aggressive efforts to negate our long-standing warfighting advantages while challenging America's interests and geopolitical position. China in particular is the nation's pacing threat. It has rapidly become more assertive, and is the only competitor potentially capable of combining its economic, diplomatic, military, and technological power to mount a sustained challenge to a stable and open international system.

The Chief of Staff of the Air Force has articulated what is at stake with his *Accelerate Change or Lose* white paper. It states "*unless we make significant changes to the Air Force's programmed force, we will not meet the pacing threat of China in 2030. Unless something changes, we will not be able to accomplish the Air Force's core mission's in the future operating environment.*" A growing body of evidence from adversary assessments, recent wargames, exercises, studies, reports, and other analysis underpins this assessment.

To make these changes will require difficult choices. It will require taking calculated risk now to reduce existential risk in the future. When considering the missions we perform today, in the Middle East and elsewhere, it is fairly easy to calculate risk and recognize the necessary changes. However, measuring risk becomes more challenging when we look into the future, at conflict scenarios with peer competitors like China. We must consider the risk that arises if we fail to recognize the need to change. The risk to our nation of losing in those scenarios far outweighs the calculated risks we are willing to take today to accelerate change.

The mission of the U.S. Air Force is to *fly, fight, and win...Airpower anytime, anywhere.* Military airpower is global, agile, flexible, rapid, and when necessary, highly destructive. The Air Force was created to realize the potential of military airpower to defend the United States, our citizens, and our friends. We know our potential adversaries respect—even fear—U.S. airpower, as they devote extreme amounts of money, time, and manpower to defend against it.

We also know they are fielding capabilities to attack the U.S. and our allies through the air. In this, they hope to hold our territory, bases, and citizens hostage, making us vulnerable to coercion. Both of these conditions are not new. They existed after World War II and provided the impetus to create the Air Force in 1947. In 2021, we must remember this "why" behind the Air Force as we look to the future. We can make the changes necessary to sustain and strengthen the U.S. advantage in airpower, but to do so, we must concentrate on the core reasons we exist.

The U.S. Air Force has five core missions: air superiority; intelligence, surveillance, and reconnaissance (ISR); command and control; global strike; and global mobility. These core missions represent what the nation expects of the U.S. Air Force, and they are part of our heritage; however, our continued ability to provide these core missions in defense of the nation is not guaranteed. The Air Force must change, because our environment is changing and our competitors are closing in. For too long, we have mitigated short-term risk at the expense of long-term, and we must correct this imbalance.

Since the publication of the National Defense Strategy (NDS) in 2018, the Air Force has worked tirelessly to identify new ways of approaching our toughest challenges in a peer fight, to include careful assessments of current and future risks. But our work is far from over. We look forward to continued engagement on the Air Force's future force design with this subcommittee and all of our stakeholders. It is the only way to ensure we are building a relevant and ready force for the future. This year's budget request will be another step in that journey.

CURRENT CAPACITY AND CAPABILITY

Aircraft currently in the Air Force inventory are becoming significantly more expensive to sustain as they age, and our fleet is the most aged of all. The average age of the Air Force fleet is 29 years, while the U.S. Navy is 14.4 years and the U.S. Army is 15.3 years. In comparison to our allies, the average age of the Royal Australian Air Force (RAAF) is 8.9 years and the Royal Air Force (United Kingdom) is 16.5 years. Weapons System Sustainment (WSS) costs have increased 130 percent over the last 20 years, even with a 15 percent decrease in total aircraft inventory (TAI). We need new platforms and weapons to replace an aging force, but also must invest in cutting edge technology needed to confront and pace peer threats.

Following NDS and National Security Strategy guidance, the Air Force seeks to invest in technologies and field systems that are both lethal and survivable against a peer threat. This ultimately means transitioning away from many legacy platforms in order to free up manpower

as resources to field more capable systems and modernize. If we are to modernize to address the emerging threat, we must use resources tied to our legacy platforms and weapons systems that are decreasing in relevance today and will be irrelevant in the future. We must strike a balance between risk in the near-term and risk in the future.

Fighter Force Structure

The Air Force must accelerate change to its fighter force structure to meet the threat posed by China and Russia, ensuring the Air Force can achieve air superiority and dominance over peer adversaries and has the capacity to meet world-wide demands in the 2030s and beyond. Extensive gaming and analysis using the most difficult problem (i.e., China) and the most difficult scenario (i.e., Taiwan) at the most difficult time (i.e., 2035), shows that the Air Force must change the future fighter force structure mix by changing investment priorities to provide the capability, capacity, and affordability required to meet the peer threat. To just keep pace with the threat would require an additional $6 billion to $7 billion per year to modernize our current force projected into the future. Even if that was affordable, that force would fall well short of the capability required to counter a future peer threat. Modernization programs cannot transform our 4th generation fighters into 5th generation fighters, or 5th generation fighters into next Generation Air Dominance (NGAD).

In realistic budget projections, we must balance the need for high end technology with affordable capacity. To attain this desired fighter fleet, the Air Force must right size current aircraft inventories to expedite the transition away from less capable, aging aircraft and emphasize investment in future capabilities such NGAD and F-35 modernization. The desired Air Force fighter fleet should match capability and capacity of both platforms and weapons to mission requirements. As part of its force structure change, the Air Force must transition its fighter fleet from seven platforms (i.e., F-35, F-22, F-16, F-15EX, F-15E, F-15C, A-10) to four platforms (i.e., NGAD, F-35, F-15EX, F-16) plus the A-10 in the near- to mid-term.

In determining the correct future force mix, the Air Force is in the final stages of a comprehensive study on the optimal Tactical Fighter Aircraft (TACAIR) force. We look forward to sharing the results of this study later this summer. Simultaneously, the Air Force is working closely with the Joint Staff and OSD on DOD-wide TACAIR study. We believe the two studies will be complementary and very helpful in focusing our future investment in fighter aircraft.

Next Generation Air Dominance (NGAD)

The Air Force is investing in technologies as part of a family of capabilities to assure air dominance in the future. NGAD is an advanced, air superiority fighter designed to operate within the most challenging operational environments and replace the aging F-22. The requirement to establish and maintain air superiority within the battlespace cannot be understated as it underpins joint force operations in any theater. The FY22 President's Budget requests $1.5 billion to fund the continued development of a next generation open mission system architecture, advanced sensors, cutting-edge communications, prototyping activities, and integration of the most promising technologies into a family of capabilities. Furthermore, this program incorporates novel agile and digital acquisition practices that are yielding favorable results and are providing greater value for the taxpayer. Our efforts are being shaped by multiple analyses, including recommendations from the Chief of Staff of the Air Force-approved Air Superiority 2030 Flight Plan, the 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.

The Next Generation Adaptive Propulsion (NGAP) program leverages the Adaptive Engine Transition Program (AETP) technology suite and applies it to delivering capability-enabling engine options for NGAD. NGAP trade studies are complete and competitive preliminary design activities underway. The acquisition strategy for the NGAP prototyping effort accommodates funding uncertainty while driving digital transformation in the propulsion industrial base. Contract awards are expected in the third quarter of FY22.

F-35

The F-35 is the cornerstone of our future fighter fleet. The F-35 today is dominant, purpose built, and equipped with advanced weapons for the contested environment. The original program of record was designed to replace all F-16s and all A-10s. Whether the Air Force is able to afford to replace the majority of the fighter fleet with F-35s is a decision-point that is still a few years away. In the near-term, we must concentrate on achieving the F-35 capability needed for advanced threats. While the F-35 is a formidable platform today, it faces challenges to ensure it stays dominant against an evolving future threat. To keep pace with the threat in future contested scenarios, follow-on modernization efforts centered on "Block 4" enabled by

Technical Refresh 3 (TR-3) hardware must be affordably realized on competition-relevant timelines.

To best posture the F-35 force for the upcoming Block 4 / TR-3 upgrade, the FY22 President's budget request decreases the F-35 procurement quantity in FY22 to 48 from the FY21 enacted position of 60 aircraft and commits $5.09 billion to procurement (air vehicle, modifications, and spares) and $1.05 billion to RDT&E (including $985.4M for Continuous Capability Development and Delivery, i.e. C2D2). Block 4/TR-3 provides the capabilities we need to address future threats and maintain advantage. Procuring additional aircraft before Block 4/TR-3 "cuts into" production and drives a retrofit bill and is therefore not desired. As a cornerstone capability, the Air Force must retain the F-35's mission contribution, even if this requires offsets from within the program.

Regarding affordability concerns, F-35 operating costs (as currently projected) and long-term sustainment costs still require continued focus to maximize affordability.

The Air Force remains focused on completing planned AETP prototype engine testing to inform potential follow-on efforts that will most appropriately leverage this revolutionary new technology, to include a potential F-35 engine upgrade. Analysis illustrates the increased fuel efficiency of adaptive engines offers up to 30% range increase depending on mission profile, 18% decrease in acceleration time and a significant increase in thermal management over the baseline F-35A power module. Applied to a notional scenario, these improvements could translate to reaching three times more targets or elimination of tanker dependence, increased aircraft survivability and Block 4+ mission system growth that increases weapon system lethality. At this time, the current F135 engine meets the warfighter's requirement; however, the F-35 program continues to monitor AETP progress closely, and if a validated requirement arises from the Air Force, implementation of AETP on the F-35 will be assessed accordingly.

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 FY22 President's budget request includes $1.1 billion in FY22 for modernization efforts essential to gain and maintain air superiority against evolving threats. Raptor Release, (formerly known as the Capability Pipeline) an agile acquisition construct, combines former TackLink16, Tactical Mandates (TACMAN), and GPS M-code

programs to deliver slices of each capability on a regular release cadence to the field. Future modernizations will continue to leverage Raptor Release as a vehicle to rapidly prototype and iteratively field critical enhancements with capabilities delivered to the fleet in order to ensure "first look, first shot, first kill" capability in highly contested environments. The transition timeline from F-22 to NGAD is dependent on the progress of NGAD development efforts.

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-15C/Ds in the Air Force inventory will reach the end of their design service life in the next six to eight years, and our analysis shows additional service life extension programs are not cost effective. The FY22 President's budget request divests 48 F-15C/Ds from the active fleet. We have already started to replace this fleet with a modernized successor by purchasing the F-15EX. The F-15EX "Eagle II" will provide superior sensor, range, and payload for Critical Infrastructure Defense. The Eagle II additionally brings outsized long range weapons (i.e., air-to-surface and air-to-air) into a peer fight. The FY22 President's budget request procures 12 F-15EX aircraft at a cost of $1.335 billion. Notably, the Air Force remains fully committed to advanced 5th and next generation capabilities and the F-35. The decision to refresh the 4th generation fighter force with the F-15EX is a complementary step to both F-35 procurement and NGAD development, and helps mitigate capacity risk while balancing near-term readiness concerns.

The existing F-15E Strike Eagle fleet provides all-weather, long range global precision attack in all but the highest threat environments. The FY22 President's budget requests $488.7 million in FY22 to continue modernization efforts to ensure the aircraft remains viable to the 2030s. Modernizing the F-15E with Early Passive Active Warning Survivability System (EPAWSS), also used on the F-15EX, demonstrates our commitment to building a more lethal Air Force. EPAWSS will allow the F-15E/EX to survive to attack targets in high threat environments.

F-16

The F-16 is the Air Force's primary multi-role fighter and Suppression of Enemy Air Defense (SEAD) aircraft. Our more than 600 late block F-16s will provide affordable capacity for the next 15 or more years, in both competition and more permissive combat environments. We are beginning to transition away from our oldest, early block F-16s, with a reduction of 47

planned in FY22. We will continue to modernize the late block F-16s we keep as our "affordable capacity" fighter into the 2040s. The F-16 investment strategy funds modifications for the most capable, late block aircraft to ensure they can operate and survive in today's threat environment. The FY22 President's budget requests $888.3 million in FY22 to continue these modernization efforts. This includes continuing the Service Life Extension Program comprising 12 structural modifications, affecting 450 aircraft, as well as several avionics capability upgrades including the Active Electronically Scanned Array (AESA) Radar upgrade. The new radar replaces the current mechanically scanned radar, with greater ability to detect, track, and identify low-observable, low-flying, and slow-flying targets. This joint emerging operational need is critical for the F-16 platform to meet aerospace control alert mission requirements to properly defend the homeland against modern threats. These radars continue fielding in FY22.

A-10

The A-10 remains an effective close air support platform for the current Counter Violent Extremist Organization fight. With very limited utility in a contested fight, we are right-sizing our A-10 fleet for the current and anticipated future demand and then structurally extending and modernizing the aircraft we keep. We will continue to re-wing and modernize 218 A-10s while we reduce the fleet by 42 in FY22 and an additional 21 in FY23. Re-winging is the A-10's most significant modernization program and we have purchased wings to outfit a fleet of 218 aircraft. In FY22, we will continue executing FY21 funding to begin installs and support engineering change orders, and other government costs that are typically required to execute major modification efforts of this nature. The FY22 President's budget requests $122.8 million (Procurement; and Research, Development, Test, and Evaluation funds) in FY22 for modernization. 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 the Secretary of the Air Force briefs the findings to congressional committees. We are seeking legislative relief to delink the Comparative Test portion of the report, given that portion of testing and evaluation has been completed, from the overall Initial Operational Test and Evaluation report in order to begin right-sizing this fleet.

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. For the T-6, the Air Force is completing installation of Automatic Dependent Surveillance-Broadcast (ADS-B) Out, 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. For the T-38C, modifications are also required to sustain and upgrade the fleet until the T-7A delivers, including avionics, Pacer Classic III, Talon repair, inspections, maintenance, and front canopy replacement programs until the *e*T-7A is delivered. The FY22 President's budget requests $3.9 million, $8.8 million, and $54.3 million for the T-1, T-6, and T-38 fleets, respectively.

eT-7A

The Advanced Pilot Trainer (*e*T-7A) contract was awarded to The Boeing Company on 27 September 2018. The *e*T-7A System Critical Design Review was completed in the summer of 2020. The *e*T-7A replaces the Air Education and Training Command's existing fleet of 427 T-38C aircraft with 351 aircraft and associated simulators, ground equipment, spares, and support equipment. The *e*T-7A 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 FY22 President's budget request of $199.3 million continues the program's Engineering and Manufacturing Development and early aircraft flight test efforts, as well as procures long lead support equipment, ensuring we meet the 2024 Initial Operational Capability and 2034 Full Operational Capability milestones.

Munitions

The Air Force must maintain a suite of affordable air-to-air and air-to-ground kinetic and non-kinetic weapons delivering capability and capacity to defeat rapidly evolving peer competitors. As such, we continue to procure preferred munitions, but are tapering production as programs approach warfighter inventory objectives, while simultaneously investing in new technology to counter future peer threats in highly contested environments. During the last

several years, we have successfully ramped up production capacity across the portfolio and our FY22 President's budget request reduces procurement rates of preferred munitions to sustain inventory objectives, while continuing to provide resources to apply toward advanced weaponry and hypersonics. We will continue to invest in future weapon design, development, and fielding to ensure advanced capabilities are available to engage all future threats. 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 in the current fight and the expenditure rate has reduced by 42 percent in FY21 (840) compared to FY20 (1,443). After increasing tailkit production to 45,000 tailkits per year in FY18 to meet the needs of the Services and Foreign Military Sales (FMS) partners, the Air Force has adjusted to demand and now plans to procure 1,900 tailkits in FY22 with a request of $124 million, with Navy and FMS partners procuring the remaining production capacity.

Small Diameter Bomb I (SDB I) and II (SBD II) provide 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 for SDB I from 3,000 weapons per year in FY15 to 8,000 weapons in FY17. With demand dropping and advanced standoff weapons in higher demand, the FY22 President's budget requests $82.8 million and plans to order 998 weapons leaving residual production capacity available to FMS partners. For SDB II, the FY22 President's budget requests $294.6 million to procure 985 weapons.

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. With lower demand and higher priority advanced weapons requirements, the FY22 President's budget requests $104 million and procures at least 1,176 Hellfire missiles.

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 NDS. Doing so requires advanced weapons capabilities and the FY22 President's budget request reflects the Air Force's plan to continue investing in those areas, specifically with the Joint Air-

to-Surface Standoff Missile (JASSM), the Long-Range Anti-Ship Munition (LRASM), and the Advanced Medium Range Air-to-Air Missile (AMRAAM). These weapons provide unique and necessary capabilities for the highly contested environment.

JASSM is the premier air-to-ground, low observable missile for defeating threats in highly contested environments and is the weapon of choice for a future fight against peer adversaries. The program is focused on increasing 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 percent increase in our inventory objective. The FY22 President's budget requests $711 million, with the corresponding available max rate for JASSM increasing to 525.

LRASM, produced in the same facility as JASSM, is a purpose-built anti-ship missile particularly critical for the future fight in a maritime environment. The FY22 President's budget does not request procurement due to a supply chain obsolescence limitation. Future procurement has mitigated the limitation.

Production of AMRAAM missiles, a critical air dominance weapon, remains consistent with FY22 procurement levels by requesting $214 million for 168 missiles, as industry partners begin to cut-in a solution to obsolescence issues through the Form Fit Function Refresh (F3R) effort.

Stand-In Attack Weapon (SiAW)

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 development of the Stand-In Attack Weapon (SiAW) to deliver a strike capability to defeat rapidly relocatable targets, a hallmark of the highly contested environment. SiAW is the munition that gives the F-35 unique air-to-surface capabilities in the high end fight for the entire Joint Force. The FY22 President's budget requests $166.5 million for SiAW development and prototyping.

Hypersonics

The Air Force is poised to field the first production hypersonic munition in the DoD. The AGM-183 Air-Launched Rapid Response Weapon (ARRW) is completing test and begins procurement with budget requests of $160.8 million for 12 munitions in FY22 and $238 million for research and development. Capable of employment from fighters as well as bombers, the Air

Force is also developing the Hypersonic Attack Cruise Missile (HACM) to complement ARRW. The FY22 President's budget request of $200 million for HACM development is designed to result in production article procurement in late FY26.

Intelligence, Surveillance, and Reconnaissance (ISR) and Command and Control (C2)

Aligned with the NDS, the Air Force is aiming to re-orient 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 uses advanced technology. It will be resilient, persistent, and penetrating to support both kinetic and non-kinetic capabilities alike. Global Integrated ISR must transition to connected, survivable platforms, and that requires accelerating investment and accepting short-term risks by transitioning away from outdated and underperforming ISR assets that offer limited capability against peer and near peer threats.

The FY22 President's budget request takes further steps towards repurposing, retooling, automating, and stabilizing the force to ensure the ISR Enterprise can achieve this vision within the next decade.

MQ-9

The FY22 President's budget request of $357.9 million will continue MQ-9 fleet modernization efforts aimed at providing needed capabilities to the Combatant Commands. To date the MQ-9 fleet has flown over 2.5 million hours, with 91 percent of those hours supporting combat operations. This 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 development and testing of planned modernizations are conducted in parallel. 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 establishment of an MQ-9 Multi-Domain Operations (M2DO) configuration which are capability upgrades that will keep the fleet relevant.

Some of the upgrades in the M2DO configuration include Anti-jam Global Positioning System, C2 Resiliency, Enhanced Power, Link-16, 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.

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 using 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 FY22 President's budget request 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, and exploitation and dissemination supported by enhanced artificial intelligence algorithms. Also, the first KC-135 to WC-135 conversion will be accomplished and delivered in FY22. Finally, our partnership with the United Kingdom's RAF on the RC-135 and the RAAF on the MC-55 Peregrine continues to set the standard for cooperative efforts that strengthen alliances while increasing partner interoperability.

RQ-4

The RQ-4 Global Hawk uncrewed aircraft system provides high altitude, long endurance, all weather, wide area reconnaissance and surveillance. The FY22 President's budget request of $121.7 million furthers modernization and sustainment efforts, to include modernizing the ground segment, addressing diminishing manufacturing sources, and standing up and assigning a maintenance depot for RQ-4 launch and recovery elements and mission control elements.

The Ground Segment Modernization Program is on track to complete installation of upgraded cockpits at Grand Forks Air Force Base and Beale Air Force Base in FY23. Finally, the Secretary of Defense signed the certification waiver for RQ-4 Block 30 divestment as stipulated in the FY21 NDAA. Funding made available over the FYDP by the divestiture will enable the Department to invest in penetrating ISR capabilities.

COMPASS CALL

COMPASS CALL is the Air Force's only wide-area, standoff, Airborne Electronic Attack (AEA) Command and Control Warfare/Information Operations weapon system. The COMPASS CALL program is currently undergoing a re-host effort to transition the capability from an EC-130H to an EC-37B in order to maintain U.S. Electromagnetic Spectrum (EMS) Superiority in future conflicts. To date, six EC-37B aircraft have been procured and are undergoing modification, with limited fielding planned to deliver in the FY24 timeframe. The FY22 President's budget requests $352 million for developing System-Wide Open Reconfigurable Dynamic Architecture (SWORD-A) capabilities while deferring the next aircraft procurement. The open and agile architecture of SWORD-A enables capability that can respond to the evolving threat landscape. SWORD-A capabilities make the EC-37B the centerpiece of the Electronic Warfare (EW)/EMS Superiority Strategy of the Air Force and DoD.

E-8 JSTARS

The E-8C JSTARS provides wide-area Ground Moving Target Indicator (GMTI) capability and dynamic Battle Management Command and Control (BMC2). JSTARS aircraft will have survivability challenges in future scenarios, as airborne GMTI platforms have to operate closely (from within contested areas) to adequately sense ground moving targets. The future of the GMTI is a pivot to space. As such, the Department is transitioning from legacy airborne GMTI platforms to space-based capabilities, where sensing will be possible in anti-access/area denial (A2/AD) scenarios. As part of this transition, the FY22 President's Budget request divests four E-8C JSTARS aircraft. The Air Force is pursuing a Secretary of Defense certification to divest the fleet across the FYDP, as directed by the FY21 NDAA.

E-3 AWACS

The E-3 AWACS provides wide-area Airborne Moving Target Indicator (AMTI) capability and dynamic Battle Management Command and Control (BMC2) to build an accurate battlespace picture. The FY22 President's budget request of $311 million funds modernization efforts to address diminishing manufacturing sources (DMS) to maintain its cutting edge BMC2 capabilities. Despite these modernization efforts, however, the AWACS fleet cannot perform the full spectrum of AMTI needed to support combatant commanders today. Although there are promising future technologies that could someday operate without a crewed airborne command and control platform at the tactical edge, these future concepts are not projected to be ready

before the end of service of the AWACS platform, creating the need for a bridging capability now. The Department is actively evaluating options for such an AMTI platform.

FUTURE CAPABILITY

Competing against rising peer adversaries during this time of unprecedented technology change requires a competitive acquisition system—one that is faster and more agile than our rivals. Consequently, the Air Force is transforming what we buy, how we buy, and who we buy from to retain the battlefield dominance we presently enjoy.

Understanding what to buy begins with a deep understanding of our potential adversaries and the anticipated future operating environment. We are using a future force design that incorporates adversary assessments and lessons from wargaming and other analysis to drive warfighter requirements and our acquisition choices. We will continue to incorporate our learning from these activities into future design iterations. This overall force design is being folded into our planning and programming in order to transition from the force we have to the force we need.

Faster Acquisitions

Fielding systems faster is step one. Through rapid prototyping authorities granted by Congress, like Middle Tier of Acquisition, we are trimming low-value-added steps that previously bogged down programs and slowed capability to warfighters. In May 2019, we achieved our "Century Challenge" goal of removing 100 years from program schedules and we've just kept going toward a new goal of 150 years. By the end of FY20, we identified 83.75 years of program accelerations for MTA programs and an additional 29 years of accelerations by tailoring our traditional acquisition programs. Rapid prototyping—"flying before you buy"—is not just a faster acquisition approach; it allows risks to be tackled earlier, before systems are in production when there is still time to troubleshoot. The benefit is proving out in our MTA programs, which maintain the same documentation and discipline as traditional programs.

The Department of the Air Force is embarking on an acquisition transformation by driving a "Digital Trinity" of initiatives into our acquisition enterprise. The Digital Trinity consists of Digital Engineering, Agile Software Development, and Open Systems Architectures. These three initiatives will greatly reduce acquisition schedules, increase our access to innovative and emerging technology, reduce vendor lock, and allow us to field warfighting systems at the speed of relevance. Digital Engineering approaches will change the way we do

business – shifting us from a document-based enterprise to one based in models and data, allowing us to analyze, assess, and make decisions regarding our system designs at machine enabled speeds. Agile Software Development enables us to deliver rapid, iterative improvements to our software in an assured and secure manner. Finally, Open Systems Architecture will maximize flexibility in system design, improve access to commercial products and competition, and enable our weapon systems to be affordably and quickly modernized and upgraded.

To successfully do this, the Department must establish a digital environment, or "tech stack," that is accessible across organizations—both industry and government—and enables our workforce to access, understand, and modify the models of our weapon systems. We must change the way we do business beyond document-based descriptions of our weapon systems toward model-based systems engineering methods that extend across the lifecycle from design to disposal. We must apply smart coding and containerization to bring functionality from the labs to the field at a rapid pace.

The Air Force is pursuing these initiatives on several fronts. First, our Air Force Digital Campaign, with over 900 participants, is drafting best practices and training, developing acquisition tools and enablers, and crafting the steps forward. The Air Force issued acquisition guidance for each of the three elements of the Digital Trinity, as well as criteria for programs to achieve e-designations: a formal acknowledgement of weapon systems championing and reaping the benefits of these modern practices. We are actively deploying acquisition enablers, software containerization and code reuse platforms, and open architectures embodied in ever-maturing Government Reference Architectures.

Finally, we have a number of trailblazing programs that are actively employing these initiatives and experiencing great results. The T-7 program, our next training aircraft, is embracing model-based engineering and 3D design tools. In doing so, Boeing reduced assembly hours by 80% and cut software development time in half. The aircraft moved from computer screen to first flight in just 36 months. Our Ground Based Strategic Deterrent (GBSD) Program analyzed over 6 billion variant designs digitally prior to making a selection. GBSD's implementation of all elements of the Digital Trinity will enable faster design cycles and optimized weapon system decision making, ensuring the land-based element of our nuclear triad is a deterrent for many years to come. The A-10 Enhanced Wing Assembly program demonstrates the value these principles bring to legacy platforms. Implementing digital

engineering resulted in 236,500 operational hours returned to the A-10 fleet through individual aircraft maintenance assessments based on risk analysis methods pioneered by the organic A-10 government team. These tools have the ability to ensure airworthiness, safety, and affordability of the A-10 fleet into 2030 and beyond. We're excited about the potential of these new digital practices and look forward to reaping the benefits.

Smarter Acquisitions

As a key innovation engine for the Department of the Air Force, AFWERX teams Airmen and Guardians talent with commercial technology developers to transition agile, affordable, and accelerated capabilities. Per May 2020 direction from the Vice Chief of Staff of the Air Force, AFWERX 1.0 was combined with AFVentures and Agility Prime. In this arrangement we moved AFWERX under the Air Force Materiel Command, where the Air Force Research Laboratory provides the "organize, train, and equip" functions for AFWERX, while strategic direction is provided by the Service Acquisition Executive. In December 2020, SpaceWERX became part of AFWERX, and in January 2021, the Small Business Innovation Research and Small Business Technology Transfer Center of Excellence also joined AFWERX. Together AFWERX establishes technology, talent, and transition partnerships for competitive commercial advantage and military capability through the three lines of effort, AFVentures, Prime, and Spark.

"Air Force Ventures" or "AFVentures" is a key means of accelerating capability development by adjusting our work with startups, small businesses, and private investors. With over eighty percent of our nation's research and development (R&D) now commercial—and our Defense Industrial Base continuing to shrink through mergers and acquisitions—transforming the way we work with commercial companies is imperative. In 2018, we began energizing our Small Business Innovation Research/Small Business Technology Transfer Program (SBIR/STTR) to lower barriers for commercial tech companies, speed contracts, and bring private investment into the Defense market. Since 2018, using our AFVentures process, we have awarded more than 2,000 contracts, with over 75 percent of the recipient small businesses being new to the Department of the Air Force. Those companies have gone on to raise $2.2 billion in follow-on private capital and win $1.4 billion non-SBIR government funding, resulting in a $5.6-to-$1 Return-on-Investment for the Department of the Air Force.

This Air Force Ventures process – one in which we open the door for innovative

companies to propose ideas to the Department of the Air Force – showed strong value last year in being applied to non-Defense missions. Specifically, the AFVentures team was integrated into the Department of the Air Force Acquisition COVID-19 Task Force used to fight the COVID-19 pandemic, and asked to scale their operations to support FEMA, DHHS, and Joint priority missions. Over the course of 2020, the AFVentures process brought in over 3,700 pandemic-fighting ideas, 449 of which were identified to meet emerging COVID-19 related requirements – including PPE manufacture, digital contact tracing, and remote telework. The AFVentures evaluation approach, which can scale to evaluate hundreds of proposals in a matter of weeks, was implemented by the FEMA Emergency Response team, evaluating over 300 proposals and resulting in $645 million worth of awards. In all, the lessons learned from last year showed that the AFVentures process can be quickly implemented to solve emerging and urgent needs.

In an effort to scale the AFVentures success and accelerate transition of emerging technologies AFWERX established Prime. The first Prime program is Agility Prime. Agility Prime is a non-traditional program seeking to operationalize commercial electric vertical takeoff and landing (eVTOL) vehicles (i.e., "flying cars") for military missions to accelerate the emerging commercial market. Agility Prime is the only all-electric passenger aircraft program in the U.S. Government. So far the program has awarded more than $100M of contracts with close collaboration between FAA, NASA, DOT, DOE, and HHS. Agility Prime use cases include: humanitarian response, disaster relief, firefighting, distributed logistics, personnel recovery, disaster response, ship to shore delivery, and medical evacuation. The Department of the Air Force has unique testing and safety resources and military use cases to help mitigate current commercial market and regulatory risks. Agility Prime has been using these resources, rather than significant R&D funding, to attract investors, build confidence, and expedite commercialization, all while providing warfighters revolutionary flexibility with assessment across 13 different air mobility missions, some that will be tested in exercises beginning this year. Since releasing the Innovative Capabilities Opening in February 2020, 24 companies have applied. Two of those companies have made it through the Air Force airworthiness process, with several more following soon. This unlocks their opportunity to generate revenue for commercialization and to generate more data for accelerated learning, and civil and military certification. The program is designed to certify safety and airworthiness, procure systems for the most promising missions, and reach operational capability by FY23. Expanding our R&D

enterprise from creator to catalyst is key for accelerating dual-use technology and countering the advantages of state-sponsored industrial bases. Based on the success of this model, AFWERX Prime announced Space Prime as the follow-on to "Agility Prime." Other potential Primes go across five sectors to include commercial alternative energy, autonomy for mission and maneuver, digital engineering and advanced wargaming, supersonic travel, and microelectronics.

Foundational to the success of any of these AFWERX efforts is the amazing innovation network of Airmen and Guardians being empowered by Spark. AFWERX Spark has implemented fellowship programs to include the Defense Ventures Fellows, AFRL Fellows, and Academic fellows to rotate through AFWERX or private industry. Additionally, Spark empowers over 80 base-level Spark Cells to ensure close connectivity with current needs of our Airmen and Guardians.

Integrated and Adaptable Acquisitions

Our potential adversaries are modernizing and advancing individual systems while bringing families of systems (or systems of systems) together into an architecture to deny U.S. interests and counter potential U.S. action. To meet this threat we must not just field capable individual systems but also integrate our systems so they can work in unison to achieve the necessary operational effects on increasingly rapid timelines allowing us to fight at machine speeds. The Department of the Air Force must not only invest in war-winning capabilities but also invest in war-winning technology architectures. By way of analogy, it is no longer sufficient to have the right ingredients, but we must also have the best recipe.

To achieve this integrated approach, we continue to design, demonstrate, and evaluate a Department of the Air Force-wide integrated architecture under the auspices of our Department of the Air Force Chief Architect. This effort will require programs and platforms themselves to be built with agility via open systems and open standards so that they can adapt and upgrade components quickly in response to threats or opportunities to integrate technology as advances are made. We will also be engaged in a regular campaign of learning at the architecture level with live demonstrations and evaluations of how we fight and where we fight. This is critical to moving from simply buying ingredients and hoping they form a coherent recipe, to a deliberate approach that impacts overall Air Force and Space Force architecture design, investments,

technical requirements for future capabilities, and acquisition baseline updates for current systems.

An example of this impact of force level demonstration and evaluation occurred in February of this year during an Architecture Demonstration and Evaluation with U.S. European Command. This effort showed the importance of demonstrating and evaluating at the architecture level not only "how" the Department fights but also "where" it fights. By taking Architecture Demonstrations and Evaluations to the field, the Department uncovered mission-critical gaps that could not have been uncovered merely at test ranges. This testing allows us to discover and fix the problems now rather than on the road to conflict when it would be too late to correct. We are committed to working with our Joint and Allied Partners so that existing systems can join easily. We ask Congress to support this capability so that future operators on the battlefield enjoy the same empowered capabilities they presently enjoy at home.

Connecting With the Joint Force

One effort that will stress how fast and smart our requirements, acquisition, and operations process can move is Joint All-Domain Command and Control (JADC2) powered by the Advanced Battle Management System (ABMS). Charged by the Secretary of Defense with leading the concept development for JADC2, the Department of the Air Force is building ABMS to create decision superiority by delivering relevant information and capabilities to warfighters and operators at all echelons. ABMS will integrate today's and tomorrow's sensors; develop applications embedded with artificial intelligence, sophisticated algorithms, and multi-layered protections to make sense of massive amounts of trusted data; link space capabilities with weapons systems and personnel across all domains; and design pods, platforms, pathways, procedures, and policies that connect and integrate the warfighter better and faster than in any time in our history.

On 24 November 2020, the Department of the Air Force Rapid Capabilities Office (DAF RCO) was assigned as the Integrating Program Executive Office (PEO) for ABMS in a deliberate transition to start acquiring enduring capability through focused acquisition efforts and investments in digital infrastructure. ABMS continues to leverage technology integration opportunities borne out of rapid technology innovation and evaluation campaigns across the Department.

The ABMS acquisition effort will pursue two interconnected investment paths: enduring digital infrastructure investments and Capability Release packages, which leverage those enduring investments but focus on closing kill-chains and delivering immediate operational capability to the warfighter. DAF RCO is working in conjunction with the acquisition community to ensure Air Force and Space Force systems have seamless interoperability and compatibility to meet the JADC2 operational requirements. The six ABMS capabilities required to connect the warfighter are secure processing, connectivity, data management, applications, sensor integration, and effects integration.

Driven by requirements approved by the Chief of Staff of the United States Air Force and the Chief of Space Operations, Capability Release #1 (CR #1) (Airborne Edge Node) will focus on the edge network to enable sharing of information across 5th generation tactical air and provide situational awareness to KC-46 and C2 nodes. Data from CR #1 (Airborne Edge Node) will enable faster decision-making by the tactical, operational, and strategic customers.

Thank you again for the opportunity to testify before this subcommittee. The dialogue we have today will help us design, build, and operate a force capable of fighting and winning now and in the future.

Darlene Costello

Ms. Darlene Costello, a member of the Senior Executive Service, is the Principal Deputy Assistant Secretary of the Air Force Acquisition, Technology & Logistics. Her duties include providing expert advice and guidance on Air Force acquisition programs and procurements. Ms. Costello is also responsible for the development and execution of policies and procedures in support of the operation and improvement of the Air Force's acquisition system. She oversees an Air Force research and development, test, production and modernization program portfolio of over $40 billion annually.

Ms. Costello has held acquisition positions of increasing responsibility and at all levels of command. Within the Department of the Navy, she held positions as a project engineer, assistant design manager, and program manager. Ms. Costello was then competitively selected for the Commander's Development Program with assignments in the Office of the Secretary of Defense for Naval Warfare, the Office of the Deputy Assistant Secretary of the Nav y (Research, Development, and Acquisition) for Ship Programs, the Office of the Director for Expeditionary Warfare (OPNAV N85) Amphibious Warfare Branch, and the Program Executive Office for Aircraft Carriers.

In 2000, Ms. Costello moved from the Navy to the Office of the Secretary of Defense, as a staff specialist for Naval Warfare, Strategic and Tactical Systems, within the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics. In 2005, she was appointed to the Senior Executive Service and was promoted to the position of Deputy Director for Naval Warfare, responsible for the oversight of all Naval Warfare acquisition programs including 15 major shipbuilding programs and related weapon systems.

In 2011, she assumed the duties of the Principal Director for Strategic and Tactical Systems and Director for Acquisition and Program Management. As Principal Director, she was responsible for direct oversight of Major Defense Acquisition Programs for all strategic and tactical systems including the technical and programmatic evaluation of air, land, naval, strategic and unmanned warfare programs. As Director for Acquisition and Program Management, she was responsible for the program management functional area, including policy formulation and initiatives to improve the qualifications and abilities of Department of Defense program managers. In 2013 she became the Acting Deputy Assistant Secretary of Defense for Strategic and Tactical Systems and in 2014 was promoted to the Principal Deputy Assistant Secretary of Defense for Acquisition in the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics. She advised the Under Secretary of Defense (Acquisition, Technology and Logistics), the Deputy Secretary of Defense, and the Secretary of Defense on matters relating to the Department of Defense acquisition system; Major Defense Acquisition Programs; and strategic, space, intelligence, tactical warfare, command and control, and business system acquisitions.

EDUCATION

1989, Bachelor of Science degree in Mathematics; University of Maryland, University College, College Park

2000, Master of Science degree in Management; Florida Institute of Technology, Melbourne

CAREER CHRONOLOGY

1989 - 1995, Project Engineer, Department of the Navy

1995 - 1998, Assistant Design Manager and Program Manager, Department of the Navy

1998 - 2000, Commander's Development Program: Office of the Secretary of Defense for Naval Warfare; Office of the Deputy Assistant Secretary of the Navy (Research, Development, and Acquisition) Ship Programs; Office of the Director for Expeditionary Warfare (OPNAV N85) Amphibious Warfare Branch; Program Executive Office for Aircraft Carriers (rotational assignments)

2000 - 2005, Office of the Secretary of Defense, Staff Specialist for Naval Warfare, Strategic and Tactical

Systems, within the Office of the USD(AT&L)
2005 - 2011, Deputy Director for Naval Warfare
2011 - 2014, Principal Director for Strategic and Tactical Systems (S&TS) and Director for Acquisition and Program Management
2013 - 2014, Acting Deputy Assistant Secretary of Defense for Strategic and Tactical Systems
2014 - 2016, Principal Deputy Assistant Secretary of Defense for Acquisition in the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics
2016 - present, Principal Deputy Assistant Secretary of the Air Force Acquisition, Technology & Logistics

AWARDS
Defense Distinguished Civilian Service Award
Meritorious Presidential Rank Award
OSD Medals for Exceptional Civilian Service
AF Decoration for Exceptional Civilian Service

(Current as of July 2018)

Lieutenant General David S. Nahom

Lt. Gen. David S. Nahom is the Deputy Chief of Staff for Plans and Programs, Headquarters U.S. Air Force, the Pentagon, Arlington, Virginia. In support of the Chief of Staff and Secretary of the Air Force, he leads the development and integration of the Air Force resource allocation plan. As the Air Force's senior programmer, he leads the development, integration, evaluation and analysis of the Air Force Program across the Future Years Defense Plan. He directs and coordinates activities ensuring the Air Force builds and employs effective air, space and cyber forces to achieve national defense objectives.

Lt. Gen. Nahom was commissioned through the Reserve Officer Training Corps at the University of Colorado and is a distinguished graduate of both undergraduate navigator training and Euro-NATO Joint Jet Pilot Training. During his 31-year active duty Air Force career, the general commanded at the squadron, group and wing level and is a command pilot with more than 3,400 hours in the F-22A,Raptor, F-15A/B/C/D Langley-Eustis, Va. Eagle and F-111F Aardvark.

In addition to his flying and command experience, Lt. Gen. 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 Air Force and Air Forces Central Command. Prior to his current assignment, the general was the Director of Programs, Office of the Deputy Chief of Staff for Plans and Programs, Headquarters Air Force, the Pentagon, Arlington, Virginia.

EDUCATION
1988 Bachelor of Arts, Economics, University of Colorado, Boulder
1993 Squadron Officer School, Maxwell Air Force Base, Ala.
2001 Army Command and General Staff College, Fort Leavenworth, Kan.
2001 Master of Military Operational Arts and Science, Fort Leavenworth, Kan.
2006 Air War College, Maxwell AFB, Ala., by correspondence
2009 NATO Defense College, Rome, Italy

ASSIGNMENTS
November 1988-August 1989, Student, Specialized Undergraduate Navigator Training, Mather Air Force Base, 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, Mountain Home AFB, Idaho
June 1990- February 1993, F-111F Weapons Systems Officer, 492nd TFTS, RAF Lakenheath, United Kingdom
March 1993- July 1994, Student, 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, Tyndall AFB, Fla.
July 1995-September 1997, Aircraft Commander, Mission Commander, 71st Fighter Squadron, Joint Base Langley-Eustis, Va.
September 1997-December 1999, Flight Lead, Chief Squadron Scheduler, Operations Support Squadron, JB Langley-Eustis, Va.
December 1999--June 2000, F-15C Instructor Pilot, Assistant Director of Operations, 95th FS, Tyndall AFB, Fla.
June 2000-July 2001, Student, Army Command and General Staff College, Fort Leavenworth, Kan.
September 2002--June 2003, Chief Wing Training, F-15C Instructor Pilot, 33rd Operations Support Squadron, Eglin AFB, Fla.
June 2003-August 2005, Assistant Director of Operations, Director of Operations, 60th FS, Eglin AFB, Fla.

August 2005-June 2006, Chief of Wing Safety, 33rd Fighter Wing, Eglin AFB, Fla.
June 2006-August 2008 Commander, Deputy Commander for Maintenance Group, 60th FS, Eglin AFB, Fla.
July 2008-January 2009, Student/Senior Course Member, NATO Defense College, Rome, Italy
June 2010-July 2012, Commander, 18th Operations Group, Kadena Air Base, Japan
July 2012-March 2013, Executive Officer to Commander Pacific Air Forces, JB Pearl Harbor-Hickam, Hawaii
March 2013-August 2014, Commander, 3rd Wing, JB Elmendorf-Richardson, Alaska
September 2014-October 2015, Director of Regional Affairs, Deputy Under Secretary of the Air Force, International Affairs, Headquarters Air Force, Arlington, Va.
November 2016-April 2017, Deputy Director of Plans, Programs and Requirements, JB Langley-Eustis, Va.
April 2017-May 2018, Deputy Commander, US Air Forces Central Command; Deputy, Combined Force Air Component Commander, US Central Command, Southwest Asia
May 2018-September 2019, Director of Programs, Office of the Deputy Chief of Staff for Plans and Programs, Headquarters Air Force, the Pentagon, Arlington, Va.
September 2019-present, Deputy Chief of Staff, Plans and Programs, Headquarters Air Force, the Pentagon, Arlington, Va.

SUMMARY OF JOINT ASSIGNMENTS
July 2001-July 2002, Chief of Fighter Operations, NATO Combined Air Operations Six, Eskisehir, Turkey, as a major
February 2009-June 2010, Chief J37 Training, Readiness, and Exercises Division, U.S. Pacific Command, Yong San, Seoul, South Korea, as a colonel

FLIGHT INFORMATION
Rating: command pilot
Flight hours: more than 3,400
Aircraft flown: F-22A, F-15 A-D, AT-38, T-38, T-37 and F-111A/F

MAJOR AWARDS AND DECORATIONS
Defense Superior Service Medal with oak leaf cluster
Legion of Merit with oak leaf cluster
Distinguished Flying Cross with oak leaf cluster
Defense Meritorious Service Medal
Meritorious Service Medal with three oak leaf clusters
Air Medal with four oak leaf clusters
Aerial Achievement Medal with three oak leaf cluster
Air Force Commendation Medal with oak leaf cluster
Air Force Achievement Medal with two 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
Lieutenant General Sept. 4, 2019

(Current as of October 2019)

NOT FOR PUBLICATION UNTIL RELEASED BY
THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AVIATION AND LAND FORCES

STATEMENT OF

FREDERICK J. STEFANY
ACTING ASSISTANT SECRETARY OF THE NAVY FOR
RESEARCH, DEVELOPMENT AND ACQUISITION (ASN (RD&A))

LIEUTENANT GENERAL MARK R. WISE
DEPUTY COMMANDANT FOR AVIATION

AND

REAR ADMIRAL ANDREW LOISELLE
DIRECTOR AIR WARFARE

BEFORE THE

TACTICAL AIR AND LAND FORCES SUBCOMMITTEE OF THE

HOUSE ARMED SERVICES COMMITTEE

ON

DEPARTMENT OF THE NAVY FISCAL YEAR 2022 BUDGET REQUEST FOR TACTICAL AVIATION

JULY 13, 2021

NOT FOR PUBLICATION UNTIL RELEASED BY
THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AVIATION AND LAND FORCES

Chairman Norcross, Ranking Member Hartzler and distinguished members of the Subcommittee, thank you for the opportunity to appear before you today to address the Department of Navy's (DON) Fiscal Year (FY) 2022 budget request for Tactical Aviation (TACAIR) programs. TACAIR proficiency is critical to winning the high-end fight, and we thank Congress and this Committee for your support of these programs in the FY 2021 Authorization and Appropriation Acts.

In an increasingly interconnected and interdependent world, a dominant naval force and a strong maritime strategy are critical to the security of the Nation. The global security environment is increasingly influenced by our competitors, requiring the Navy and Marine Corps team to operate continually to provide credible combat power forward and a ready response force to global crises and disasters. As our national security posture evolves to confront new challenges, the DON continues to invest in key capabilities that maximize our naval power contribution to the Joint Force and ensure a proper balance of readiness, capability, and capacity within the limits of available resources.

To address growing demands placed on our warfighters, the DON is making necessary investments in lethal capabilities, maintenance and flying hours across a broad spectrum of platforms and programs. We will deliver 54 new manned aircraft and four unmanned aircraft to Navy and Marine Corps units in FY 2021, improving capability and enabling the divestiture of less affordable and less capable legacy systems. The Department achieved over 80 percent Mission Capable rates for the F/A-18E/F and EA-18G fleet in FY 2020 and continues that positive trend in FY 2021. With higher numbers of aircraft available, our aircrew are more ready to fly and fight than at any point over the last 10 years. An important element of sustaining this momentum is consistent funding for our aviation depots and an increase in flight hour funding to translate gains in aircraft readiness into improved aircrew proficiency.

In order to increase capabilities of our 4th and 5th generation aircraft, we have invested in research and development of advanced sensor and electronic warfare (EW) capabilities, such as Next Generation Jammer (NGJ), that will provide an increase in capability against radar, communications and non-traditional EW targets. Additionally, we have been working to increase the internal weapons bay capability onboard F-35s to allow integration of new 5th generation compatible weapons such as Advanced Anti-Radiation Guided Missile – Extended

Range (AARGM-ER), enabling power projection and suppression of enemy air defenses.

The Department continues maturation of critical warfighting investments. In March 2021, VFA-147, the first operational F-35C squadron, completed the longest at-sea period (approximately five weeks) by F-35Cs onboard USS Carl Vinson (CVN 70). VFA-147 completed missions in all warfare areas while reporting a 97.6 percent sortie completion and 80 percent Mission Capable rates. During the same timeframe, the Marine Corps successfully completed its sixth F-35B deployment with VMFA-122, achieving an average readiness rate across all Marine Expeditionary Units (MEUs) of 75.6 percent. Currently, VMFA-211 is executing the seventh F-35B deployment jointly with U.K. forces aboard the HMS QUEEN ELIZABETH and with an average readiness rate of 85.3 percent. Additionally, FY 2021 funds supported Engineering and Manufacturing Development (EMD) for the ALQ-249 NGJ Mid-Band (NGJ-MB), which received Milestone C approval to enter the Production and Deployment phase and proceed with Low Rate Initial Production last month. NGJ Low-Band (NGJ-LB) had a successful Milestone B event and awarded an EMD contract in December 2020, which included eight operational prototypes to begin delivery in FY 2026. These crucial investments will continue to advance our warfighting edge against strategic competitors.

The Fiscal Year 2022 President's Budget Request

The President's FY 2022 budget advances key DON priorities to defend the nation, innovate and modernize the Department, increase resilience and readiness, and build a workforce to compete and win. It balances the urgent readiness needs of our force today with investments that maximize our naval contribution to the Joint Force, and reflects hard decisions to divest of less capable platforms and systems, freeing resources to invest in a future force that can deliver greater efficiency and effectiveness.

While the Aircraft Procurement account is decreasing overall in FY 2022 as several platforms reach end-of-purchase, including F/A-18E/F Super Hornet, P-8A Poseidon, and VH-92 Presidential Helicopter, this request does increase the lethality and capability of the aviation portfolio by funding leading edge technology development and platform modernization. The budget requests funding for 48 fixed wing aircraft including 20 F-35C carrier variants, 17 F-35B Short Takeoff and Vertical Landing variants, five E-2Ds and six KC-130J aircraft. The budget maximizes carrier air wing (CVW) lethality with capability improvements to 4th and 5th generation

fighters, funding F-35C procurement and modernization that will field six F-35C CVWs by FY 2026. Delivering 4th and 5th generation transformational capabilities to front-line forces as soon as possible remains a top priority.

The FY 2022 budget continues investment in aviation research and development programs. Research, Development, Test and Evaluation (RDT&E) funding will be used to continue development of F-35 Block 4 capabilities to support initial fleet availability of Block 4 upgrades and Infrared Search and Track (IRST) improvements for F/A-18 E/F. The budget also requests RDT&E funding for NGJ Mid and Low Band to continue development and test of this multi-generational leap in Advanced Electronic Attack (AEA) capability.

The budget carefully balances resources and requirements to weigh the effects of program decisions on the industrial base. It ensures our nation maintains the skills, capabilities, and capacities critical to our national defense, maximizing efforts in support of the President's Build Back Better initiatives. The budget shows a realistic and forward-thinking approach to future force planning, while providing future capability requirements within projected budgets, and helps keep America's industrial base loaded at an executable level.

Summary

The Department of the Navy continues to deliver aviation platforms with the capability we need to address today's maritime challenges while looking ahead to tomorrow's evolving security environment. With Congress' continued support, we will provide the Nation with the Integrated All-Domain Naval Power required for the Joint Force to win today and tomorrow.

Programmatic details regarding Navy and Marine Corps capabilities are summarized in the following section.

U.S. NAVY AND MARINE CORPS TACTICAL AVIATION CAPABILITIES

TACTICAL AVIATION

Carrier Air Wing (CVW)

The striking power of the CVW remains the cornerstone of power projection capability from 11 of the world's most survivable airfields, our aircraft carriers (CVNs). The current CVW is transitioning to an optimal mix of 4th and 5th generation strike fighter aircraft necessary to compete with potential adversaries in the 2020's. The Navy is managing 4th generation F/A-18 inventory

requirements through Service Life Modification (SLM) and 5th generation requirements through F-35C procurement. SLM extends the existing 4th generation capacity while adding advanced Block III capability at one-third the cost of new procurement F/A-18 aircraft. The active F-35C production line and the F/A-18E/F SLM effort are the critical levers for the Navy to manage strike-fighter inventory into the 2030s, ensuring the service maintains the capacity required to meet Global Force Management (GFM) demand while investing in the new technologies required to win against the pacing threat.

Next Generation Air Dominance (NGAD)

The Navy remains committed to the accelerated development of the Next Generation Air Dominance (NGAD) Family of Systems (FoS) and other key aviation wholeness investments. This decision ensures the CVW will maintain capable strike fighter capacity to pace the most stressing threat through the 2030s. NGAD FoS will leverage manned and unmanned teaming to deliver increased lethality and survivability. F/A-XX is the strike fighter component that will replace F/A-18E/F in the NGAD FoS.

F/A-XX will provide advanced carrier-based power projection within the CVW and maintain CVN relevance in contested threat environments. F/A-XX is currently undergoing concept refinement to assess potential capabilities and technologies. During this phase, iterative collaboration between Government and industry teams will lead to the development of vendor concepts that balance advanced air dominance capabilities and long-term affordability.

Strike Fighter Inventory Management

The DON is carefully managing strike fighter capacity to reduce readiness gaps and future inventory shortfalls. Strike Fighter Inventory Management (SFIM) tracks three critical and independent factors: depot maintenance ability to sustain the fleet; new procurement to replace end-of-service life aircraft; and utilization rates required for force generation. Currently, there are sufficiently funded resources and levers to drive execution-year Strike Fighter Shortfall (SFSF) to zero for all deploying squadrons and overall SFSF to zero by FY 2025. These levers include ongoing F-35C production, 78 remaining F/A-18E/F deliveries, 28 aircraft returning from long-term down status, and F/A-18E/F SLM and capability improvements. Additionally, in the last year,

F/A-18E/F Primary Aircraft Authorized forecast for FY 2025 was reduced by 20 aircraft due to changes in the adversary recapitalization plan.

In FY 2021, the DON's near-to-mid-term capacity and readiness risk was reduced from high to medium due to reform efforts. The Department invested in industrial equipment assets for the Fleet Readiness Centers, and Naval Aviation Maintenance Centers of Excellence returned long-term down aircraft to the fleet.

In FY 2020 F/A-18 SLM delivered three mission capable aircraft with a service life of 7,500 hours, adding approximately seven additional years to the life of the aircraft. In FY 2021 there have been five SLM aircraft delivered to date, with an additional four SLM deliveries expected this fiscal year. FY 2022 inductions will include 15 aircraft. The SLM program continues to mature, decreasing cost and schedule while extending the service life and capability of existing F/A-18E/F inventory. The Department is actively managing SLM performance through a Perform to Plan (P2P) approach.

Tactical Aircraft Force Mix

The Carrier Air Wing of the future focuses on coupling the 5th generation combat capabilities resident aboard the F-35C with the weapons capacity aboard the 4th generation F/A-18 E/F. Continued investment in the survivability and lethality in our Lightning II, Super Hornets, and future weapons will ensure Department investments directly counter and defeat our adversaries' combat advancements. The F-35C also brings other unique warfighting capabilities to the USMC and the Marine Air-Ground Task Force. Combined with the TACAIR Integration commitment, the F-35C will integrate and deploy for all USMC global force commitments except MEU deployments, which require vertical landing capability aboard L-Class ships.

In 2020, the Marine Corps contracted a third party to study the TACAIR transition plan and force posture. That study was released in March of this year. The Marine Corps is currently conducting a force analysis of manpower posture to redesign the force for maximum efficiency and to align with the Commandant's Force Design planning guidance. This analysis includes training models, pilot and maintainer qualification requirements, and unit end-strength models. The Marine Corps continuously evaluates the number of TACAIR squadrons in order to ensure support to the Combatant Commanders, while effectively managing the deployment tempo our personnel and equipment.

The Navy has divested from legacy Hornets at the operational edge, with the Reserve component and Naval Aviation Warfighting Development Center following in 2022. This also affords the Marine Corps the opportunity to select the remaining "best of breed" legacy Hornets to maximize the overall readiness, capacity, and capability to round out the Department's inventory.

Pilot and Aircrew Shortfalls and Mitigation Strategies

Naval Aviation continues to meet all fleet requirements. The Department is continually evaluating and analyzing diversity, equity, and inclusion (DE&I) within Naval Aviation. This analysis has informed our lines of effort for broadening recruitment and outreach efforts to attract underrepresented talent, as well as focusing on retention efforts to ensure the Department retains those with the qualifications needed. Retention and merit-based bonuses and incentive pay are showing some success in retaining Post-Command Commanders, though Aviation Department Head acceptances are still short in some type model series. The Department expects competition for talent with industry will continue, requiring a robust and competitive compensation program to recruit, retain, and distribute the force. The Department remains committed to attracting and retaining a diverse talent pool of highly qualified Naval aviators.

F-35 Joint Strike Fighter

The F-35 Joint Strike Fighter will develop and field an affordable, highly common family of next generation strike aircraft for the DON, the Air Force, and international partner countries. F-35 has unique capabilities that cannot be matched by modernizing 4th generation aircraft – enabling shortened engagement times, and less exposure to threats, while retaining the element of surprise. Both the F-35B and F-35C are vital to our future as they become the lethal cornerstone of our naval air forces. During the next 10 years, the Navy and Marine Corps will transition 21 squadrons to the F-35 as we replace our aging legacy fleet.

The Marine Corps has already established two Fleet Replacement Training Squadrons, one operational test squadron, and six operational line squadrons. USMC F-35Bs are currently deployed with the 31st MEU / USS AMERICA (LHA-6) Amphibious Readiness Group in the INDO-PACOM area of responsibility. The MEU's composite Air Combat Element included six F-35Bs. Additionally, 10 F-35Bs from VMFA-211, the "Wake Island Avengers", are deployed

with eight F-35Bs from the UK's 617 Squadron aboard HMS QUEEN ELIZABETH (R08) as part of the Carrier Strike Group 21 joint deployment with ships and a submarine from the UK, US, and the Netherlands. Three F-35B squadrons have operated in combat.

The Navy has established one Fleet Replacement Training Squadron, one operational squadron, and has completed the transition of the first USMC F-35C squadron. This summer, the first operational squadron will embark aboard the USS Carl Vinson for the maiden F-35C deployment. The second Navy operational squadron is in transition and is scheduled to complete in February 2022. TOPGUN is operating two F-35Cs and has incorporated the F-35C into the 4th / 5th generation Fighter integration events in TOPGUN classes.

The Department remains committed to reducing F-35 costs, successfully reducing the recurring flyaway costs. The F-35 Program identified seven levers to meet Service cost per flying hour (CPFH) / cost per tail per year (CPTPY) affordability targets. In June the Program Office reached a handshake agreement on a CY 2021-2023 air vehicle sustainment contract, a key step towards achieving the DON's cost targets. Based on the current contract structure, CPFH of approximately $30,000 could be achievable by 2025. We are also working to decrease operation and sustainment costs targeting steady state CPTPY of $6.8 million for the F-35B by 2033, and $7.5 million CPTPY for the F-35C by 2036.

The F-35 enterprise is addressing the F-135 Engine Power Module (PM) shortfall issue through three lines of effort: increasing Heavy Maintenance Center (HMC) Tinker throughput; increasing and accelerating other enterprise depot capacity; and reducing fleet demand by increasing time on wing. The latest analysis of these areas indicates that enterprise depot PM repair capacity will meet demand by 2024, and the backlog of non ready for issue PMs will be eliminated by 2029. This progress was enabled by reductions in repair turnaround time at HMC Tinker from 240 to 183 days, trending on glideslope to the target of 122 days. HMC Tinker has produced more PMs in the first have of 2021 than all of last year. As the Service Acquisition Executive, the DON is working with the USAF and the F-35 Joint Program Office to assess F-135 and PM sparing posture, which will inform future requirements and budgets.

The FY 2022 President's budget requests $5.3 billion in Aircraft Procurement (APN) funds for 17 F-35B and 20 F-35C aircraft, modifications and spares.

F-35 Continuous Capabilities Development and Delivery (C2D2)

The F-35 program has closed the Block 3F System Development and Demonstration phase and has shifted to an aircraft modernization program in order to maintain the advantage over advancing adversary fighters and ground-based radar threats.

Towards that end, the Department restructured the original Block 4 Follow-on Modernization acquisition strategy into a more agile Continuous Capabilities Development and Delivery (C2D2) model. The C2D2 approach develops capability in smaller, more easily managed increments, and advances departmental goals of reducing C2D2 risk and lowering cost. To continue the delivery of capability to the warfighter in FY 2022, the DON requests $998 million in RDT&E.

F/A-18 A/B/C/D Hornet

Service Life Modification, High flight hour (HFH) and Center Barrel Replacement (CBR+) efforts extend the F/A-18 A-D beyond its original service life of 6,000 hours to 9,000 hours, and in select aircraft, up to 10,000 flight hours. Twenty-three aircraft were inducted for HFH and/or CBR+ and included SLM modifications in FY 2020 with 17 aircraft planned for delivery in FY 2021. Along with flight hour extensions, these aircraft require capability upgrades to their radars, electronic warfare suites, and avionics systems to maintain lethality, survivability, availability, and interoperability with 5th generation strike fighters. These capability requirements enable the Marine Corps to operate the F/A-18 A-D through FY 2030, supporting the TACAIR transition to F-35B/C. Overall Readiness and Sustainment of the F/A-18A-D platform provided an average mission capable rate of 64 percent in calendar year 2020 and 67 percent in calendar year 2021 to date.

The FY 2022 President's Budget requests $172.8 million in APN for F/A-18 A-D. This includes $140.2 million to implement aircraft commonality programs, enhance capability, improve reliability, and ensure structural safety of the F/A-18 A-D inventory and $32.6 million for the continuation of the Hornet SLM.

F/A-18E/F Super Hornet

The F/A-18E/F Super Hornet will be the numerically predominant aircraft in the CVW into the 2030s. Continued delivery of new aircraft, capability enhancements and SLM

significantly improves CVW lethality. There are 78 remaining new production Block III aircraft that commenced delivery in FY 2021 and complete in FY 2025. In tandem with these Block III deliveries, SLM initiatives and capability upgrades enhance our inventory by maintaining the tactical relevance of the F/A-18 E/F. Under a separate acquisition program, the F/A18E/F enhanced Block I IRST completed a highly successful combat deployment with CVW-17 to CENTCOM Area of Responsibility. IRST Block II development and testing continues and is on track to Initial Operational Capability (IOC) in the fourth quarter of FY 2022, bringing critical out-of-band detection and weapon-quality-track capability against advanced air threats.

In terms of overall readiness and sustainment of the F/A-18E/F platform, the average mission capable rate of Primary Mission Inventory Aircraft was 80 percent for the F/A-18E/F in FY 2020 and continues that positive trend in FY 2021. The FY 2022 President's Budget requests $87.8 million of APN for support costs associated with the final delivery of F/A-18 E/F aircraft. Additionally, the budget requests $1,112.4 million of APN for F/A-18 A-D Unique, F/A-18 E/F and EA-18G Modernization and Sustainment, IRST, and F/A-18 Series. Finally, the FY 2022 budget requests $316.9 million of RDT&E for improvements, radar upgrades and Block III development.

AV-8B Harrier

During FY 2020 and FY 2021, the AV-8B Harrier program completed critical Fleet required Validation/Verifications to enhance flight safety, increase readiness and improve supply chain asset management. The program completed Joint Standoff Weapon (JSOW) integration and continued development of final fit capabilities including Sidewinder Air-Intercept Missile (AIM-9X) integration, expanded JSOW and Joint Direct Attack Munition (JDAM) capabilities, and enhanced Link-16 functionality. These upgrades enabled three combat deployments and are preparing the platform for continued MEU support through 2028.

The FY 2022 budget request initiates a time-phased budget transition from investment accounts toward Operations and Maintenance, Navy to support platform sustainment during sundown. $10.1 million in RDT&E funds continue design, development, integration and test of final fit platform capabilities. $17.9 million in APN continues the incorporation of Obsolescence Replacement/Readiness Management Plan systems, electrical and structural enhancements,

LITENING Pod upgrades, engine safety, digital interoperability upgrades that include Link-16, and inventory sustainment upgrade efforts to offset obsolescence and attrition.

AIRBORNE ELECTRONIC ATTACK (AEA)

EA-18G Growler

The EA-18G Growler is a critical enabler for the Joint force, bringing fully netted electronic warfare capabilities to the fight and providing essential capabilities in the Electromagnetic Maneuver Warfare environment. NGJ pods will augment and eventually replace the legacy ALQ-99 pods on the EA-18G and provide full spectrum integrated non-kinetic effects. The delivery of NGJ increases EA-18G Growlers lethality and capability against radar, communications, and non-traditional EW targets utilizing advanced AEA techniques while providing improved reliability and maintainability. Growler Capability Modifications started in FY 2021, consisting of the AEA System Enhancement upgrade and Integrated Capability Package 3. These modifications will improve emitter detection and electronic attack performance, and provide the ability to carry the NGJ-MB upon pod IOC.

Next Generation Jammer (NGJ)

The NGJ is the follow-on to the legacy AN/ALQ-99 to counter electronic warfare capabilities and keep pace with the evolving threat. NGJ will maximize the survivability and lethality of the Navy's 4th and 5th generation aviation platforms, strike weapons, and support all Services and joint/coalition air, land, and sea tactical strike missions. NGJ will be implemented via three separate programs: Mid-Band (MB), Low-Band (LB), and High-Band. NGJ-MB has entered developmental test, with positive results to date. NGJ-MB has a frequency range which covers the highest density threats and completed Milestone-C in June 2021. Currently in the Production and Development phase, NGJ-MB is focused on the development and delivery of test pods for ground and flight test activities, as well as the continued build of six System Demonstration Test Articles. NGJ-MB is a cooperative development, production and sustainment program with Australia. The FY 2022 budget includes $243.9 million in RDT&E funding for NGJ-MB to focus on instrumented test pod deliveries, continued mission system flight test and expansion of the flight envelope, and $266.7 million in APN funding for five Low Rate Initial Production II shipsets, associated support equipment and production support.

NGJ-LB had a successful Milestone B event and awarded an EMD contract in December 2020, which includes the delivery of eight operational prototypes. NGJ-LB is a critical AEA capability to augment and replace legacy ALQ-99 Tactical Jamming System on the EA-18G in the low frequency bands not covered by MB. The FY 2022 budget request $248.1 million RDT&E for NGJ-LB to focus on pod design, advanced capabilities development, and support to flight test. NGJ-LB is a cooperative development program with Australia.

WEAPONS PROGRAMS

The Department continues to support a wider, more systematic approach towards delivering offensive weapons balance. By preserving the readiness and capacity of our key strike weapons inventories, pursuing strike weapon capability enhancements, and developing next-generation strike missile capabilities to address emerging threats, the DON will increase overall force effectiveness to address emerging threats.

Offensive Anti-Surface Warfare (OASuW) Increment 1/ Long Range Anti-Ship Missile (LRASM), OASuW Increment 2, OASuW Navy JASSM

OASuW Increment 1/LRASM provides Combatant Commander the ability to conduct ASuW operations against near/mid-term high-value surface combatants protected by Integrated Air Defense Systems with long-range Surface-to-Air-Missiles and to deny adversaries sanctuary of maneuver. The program achieved Early Operational Capability on the Air Force B-1B in early FY 2019 and on the Navy's F/A-18E/F aircraft in early FY 2020. The FY 2022 President's Budget completes Navy LRASM 1.1 development, which will deliver incremental upgrades to keep pace with emerging threat capability and also supports procurement of 48 LRASM missiles. .

The FY 2022 President's Budget requests New Start authority to begin Technology Development in support of OASuW Increment 2. OASuW Increment 2 will provide a carrier-based, long range, air launched ASuW weapon to address advanced threats from sanctuary and enable the Navy to operate in, and control, contested battle space in littoral waters and A2/AD environments.

The FY 2022 President's Budget requests procurement of the Navy JASSM-ER with 20 missiles. The F/A-18E/F is capable of employing the USAF's Universal Armament Interface (UAI) compliant JASSM-ER and will complete full integration by delivery. This JASSM-ER

AGM-158 derivative will enhance the Navy's long range strike capability and respond to rapidly changing threats in the maritime environment.

Advanced Anti-Radiation Guided Missile (AARGM) & AARGM Extended-Range

AARGM procurement completed in FY 2021 with deliveries continuing through FY 2024 in support of the transition to AARGM-ER. AARGM-ER provides the DON with a 5th generation compatible extended range asset to project power and provide Suppression of Enemy Air Defenses, both at-sea and on land. There have been 1242 AARGMs (All Up Rounds, Training Missiles, and Spares) delivered to the Fleet (as of 28 June 2021). Program of record delivery is 1803 missiles. The FY 2022 President's Budget requests $116 million in WPN to procure 54 AARGM-ER missiles and supports operational testing of production representative hardware.

Sidewinder Air-Intercept Missile (AIM-9X)

The AIM-9X (Sidewinder) missile is a "launch-and-leave" munition that employs passive infrared energy for acquisition and tracking of enemy aircraft. The FY 2022 budget requests $23.9 million in RDT&E that will be applied toward the EMD of critical hardware redesign driven by obsolescence; and development of hardware and software to maintain required performance against evolving threat countermeasures. The budget also includes $86.4 million in WPN funding to procu a combined 178 All-Up-Rounds and Captive Air Training Missiles and associated missile/trainer related hardware.

Advanced Medium-Range Air-to-Air Missile (AMRAAM/AIM-120D)

The FY 2022 budget requests $32.6 million in RDT&E. The RDT&E will be applied toward continued software capability enhancements to counter emerging threats; completion of test and fleet release of System Improvement Program missile. Due to the AMRAAM Form, Fit, Function, Refresh (F3R) program experiencing hardware integration issues resulting in a 13 month schedule slip in 2020, AMRAAM procurement quantities were minimized through FY 2022 Lot 36, therefore allowing the DON to fund higher priority requirements in FY 2022.

Small Diameter Bomb II (SDB II)

Small Diameter Bomb Increment II (SDBII) is an Air Force led, joint program that provides the warfighter a capability to attack mobile targets in all weather conditions from stand-off range. The FY 2022 budget requests $46.8 million in RDT&E for continued development/test of the SDB II weapon, F-35 developmental testing and integration, Boeing BRU-61 integration and support for integration of BRU-55 racks on F-18 midboard stations. The Department also requests $40.9 million in WPN to procure 180 All-Up-Round weapons.

Harpoon II+

The FY 2022 budget request does not include procurement funds for additional Harpoon HII+. However, the Navy will continue to receive Harpoon II+ deliveries via the Sales Exchange Agreement through FY 2025.

Joint Air-to-Ground Missile (JAGM)

The Joint Air-to-Ground Missile (JAGM) is the replacement for Hellfire missile. JAGM is an air-launched missile system, which utilizes multi-mode seeker technology providing advanced line-of-sight and beyond-line-of-sight capabilities. The FY 2022 budget requests $0.356 million in RDT&E to support completion of JAGM integration on the USMC AH-1Z. The budget request also includes $49.7 million in WPN to procure 164 tactical missiles and six Captive Air Training Missiles.

Advanced Precision Kill Weapon System II (APKWS II)

APKWS II provides high-stowed precision capability combined with low-yield warheads to reduce the risk of collateral damage while achieving the desired effect on the target. The FY 2022 budget requests $24.3 million in Procurement of Ammunition, Navy and Marine Corps (PANMC) for procurement of 1,038 APKWS II guidance section kits for use on both rotary-wing and fixed-wing platforms.

Direct Attack Weapons and General Purpose Bombs

Fully funding the General Purpose Bombs and JDAM line items are critical to building and maintaining the DON's direct attack weapons inventory. The FY 2022 budget requests

$48.6 million for General Purpose Bombs, $74.1 million to procure 2,971 JDAM kits, and $52.2 million for more affordable practice bombs to enhance readiness and prepare for future contingencies.

OPERATIONAL TESTING

Currently there are two dedicated Navy Aviation Operational Test (OT) squadrons (VX-1/VX-9) that provide mitigation to risk-to-mission and risk-to-force for new and emerging capabilities. Each squadron manages OT for multiple Type Model Series (TMS) aircraft with a dedicated, military and civilian, staff of specialized operators, aircrew, test professionals, and maintainers; as well as contracted support for maintenance, project planning, and administrative functions. These squadrons are responsible for the test and evaluation of capabilities (weapon capabilities, platforms, networks, etc.) in the anticipated operational environment, against anticipated threats, using anticipated procedures, and using representative operators and maintainers to determine the effectiveness, suitability, lethality, and survivability of each capability.

The DON is continuing to search for more effective and efficient ways to conduct aviation OT, and satisfy OT requirements. While the majority of Navy aviation OT will continue to be conducted by dedicated OT squadrons, the Aviation Test community is reviewing current processes to identify real opportunity for efficiencies and to integrate with acquisition to reduce serial evaluation. There is potential to improve OT effectiveness, while maintaining a high level of confidence in the OT process. Part of these efforts include implementing "Capabilities Based" Test & Evaluation across the test continuum, accelerating early discovery, reducing overall cost, and providing relevant decision quality information while there is time and budget to make decisions, as well as focusing on Mission-Based vice Specification-Based testing. A key focus area will be achieving a clear differentiation between test and test support activities in order to baseline the true costs of OT.

Frederick J. Stefany
Assistant Secretary of the Navy for Research, Development and Acquisition (Acting)

On January 20th 2021, Mr. Frederick J. (Jay) Stefany assumed the duties of Acting Assistant Secretary of the Navy for Research, Development and Acquisition. In October 2019, Mr. Stefany began serving as the Principal Civilian Deputy to the Assistant Secretary of the Navy for Research, Development and Acquisition (ASN RDA). His responsibilities include oversight and policy for Navy and Marine Corps research, development, and acquisition/sustainment programs for shipbuilding, aviation, space, weapon systems, and communication systems. His portfolio includes oversight of more than 100,000 people and an annual budget in excess of $50 billion. Mr. Stefany also leads the Department's Senior Executive Acquisition Corps.

Prior to that he served as the Deputy Assistant Secretary of the Navy for Ship Programs from April 2018 through September 2019. In this role, he was responsible for executive oversight of all naval shipbuilding programs, major ship conversions, and the modernization and disposal of in-service ships. He was also responsible for executive oversight of cost, schedule and performance of surface ship, submarine, and Marine Corps combat systems, electronic warfare systems, shipboard radars, and Navy missile defense programs.

Previously Mr. Stefany served as Executive Director, Amphibious, Auxiliary and Sealift Office, Program Executive Office, Ships. He provided executive leadership to 200 personnel and oversaw one of the broadest acquisition portfolios in the Navy. His responsibilities spanned four major program offices where he oversaw several major shipbuilding programs including LHA 6, LPD 17, EPF, ESB, T-AKE, T-AO(X), and Heavy Icebreaker ship classes, as well as ship-to-shore connectors, landing craft, research ships, service craft & boats, and procurement of vessels for our Foreign Military Sales and other Federal Government partners.

Mr. Stefany entered the Senior Executive Service in March 2012, and has been in civil service for more than 37 years. Serving in a variety of key leadership positions throughout his career, including Program Manager and Deputy Program Manager for the LPD 17 Class Amphibious Transport Dock ship program (2004-2012). During his tenure, the first six ships of the San Antonio Class were delivered; and construction started on four additional hulls. He also assumed responsibilities for management of the initial concept work on a replacement for the Navy's Command & Control Ships and later, the replacement for the LSD 41 and 49 class ships.

Previous assignments include Director of Naval and Commercial Construction (2002-2004), responsible for oversight of the Navy's portfolio of Amphibious, Auxiliary and Special Mission ships and craft for the Assistant Secretary of the Navy for Research, Development and Acquisition (ASN RD&A); Assistant Program Manager in PMS 377 for LCAC and for Amphibious Ship Combat/C4I Systems; and Project Engineer for both the LHD 5-7 and LHD 1-4 ship acquisition programs as PMS 377 delivered LHD 1-6 and LSD 52 to the Fleet.

Mr. Stefany received his bachelor's of science in mechanical engineering from Lehigh University, Bethlehem, Pa., and his master's of science degree in management from the Florida Institute of Technology, Melbourne, Fla. He is also a 1996 graduate of the Defense Systems Management College, Advanced Program Management Course. During his distinguished federal career, Mr. Stefany has received the Presidential Rank Award for Meritorious Service, Navy Civilian Meritorious Service Award and two Navy Civilian Superior Service Awards.

11 Feb 2021

Lieutenant General Mark R. Wise
Deputy Commandant for Aviation

Lieutenant General (LtGen) Mark R. Wise was born in Amarillo, TX, and is a graduate of the University of Washington in Seattle, Washington, and the Naval War College in Newport, RI.

LtGen Wise served as the Commanding Officer of Marine Fighter Attack Squadron (VMFA) 122 Crusaders from 2003 to 2004 during which the squadron deployed in support of the Unit Deployment Program. He commanded Marine Aircraft Group (MAG) 12 from 2008 to 2009 during which he supported numerous exercises throughout the Western Pacific Region. From 2011 to 2013, he served as Commanding General, Marine Corps Warfighting Laboratory aboard Marine Corps Base Quantico, VA. From 2016 to 2018, LtGen Wise served as Commanding General, 3rd Marine Aircraft Wing (MAW) aboard Marine Corps Air Station Miramar.

LtGen Wise's operational tours include service with VMFA-333 during Operation DESERT SHIELD and Operation DESERT STORM; VMFA-312 with Carrier Air Wing (CVW) 8 aboard the USS THEODORE ROOSEVELT during Operation DENY FLIGHT and Operation SOUTHERN WATCH (OSW); the 58th Fighter Squadron during OSW; and VMFA-251 with CVW-1 and the USS GEORGE WASHINGTON in support of OSW.

LtGen Wise's staff tours include various billets with MAG-31 and MAG-12 between 1998 and 2008 as well as assignment to Headquarters Marine Corps, Aviation from 1999 to 2001. In 2009, he deployed to Kabul, Afghanistan, as an individual augment to the International Security Assistance Force. In 2010, LtGen Wise returned to Headquarters Marine Corps and served as the Deputy Branch Head for Aviation Plans, Policies, Budget, and Joint Matters until 2011. From 2011 to 2013, while serving as the Commanding General of the Marine Corps Warfighting Laboratory, he also served as the Vice Chief of Naval Research. In 2013, LtGen Wise was assigned as the Assistant Wing Commander, 3rd MAW and in 2014, he was assigned as the Deputy Commander, United States Forces Japan. From 2018-2020, he served as the Assistant Deputy Commandant for Combat Development & Integration and Deputy Commanding General Marine Corps Combat Development Command. LtGen Wise assumed his current position as the Deputy Commandant for Aviation, Headquarters Marine Corps in July 2020.

LtGen Wise's personal decorations include the Defense Superior Service Medal, Legion of Merit, Bronze Star, Meritorious Service Medal with gold star in lieu of second award, Air Medal - individual action with combat "V", Strike Flight Air Medal eighth award, Joint Commendation Medal, Navy and Marine Corps Commendation Medal with gold star in lieu of second award, and Air Force Commendation Medal. He has more than 3,500 flight hours primarily in the F/A-18 Hornet and F-15C Eagle.

Rear Admiral Andrew J. Loiselle
Director, Air Warfare, Office of the Chief of Naval Operations (OPNAV N98)

Rear Adm. Andrew J. Loiselle is a native of Cranston, Rhode Island and a 1988 graduate of Assumption College with a degree in mathematics. He was commissioned through the Naval Reserve Officers Training Corps program at Holy Cross. He earned his Wings of Gold in January 1991. He earned an Executive Master of Business Administration through the Naval Postgraduate School with a Financial Management subspecialty in 2004 and graduated from the Navy's nuclear power school with honors in 2007.

His tours at sea include Fighter Squadron (VF-142) in the F-14B, Strike Fighter Squadron (VFA-195), and command of VFA-146 in the FA-18C, executive officer of USS Theodore Roosevelt (CVN 71), command of USS Gunston Hall (LSD 44), and USS George H. W. Bush (CVN 77).

Ashore tours include Air Test and Evaluation Squadron Nine (VX-9) in China Lake, VFA-125 in Lemoore, J35 on the Joint Staff and executive assistant to Deputy Chief of Naval Operations for Operations (N3/N5), Plans and Strategy, Office of the Chief of Naval Operations.

Flag tours include deputy director, Future Joint Force Development (J7), Joint Staff, Commander Carrier Strike Group EIGHT aboard the flag ship USS Harry S. Truman (CVN 75), and as Commander Carrier Strike Group FOUR.

Loiselle became Director, Air Warfare (N98) in June 2021.

Loiselle has accumulated more than 3,600 mishap-free fighter flight hours and has more than 875 arrested landings on 10 different aircraft carriers.

His awards include Defense Superior Service Medals, Legion of Merit Medals, Meritorious Service Medals, Air Medals, Navy Commendation Medals (one with Combat V) and numerous unit and campaign citations.

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COMMITTEE ON ARMED SERVICES
U.S. HOUSE OF REPRESENTATIVES

STATEMENT

BY

DR RAYMOND D. O'TOOLE, JR.

ACTING DIRECTOR, OPERATIONAL TEST AND EVALUATION

OFFICE OF THE SECRETARY OF DEFENSE

BEFORE THE

HOUSE ARMED SERVICES COMMITTEE

TACTICAL AIR AND LAND FORCES SUBCOMMITTEE

ON

FISCAL YEAR 2022 BUDGET REQUEST OF THE DEPARTMENT OF DEFENSE FOR FIXED-WING TACTICAL AND TRAINING AIRCRAFT PROGRAMS

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COMMITTEE ON ARMED SERVICES
U.S. HOUSE OF REPRESENTATIVES
HASC – JULY 13, 2021

Raymond D. O'Toole, Jr.
Acting 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 provide an update regarding ongoing F-35 operational test and evaluation activities and relevant test and evaluation infrastructure and resource challenges. As requested, I will also provide an overview of my role, participation, and actions during formulation of the fiscal year (FY) 2022 President's Budget.

The Department of Defense conducts operational test and evaluation in order to determine a system's operational effectiveness, including lethality, operational suitability, and survivability. The objective is to inform warfighters and decision makers of a system's capabilities and limitations prior to its use in the field. DOT&E provides independent, unbiased oversight of operational test and evaluation to ensure that it is adequate and realistic, and that credible conclusions are drawn from OT&E data.

F-35 Initial Operational Test and Evaluation (IOT&E)

Testing Completed To Date

The F-35 is nearing the end of a multi-year initial operational test and evaluation (IOT&E) program. To date, the test team has completed: cold-weather trials; actual weapons employment, which included bombs and missiles; cybersecurity testing of air vehicle components and the Autonomic Logistics Information System (ALIS); deployments to ships and austere environments; and testing that compared F-35 performance to that of fourth-generation fighters against traditional and more contemporary threats currently used by our adversaries. Open-air test missions evaluated the roles of offensive and defensive counter-air, including: cruise missile defense; suppression/destruction of enemy air defenses (S/DEAD); offensive counter air; reconnaissance; electronic attack; close air support; forward air control-airborne; strike control and armed reconnaissance; combat search and rescue; anti-surface warfare; and air-to-surface attack, in higher-threat environments, in two-, four- and eight-aircraft missions. During the S/DEAD trials, the F-35 faced robust, realistic surface-to-air threats represented by Radar Signal Emulators (RSEs).

The only remaining element of the IOT&E program is 64 trials in the Joint Simulation Environment at Naval Air Station Patuxent River, Maryland. These trials will include all three variants.

The Joint Simulation Environment (JSE)

As I noted earlier, the purpose of OT&E is to determine operational effectiveness, suitability and survivability. The JSE is essential to assessing these factors for the F-35 because there are no other means, other than actual combat against peer adversaries, to test it against the dense, modern, surface and air threats we expect it to face. For a variety of reasons, open-air

testing is not feasible for this mission set and these operational scenarios, which are fundamental to achieving a credible, comprehensive, accurate evaluation of the F-35.

Constructing the F-35 JSE has proven to be a significant challenge. The JSE team is making steady progress in developing this complex simulation venue, and I am heartened by the independent technical assessment, completed by Johns Hopkins Applied Physics Laboratory, the Carnegie Mellon University Software Engineering Institute and the Georgia Tech Research Institute in May 2021. This independent report concluded that the JSE is feasible as envisioned. The keys to bringing the JSE to fruition are sufficient financial and human resources and strong support from all stakeholders. From the DOT&E perspective, it is essential that the JSE undergo a rigorous verification, validation and accreditation process that, among other elements, utilizes data collected during open-air flight testing. We must be able to trust that JSE results are truly representative.

Effectiveness

As IOT&E is ongoing, DOT&E has no formal information to share at this time. However, I would be happy to meet with members of the committee and your staff, in an appropriate venue, to discuss our classified preliminary observations.

Suitability

In calendar year 2020, several key suitability metrics continued to show signs of slow improvement. Yet, operational suitability of the F-35 fleet remains below Joint Strike Fighter Operational Requirements Document (ORD) thresholds in some areas. Maintenance data gathered through February 2021 from the U.S. fleet of all three variants show that the F-35A is not meeting, and the F-35B and F-35C are not projected to meet, the full set of ORD reliability and maintainability requirements for mature aircraft. The F-35A has accumulated the flight hours designated for maturity (75,000 hours) and therefore DOT&E assessed it against the full ORD requirement. However, the F-35B and F-35C have not yet reached their thresholds (75,000 and 50,000 hours, respectively) and thus were assessed against interim goals.

Fleet availability also continues to fall short of program goals. Data gathered through the end of May 2021 show that the 12-month fleet average availability is below the program goal. DOT&E found that mission capability rates for the U.S. fleet fell just short of the target value, while full-mission-capable rates were short of the target.

Survivability

The program has collected all live-fire and electronic attack survivability data needed to complete IOT&E. Other aspects of survivability will be assessed through the JSE trials.

As with all platforms, cybersecurity is a critical factor in F-35 survivability. The JSF Operational Test Team and other supporting test teams have conducted several cybersecurity test events on the Autonomic Logistics Information System (ALIS), F-35 training systems, integration and reprogramming labs, and actual air vehicle components. Cyber test teams conducted enterprise-wide testing on the latest release of ALIS available at the time, version 3.5.0, in July and October 2020; the final cyber tests of air vehicle components were completed

in April 2020. The results show that some vulnerabilities identified during earlier testing periods have not yet been adequately mitigated.

F-35 IOT&E Report

IOT&E findings will be summarized in the beyond low-rate initial production (BLRIP) report, which DOT&E will deliver after testing in the JSE is completed. The report will include the F-35A and A-10C comparative evaluation results, which detail F-35A capabilities in close air support, combat search and rescue, and forward air controller-airborne missions. As I already noted, IOT&E results are classified; DOT&E would be happy to discuss our final conclusions with you in the right venue when the BLRIP report is finished.

Other Topics

F-35 Block 4

The current F-35 Block 4 development process, referred to as Continuous Capability Development and Delivery, or C2D2, is not delivering capability as scheduled. The Joint Program Office intended for C2D2 to field a new software increment, known as a "minimum viable product" (MVP), every six months. To date, the process has not worked well. The first version of each increment has frequently been deficient. As a result, each increment has required more extensive developmental flight testing and multiple subsequent iterations to fix deficiencies. This, in turn, has reduced the time available to conduct adequate operational testing. Additionally, software changes intended to introduce new capabilities or fix deficiencies instead introduced stability problems that adversely affected certain existing F-35 functionality.

DOT&E has concluded that the six-month C2D2 cycle is not sound. Each MVP increment comprises mission planning software, mission data, ALIS, joint technical data, flight series data, training simulators, and other support capabilities. While individual components are tested, a final MVP configuration receives minimal, if any, testing as a complete package prior to fielding. As a result, significant problems are being discovered during OT events, which often are not in sync with the six-month C2D2 cycle, and in the field. To ensure platform effectiveness and pilot safety, DOT&E believes dedicated OT of each final MVP package is necessary prior to installation on the F-35.

To improve the quality and timeliness of software development, in November 2020, the Assistant Undersecretary of Defense for Acquisition and the Director of Defense Research and Engineering jointly chartered a Systems Engineering Tiger Team (SETT) focused on generating corrective action recommendations to manage F-35 program risk, schedule, cost, progress, and outcome expectations. DOT&E contributed to this effort, with a rigorous, technical evaluation of the status of current laboratories and modeling and simulation (M&S) capabilities required for the C2D2 effort. In parallel, F-35 program executive leadership requested an independent software review, which recommended steps for improving the overall software quality and delivery timeliness. DOT&E expects these initiatives will provide a more stable software product for operational test and evaluation and fully supports them.

Remaining F-35 deficiencies and modeling and simulation (M&S) plans also are a concern. Initial Block 4 development focused on addressing deficiencies that the F-35 program

has carried since before the System Development and Demonstration (SDD) phase was completed in April 2018. The Block 4 plan calls for remedying deficiencies while simultaneously developing new capabilities. The overall number of open deficiencies -- more than 800, to include eight Category I deficiencies -- has not changed significantly since SDD because testing continues to discover new issues. The program intends to depend more heavily on M&S in Block 4, compared to the SDD phase. Unless the program establishes rigorous internal processes, provides funding, and drives contractual performance to support development and enhancement of required M&S capabilities, this reliance on M&S likely will negatively impact efforts to resolve the deficiency backlog.

DOT&E remains concerned about the availability of the test infrastructure and resources required to execute the approved Block 4 test and evaluation programs, as well. The Services and F-35 JPO OT representatives have developed a tail-by-tail accounting of current and future OT aircraft, and identified the necessary modifications to OT aircraft and the required instrumentation. Additional work and funding are required to address these and other test-enabling and infrastructure requirements, such as the U.S. Reprogramming Lab for mission data, data sharing networks and storage systems for the test teams, and JSE upgrades. Currently, these requirements are not fully funded, programmed, or scheduled to be completed in time to support Block 4's DT, integrated DT/OT, and dedicated OT activities.

Adequate Block 4 operational testing will also require mission-level evaluations, which will rely on Open Air Battle Shaping (OABS) instrumentation, threat radar emulators, and updates to the JSE. As proven during F-35 IOT&E, the OABS capability is essential to assess accurately complex mission trials. Updated threat radar emulators that match modern air defense radars are necessary to evaluate warfighting capability. While the Department has provided some funding to acquire new emulators, more resources are needed to upgrade current emulators, procure additional new radars, continue funding OABS systems, and expand JSE for each Block 4 capability release. All of these capabilities also will be required to test a range of other emerging DOD programs and to train our warfighters.

DOT&E expects F-35 sustainment and modernization to be a challenge. The F-35 fleet will comprise multiple hardware and software configurations, all of which will require continuous updates and continuous testing to ensure operational effectiveness, suitability and survivability. The department's already stressed T&E infrastructure and personnel will be strained even further. Already, development and testing of the currently fielded hardware and software system-of-systems that comprise ALIS have been hampered by software immaturity and inadequate test infrastructure. This type of problem could become more common without sufficient T&E capacity and capability investments. The transition to Operational Data Integrated Network (ODIN) is not expected to address this concern as initially ALIS software is to be used on ODIN.

Next-Generation T&E Capabilities

Our tactical air warfighting capability largely depends on the quality of the T&E tools, infrastructure, and processes used to identify and mitigate any performance shortfalls prior to employment in combat. DOD's T&E enterprise must be able to assess adequately emerging capabilities and replicate threats, such as artificial intelligence-enabled systems, advanced sensors and shooters, space-based systems, and directed-energy and hypersonic weapons – all of which contribute to the complex, dynamic multi-domain operational picture on which

commanders and warfighters rely. Improvements to both the live and synthetic domains that support operational T&E and training are therefore imperative for mission success and national security. We must modernize our ranges to enable operationally relevant testing of fourth-, fifth-, and, eventually, sixth-generation platforms in operationally representative environments. This may include expanding the Navy's Fallon Range Training Complex, and other facilities, to support both test and training requirements. It certainly will require greater investment in T&E instrumentation, data storage and analysis tools, threat replication, and human expertise. In 2020, DOT&E commissioned the National Academies of Sciences to assess the adequacy of ranges, infrastructure, and tools to accommodate future technologies anticipated to arrive between now and 2035. When those reports are ready, DOT&E will share them with Congress and the Secretary of Defense to help inform investment decisions.

Fiscal Year 2022 Budget Request

In accordance with the FY21 Defense Appropriations Act, DOT&E worked with the Deputy Secretary of Defense and the Office of the Under Secretary of Defense (Comptroller)/Chief Financial Officer (OUSD(C)) to budget appropriately for greater oversight of programs using Section 804 acquisition authorities or rapid prototyping authorities. As you know, the FY22 budget request included $12 Million for DOT&E's Section 804 oversight activities. The department intends to review the resources necessary to support this congressional oversight mandate when it builds the FY23 budget and Future Years Defense Program. DOT&E will continue to work with all DOD stakeholders to fund this effort appropriately in the future, in accordance with H.R. 133-119.

DOT&E participated in the review of the FY22 President Budget's led by the Office of the Director of Cost Assessment and Program Evaluation (CAPE) and OUSD(C). The process re-evaluated existing decisions with a focus on a very small number of issues, none of which directly affected the responsibilities of this office.

Moving forward, it is important that the Department continue to emphasize the critical role of test and evaluation in delivering warfighting capability. Operational and live-fire test and evaluation assess a system's operational capability and identify performance issues, offering programs the opportunity to correct them before the final acquisition or fielding decision is made. The Department needs to continue to enable adequate T&E, which requires additional resources to modernize T&E ranges, laboratories, virtual and M&S environments, tools, infrastructure, and methods. In coordination with the Office of the Under Secretary of Defense for Research and Engineering, DOT&E has identified several T&E infrastructure gaps that warrant the Department's attention. Notable shortfalls exist in the areas of space; electromagnetic spectrum; hypersonic, nuclear and directed-energy weapons and threats/targets; modeling and simulation; autonomous and artificial intelligence-enabled systems; and digital modernization. Some of these gaps have been partially addressed in the FY22 budget request but many shortcomings remain. Also, we must ensure that programs have the right amount of resources and time to prioritize and execute robust T&E, then apply and test all necessary fixes prior to deployment.

Unfortunately, unlike our adversaries, who continue to make strong investments in their T&E infrastructure, in some instances we are moving in the opposite direction. For example, smaller dedicated test squadrons would introduce risk to adequate evaluation of weapon systems in operationally relevant environments; that, in turn, poses risk to the warfighter and DOD's

mission success. DOT&E urges the Committee to continue to emphasize the value of T&E and allocation of the resources necessary to deliver combat-credible weapons at the speed of relevance.

Again, I appreciate the invitation to be here today. I would welcome the opportunity to meet in person or virtually with any member of the committee or your staff to talk further about the F-35 and next-generation tactical air test and evaluation requirements and challenges.

Dr. Raymond D. O'Toole Jr.
Acting Director
Office of the Secretary of Defense – Director, Operational Test and Evaluation

Dr. O'Toole is the Acting Director, Operational Test and Evaluation as of January 20, 2021. Dr. O'Toole was appointed as the Principal Deputy Director, Operational Test and Evaluation in February 2020. In this capacity he is the principal staff assistant for all functional areas assigned to the office. He participates in the formulation, development, advocacy, and oversight of policies of the Secretary of Defense and in the development and implementation of test and test resource programs. He supports the Director in the planning, conduct, evaluation and reporting of operational and live fire testing. He serves as the Appropriation Director and Comptroller for the Operational Test and Evaluation, Defense Appropriation and the principal advisor to the Director on all Planning, Programming, and Budgeting System matters.

Dr. O'Toole is the former Deputy Director for Naval Warfare within DOT&E. He oversaw the operational and live-fire testing of ships and submarines and their associated sensors; combat and communications systems, and weapons. He was also responsible for overseeing the adequacy of the test infrastructure and resources to support operational and live-fire testing for all acquisition programs across the Defense Department.

Dr. O'Toole was previously an employee of the Naval Sea Systems Command as the Deputy Group Director of Aircraft Carrier Design and Systems Engineering. Prior to that, he was the Director of Systems Engineering Division (Submarines and Undersea Systems) where he led a diverse team of engineers who supported all Submarine Program Managers. His other assignments include being a Ship Design Manager/Navy's Technical Authority for the USS VIRGINIA Class submarines during design and new construction and for Amphibious Ships, Auxiliary Ships, and Command & Control Ships during in- service operations.

Dr. O'Toole has also held other positions within the Department of Defense such as Deputy Program Executive Officer (Maritime and Rotary Wing) at the United States Special Operations Acquisition Command, Staff to the Deputy Assistant Secretary of the Navy for Research, Development & Acquisition (Ship Programs), and Deputy Director of Regional Maintenance for COMPACFLT (N43).

In addition, Dr. O'Toole has over 30 years of experience as a Naval Officer (Active and Reserve) retiring at the rank of CAPTAIN. His significant tours include 5 Commanding Officer tours.

Dr. Raymond D. O'Toole, Jr. is a native of Long Island NY and a graduate of the State University of New York - Maritime College earning a Bachelor of Engineering in Marine Engineering. He also holds a Master of Engineering Degree in Systems Engineering from Virginia Polytechnic Institute and State University, a Master of Science Degree in National Resource Strategy from the Industrial College of the Armed Forces, and a Doctorate in Engineering in the field of Engineering Management from the George Washington University, where he is now a Professional Lecturer of Engineering Management and Systems Engineering. He has received the SECDEF Meritorious Civilian Service Award and the USN Meritorious and Superior Civilian Service Awards.

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THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AVIATION AND LAND FORCES

STATEMENT OF

MR. JOSEPH NOGUEIRA
ACTING DIRECTOR, COST ASSESSMENT AND PROGRAM EVALUATION

BEFORE THE

TACTICAL AIR AND LAND FORCES SUBCOMMITTEE OF THE

HOUSE ARMED SERVICES COMMITTEE

ON

FISCAL YEAR 2022 BUDGET REQUEST OF THE DEPARTMENT OF DEFENSE FOR
FIXED-WING TACTICAL AND TRAINING AIRCRAFT PROGRAMS

JULY 13, 2021

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THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AVIATION AND LAND FORC

Written Testimony of the Joseph R. Nogueira
Acting Director, Cost Assessment and Program Evaluation (CAPE)
Office of the Secretary of Defense

Chairman Norcross, Ranking Member Hartlzer, distinguished members of the subcommittee; thank you for the opportunity to discuss the Department of Defense's collaborative effort to develop, acquire, and operate an appropriate mix of tactical aircraft. These efforts prioritize China as the pacing challenge while addressing threats emanating from Russia, Iran, and North Korea. 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.

In support of each annual budget request, CAPE provides comprehensive options for the Secretary and Deputy Secretary to implement the current strategic guidance. Prior to the annual budget build, CAPE conducts its own non-advocate analysis to support senior leadership on force structure, modernization, and readiness trades to meet future warfighting demands. Each year, the Services submit their draft budget submissions to CAPE and the Under Secretary of Defense for Comptroller for review. CAPE, in concert with OSD, Joint Staff, Combatant Commanders, and the Services, evaluates the draft Service budget submissions and supporting analysis. CAPE develops fair and balanced alternatives to meet strategic objectives for the Secretary's final decision, captured in the final budget submission to Congress.

The Fiscal Year 2022 budget request for tactical aircraft implements the National Security Strategic Guidance in several ways, including investment in modernization, readiness, and capacity to field higher-end capabilities. In particular, the Secretary chose to shift resources away from more vulnerable tactical aircraft platforms and weapon systems that are mismatched to the threat, in order to focus investment on modernizing the tactical aircraft fleet and developing critical enabling capabilities. These are hard choices for the Department, particularly when considering the overall affordability challenges of the tactical aircraft fleet, and analysis from CAPE and others informed those hard choices.

Specifically, CAPE conducted several analytic efforts assessing the capability, capacity, and readiness of the Department's tactical aircraft fleet to support the Secretary's decision-making. Several of these studies were directed by Congress, to include the 2020 Independent Cost Estimate for the F-35 program and a 2021 assessment of F/A-18E/F Service Life Modifications. To support major defense acquisition program milestones, CAPE generated Independent Cost Estimates for the F-15 Eagle Passive/Active Warning and Survivability System program and the Next Generation Jammer – Low and Mid Bands programs. In addition, CAPE oversaw the Joint TACAIR Synthetic Training Analysis of Alternatives, the Air Force Next Generation Air Dominance Analysis of Alternatives, and the Navy Next Generation Air Dominance Analysis of Alternatives. CAPE also conducted other studies directed by Department leadership to investigate TACAIR survivability, lethality, overall affordability, and novel concepts of operation to support Combatant Commander needs. These studies continue to support the annual budget review process and current TACAIR Mix Studies.

In addition, as a part of the Fiscal Year 2021 National Defense Authorization Act, Congress tasked CAPE to complete analyses on the Service acquisition strategies for 6th Generation Aircraft, as well as the Air Force Digital Century Series business case. Both studies are underway, and CAPE is engaged in detailed discussions with the program offices, contractors, and other stakeholders to gain the necessary data and insight to inform the Department's evolving acquisition strategies and satisfy Congressional reporting requirements.

Furthermore, there are a number of separate, but closely related, analytical efforts underway across the Department to determine the appropriate balance of 6th, 5th, and 4th generation capabilities. CAPE is leading analysis focused on TACAIR portfolio affordability and the key tradeoffs between capability, capacity, and affordability. The Joint Staff, in coordination with the Combatant Commands, is leading the department's thinking on how TACAIR should be employed in a future conflict. Finally, the Air Force and Navy are conducting TACAIR studies focused on assessing both near and long-term requirements. The results of

and associated Future Years Defense Program. It is CAPE's role to advise the Secretary and Deputy Secretary with program options to align resources to strategy, ensuring a transparent and robust discussion amongst all of the relevant stakeholders.

Thank you again for this opportunity and I look forward to your questions today and a continuing dialogue about TACAIR investments.

Joseph R. Nogueira – Acting Director / Principal Deputy Director, Cost Assessment and Program Evaluation

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Bachelor of Arts, History (magna cum laude) University of California at Los Angeles, 1988
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Master in Public Policy, John F. Kennedy School of Government, Harvard University, 1990

EXPERIENCE:

2020-Present	Acting Director / Principal Deputy Director, OSD CAPE
2018-2020	Deputy Director, Program Evaluation, OSD CAPE
2010-2018	Deputy Director, Program, Data, and Enterprise Services, OSD CAPE
2006-2010	Deputy Director, Program and Administrative Support, OSD CAPE
1997-2006	Director, Force Planning Division, ODPA&E, General Purpose Programs
1995-1997	Operations Research Analyst, Force Planning Division, ODPA&E, General Purpose Programs
1992-1995	Operations Research Analyst, Naval Forces Division, ODPA&E, General Purpose Programs
1990-1992	Presidential Management Intern, Department of the Navy

HONORS, AWARDS, AND SPECIAL ACHIEVEMENTS:
Defense Distinguished Civilian Service Medal
Presidential Rank Award – Meritorious
OSD Exceptional Civilian Service Award
OSD Exceptional Civilian Service Award
Presidential Management Intern

STATEMENT OF

LIEUTENANT GENERAL ERIC FICK
PROGRAM EXECUTIVE OFFICER
F-35 LIGHTNING II PROGRAM

BEFORE THE

TACTICAL AIR AND LAND FORCES SUBCOMMITTEE
OF THE
HOUSE ARMED SERVICES COMMITTEE
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Introduction

Chairman Norcross, Ranking Member Hartzler, and distinguished Members of the Subcommittee, thank you for this opportunity to discuss the status and future of the F-35 Lightning II Program and allowing me to address how the F-35 is bringing exceptional capabilities to the Services' Tactical Aviation portfolios.

The F-35 Lightning II is the Department of Defense's largest acquisition program, is perfectly aligned with our National Defense Strategy, and is of vital importance to our Nation's security. The F-35 is replacing, and will continue to replace, the legacy tactical fighter fleets of the Air Force, Navy, and Marine Corps with a dominant, multirole, fifth generation aircraft, projecting U.S. power and deterring potential adversaries. In the hands of our Joint and International warfighters, the F-35 we have today has demonstrated exceptional performance in real-world operations around the globe. Tomorrow's engagements, featuring threats of advanced Chinese and Russian warfighting, must be supported by novel operational concepts, and rapid weapons development and capability delivery timelines. Consequently, we need a capable, available, and affordable F-35 to outpace these key competitors and win the high-end fight. As we move forward with these three mandates – capability, availability, and affordability – as our guiding lights, the F-35 will increasingly serve as the backbone of U.S. and International Partner air combat superiority for decades to come.

Capability

The drive to maintain U.S. warfighter advantage is propelling the Department of Defense forward, creating a suite of networked capabilities, anchored around F-35 integration. This integration provides theater commanders with improved interoperability between platforms in all domains, a more robust intelligence picture, and a wider range of options in support of targeting.

We are seeing these benefits from F-35s deployed today and the impact of this aircraft will increase substantially as additional capabilities are released to the fleet.

The F-35 is delivering high-end, game-changing capabilities today. Lauded by pilots and operational commanders alike, the F-35 currently performs operations from land and from the sea. The F-35 program embodies the U.S. National Defense Strategy as it strengthens alliances and attracts new international customers; 11 services in nine countries have declared initial operational capability; and six services from five countries have conducted F-35 operational missions. More than 670 aircraft are operating today. The F-35 is being fielded into a dynamic, ever-advancing threat environment. In order to continue to provide the capability our warfighters need, the F-35 program continues to focus on software development and air system modernization and sustainment.

We at the JPO understand today's threats, deliberately engage with our warfighting customers to understand future threats, and actively assess the additional capabilities required to defeat them as part of a deliberate, rigorous, and continuous modernization process.

The first set of capabilities born of this process, Block 4, is the key capability set required to ensure the F-35 stays dominant in the late 2020s and beyond. We are simultaneously developing and incrementally delivering Block 4 capabilities today. Simply put, Block 4 capabilities ensure F-35 relevance in the high-end fight, enabled by a hardware suite upgrade of the mission computer, memory system, and display system known as Technical Refresh-3 (TR-3) – Full Block 4 capability will increase our ability to prosecute targets in contested environments, increase survivability, advance interoperability, and improve sustainment.

The developmental foundation – which includes both the synthetic and open-air resources and environments required to ensure the Block 4 hardware-enabled and software-defined capabilities are ready to go – was established to provide the bedrock to support continuous

delivery of future capabilities. Recent efforts have highlighted the need to focus the JPO on ensuring the aging F-35 System Development and Demonstration (SDD) fleet can continue to support flight test until newer replacement aircraft are available to the test enterprise. The JPO is actively engaged with U.S. Services, our International Partners, and Lockheed Martin (LM) to create an executable plan to ensure future flight test requirements are met. As part of that overarching effort, we are actively managing a test fleet viability program for those specialized test assets to ensure they are able to meet test requirements.

The F-35 Joint Program Office (JPO), LM, and critical suppliers are aligned on our commitment to capability delivery and cost control, and are focused on two critical priorities: the delivery of all Lot 15 aircraft in the TR-3 configuration, and the delivery of key elements of the Lot 17 hardware configuration to meet Block 4 capability requirements. As we have discussed previously, the TR-3 hardware suite has experienced schedule delays and cost overruns. Despite these delays, the Joint Program Office and LM team have worked together to stabilize TR-3 development, mitigate delays, and minimize the impact of these delays on critical TR-3 milestones, including Lot 15 aircraft delivery. Thanks to these efforts – and despite these challenges – TR-3 development and integration is making good progress. While there is still risk ahead in System Integration and Test, we are still forecasting delivery in Lot 15 in 2023, as required. We are actively implementing multiple risk mitigations to ensure this critical Lot 15 delivery while minimizing production line disruption.

The TR-3 development challenges resulted in Block 4 capability development delays in fiscal year (FY) 2021. These delays are being addressed through prioritized contracting actions to restart critical paused efforts and through careful and purposeful management of resources, including a request for an FY 2021 above threshold reprogramming action to reduce risk on the restart and re-staffing of Block 4 development as we transition into FY 2022. In addition to

managing Block 4 resource risks, we continue our deliberate management of Block 4 production hardware configurations to meet warfighter capability needs and minimize retrofit costs.

Availability

Last year, the overall Mission Capability rate for the F-35 Fleet continued its steady rise, increasing to an annual average of 68 percent through November, an improvement of 5.4 percent from calendar year 2019, while flying nearly 94,000 hours, which was over 18,000 more hours than in the year prior.

In October 2020, USAF F-35As completed 18 months of continuous Middle East combat, flying roughly 4,000 combat sorties and 20,000 combat hours, and employing just shy of 400 weapons while maintaining a 74 percent Fully Mission Capable rate. In March 2021, VFA-147, the first operational F-35C squadron, completed the longest at-sea period (approximately five weeks) by F-35Cs onboard USS Carl Vinson. VFA-147 completed missions in all warfare areas while reporting a 97.6 percent sortie completion and 80 percent Mission Capable rates.

At this stage in F-35 fleet maturity, our production line is stable, and aircraft rolling off the line are performing well. Many of our earlier lot aircraft require modifications, and we are working through retrofits with fleet customers to optimize the timing of these modifications to minimize operational impacts. Government and industry teams are working to accelerate an affordable long-term solution while maximizing near-term F-35 availability for training and operations. These changes are driving a steady increase in aircraft full-mission capable rates, and we anticipate fleet availability will continue to climb as F-35 maintenance systems and best practices mature.

The F-35 JPO is using four primary availability levers to achieve current and future readiness goals. First, we are taking action to keep parts on the aircraft longer. Improving reliability and maintainability is therefore our first lever, and this critical work is progressing

through our Reliability and Maintainability Improvement Program (RMIP) Projects. RMIP has validated 2.6 percent improvement to Mission Capable rates and we expect to achieve an additional 4.7 percent over the next three years.

Second, we are taking action to have parts "on the shelf" and available when required; we refer to this lever as improving our supply posture. We utilize strategic contracting and service level agreements to incentivize on time delivery of spares and to achieve target stock levels. We received a congressional plus up in funding in FY 2018 to procure four additional U.S. Marine Corps STOVL engines and those engines will continue to deliver through November 2021. Additionally, in FY 2019 and FY 2020 the JPO received congressional plus ups to increase the Global Spares Pool.

The third and fourth levers are repair capacity and repair velocity, and we are taking action to improve both. . Repair capacity and repair velocity are needed to rapidly repair those removed parts and get them back on the shelf and ready to go again, and are crucial to keeping us both available and affordable. Absent both capacity and velocity, we'll end up in a very expensive sparing posture to achieve the same levels of readiness.

Affordability

We understand that all F-35 customers have limits on the resources available to the program. If we, the F-35 Enterprise, do not meet affordability requirements, our customers will be forced to choose between buying less, flying less, or pursuing alternative solutions to meet their fighter force needs.

The F-35 JPO, U.S. Services, and Partners are working together to identify ways to drive down costs. In development, the program's focus is on cost control of TR-3 and other Block 4 capabilities, as well as reducing the cost of the test enterprise and other fixed development costs. In production, while the program is currently negotiating Lots 15-17, we are also planning

affordability projects to reduce the aircraft and engine unit costs for Lots 18-23, mainly through increasing competition and making strategic procurement decisions. From Fiscal Year (FY) 2014 to today, we have reduced the cost of a USAF A-variant aircraft by 26 percent – going from almost $108 million to $80 million for upcoming Lot 13 deliveries.

Despite the strong achievement on production costs, we vividly understand that the largest share of program cost is in sustainment; in fact, sustainment costs are projected to constitute 80 percent of the program's lifecycle cost. In sustainment, the primary affordability target provided by the U.S. Services is cost per tail per year (CPTPY) at steady state, which I'll discuss in further detail. The Enterprise also continues to pursue the "25x25" stretch goal ($25k per flight hour in 2025) that has also been a stated target of all the U.S. Services. The F-35 JPO recognizes the imperative to drive down the sustainment cost of the platform for all of our stakeholders, and we are doing just that. In fact, the JPO has driven down the cost per flight hour in base year 2012 dollars (USAF A-variant, O&S less indirects & mods, plus production support) from $86.0k in 2014 to its 2020 actual cost of $33.6k and CPTPY of $7.1M. The fleet metrics also reflect reductions to 2020 actuals of $37.3k CPFH and $7.3M CPTPY - a decrease from $38.3k and $7.1M, respectively, in 2019.

While we project a further decrease in sustainment costs over the life of the program as fleet size grows and the Department of Defense maximizes economies of scale, we understand there is still work to be done. The FY21-23 sustainment contract handshake with Lockheed Martin keeps us on the path to our affordability goals, but progress to date and scale alone will be insufficient. The program continues to look for alternative ways to solve this challenging problem, including increased reliance on synthetics both in the areas of training and test.

Sustainment costs may be broken into four major areas, which I recently described to the committee: 1) airframe parts and repairs; 2) engine parts and repairs; 3) organic manpower &

operations; and 4) sustaining support. In general, total aircraft inventory (TAI) and flight hours (FH) are the most significant drivers of these costs, but utilization rates and timeline of operations are also major components. Lower level drivers also exist and the JPO has initiatives underway to actively reduce or optimize the costs in each of these areas.

The first area of cost is airframe parts and repairs and refers to the LM costs associated with maintenance. It includes organizational maintenance and support (i.e. the cost of materials and other costs used to maintain the system) as well as costs related to component depot maintenance. The main cost drivers for this area are component repair and replenishment pricing, and part reliability. With LM, the Reliability and Maintainability Improvement Program (RMIP) identifies and selects parts and/or processes which, when improved, lead to increased aircraft availability and/or reduced cost. Reliability and Maintainability initiatives and examining both organic and contract logistics support options to reduce sustainment costs over the life cycle. F-35 lifecycle costs include, but are not limited to: personnel, maintenance, fuel, ordinance, training and simulation systems, reprogramming laboratories, physical infrastructure, and a global supply network that will keep a fleet of more than 3,000 domestic and international aircraft fully-operating, and contributing to the fight for decades to come. These maintenance related costs are expected to contribute 16% of the CPTPY metric at Steady State (DoD FY36-37) in CY12$.

The second area of cost is engine parts and repairs and refers to the Pratt and Whitney (P&W) costs associated with maintenance. For the P&W scope, the main cost drivers include scheduled engine overhauls and unscheduled repairs. These maintenance related costs are expected to contribute 18% of the CPTPY metric at Steady State (DoD FY36-37) in CY12$. The JPO has instituted several programs aimed at reducing these costs. A similar program exists for Propulsion, the Component Improvement Program (CIP), which drives reduction in parts

consumption by improving engineering performance. Additional projects are underway throughout the program to improve reliability, expand repair capacity and velocity, and reduce repair timelines.

The third area of cost is organic manpower and operations and refers to the cost of operators, maintainers, and other support labor such as security, logistics, safety, and engineering assigned to operating units. The other significant portion of this cost is unit-operating material, which is largely fuel. The main cost drivers in this area are the number of maintainers at the squadron level and fuel consumption. These unit level costs are expected to contribute 25% for manpower, and 16% for operations, of the CPTPY metric at steady state (DoD FY36-37) in CY12$.

The JPO, alongside LM, P&W, and the U.S. Services are actively working to enable the reduction of unit level (i.e. organic) manpower and fuel consumption required for the F-35. In winter of 2020, the JPO kicked off an initiative to examine the current levels of organic labor assigned to F-35 units. Specifically, business case studies are underway to understand prioritization of prognostic health management requirements to enable labor efficiency by providing a more user friendly and maintainable aircraft. The team is also examining the number of man-hours required to complete tasks with the focus on best practices across the F-35 enterprise that promulgate thru training and technical publication updates. The Services are also performing labor studies to understand how to optimize labor within the units. Lastly, the JPO and P&W are exploring key initiatives such as the Compressor High Efficiency 3-D Aero initiative which should improve durability in the compressor, combustor, and turbine and have a direct impact on fuel requirements.

The fourth area of cost is sustaining support, which provides the required support labor that enables aircraft operations and maintenance. A key driver in this area is shared labor to

support enterprise operations, sustaining engineering, and logistics and unique labor to support site and squadron operations. For the F-35, the bulk of these costs are found in the personnel on the flight line and are composed of LM and P&W field service engineers, field service representatives, and Autonomic Logistics Information System (ALIS) administrators, as well as instructors and training & course materials. These costs are expected to contribute 13% of the CPTPY metric at Steady State (DoD FY36-37) in CY12$.

The JPO is executing several initiatives across the enterprise aimed at reducing this portion of sustainment cost. One of the most important initiatives is the ALIS to Operational Data Integrated Network (ODIN) evolution, which aims to reduce the ALIS labor footprint and achieve higher levels of efficiency and availability on the flight line. Another example of a JPO program aimed at reducing costs is the development of the F-35's Next Gen Mission Planning Program. This critical development effort is focused on reducing the number of Offboard Mission Support (OMS) administrators through a deliberate reduction in the F-35's mission planning hardware footprint and on upgrading the aircraft's mission planning software architecture to make it easier for mission planning teams to program operational missions. Finally, the JPOis implementing an initiative to streamline training activity for F-35 pilots and maintainers called the Lightning Learning Environment.

The remaining areas of sustainment cost related to CPTPY support the cost of hardware and software updates that occur after fielding, and the government non-maintenance consumables, transportation & warehousing, demilitarization, and disposal. These costs are expected to contribute the remaining 12% of the CPTPY metric at steady state (DoD FY36-37) in CY12$.

Special Topics

The F-35 was designed to evolve at the speed of advancing threats. The capabilities we are delivering today are distinct from those conceptualized at the start of this program more than 20 years ago. The F-35 is leveraging new concepts in the technology environment, to include digital twinning, agile software development, cloud-based collaboration, and a process we refer to as Continuous Capability Development and Delivery, or "C2D2" to deliver Block 4 capabilities. Through close work with the operational requirements and test communities, the C2D2 process will continue to mature and deliver increments of capability over time to ensure our warfighting customers stay ahead of the threat well into the future. Block 4, enabled by TR-3, delivers the power of a modular open systems architecture to the F-35, with the instantiation of Open Mission Systems, the Future in Airborne Capability Environment, and Hardware Open Systems Technologies standards. By leveraging these industry-based standards for future capability insertion efforts, we will become increasingly nimble and responsive to emerging threats. F-35 electronic warfare (EW) upgrades are designed to defeat the modern advanced threat from stand-in locations in the most demanding air defense environment. The Block 4 hardware and software are designed to detect, identify, geolocate and defeat advanced threats without the need for an external podded system. The F-35 EW capabilities are complemented by low-and mid-band Next Gen Jammer Airborne Electronics Attack, providing a lethal combination of 5th generation stand-in F-35s, along with stand-off support from the Growlers.

As we discussed extensively in my last testimony, the F-35 Enterprise has historically struggled with the ALIS. ALIS is a complex system with numerous documented shortfalls and technical challenges. You will recall last year that we announced the start of a new system, known as the ODIN, to replace ALIS. ODIN will incrementally provide a modern, user-friendly integrated information system for the F-35. It will be comprised of multiple elements to include modern hardware, architectures, software development methods, and data environments. Our

approach must maintain our existing legacy business system (as operations continue to grow and scale) while simultaneously transitioning to a modern system – in other words, as we transition from ALIS to ODIN, it will be an evolution, not a hard switch.

Over the last 18 months, several ALIS improvements have addressed many of the challenges documented in Government Accountability Office reports. More frequent ALIS software updates addressing the users' top priorities, better electronic records data quality, and new hardware have led to a better user experience and praise from the users.

With the 42% reduction in FY 2021 Research, Development, Test, and Evaluation funding, we took the opportunity to "recalibrate" the ALIS-to-ODIN strategy based on lessons from 2020, approved users' requirements, and recent ALIS improvements. Instead of abruptly replacing ALIS with a new system, the recalibrated strategy is a phased approach addressing the most pressing ALIS challenges while simultaneously evolving to ODIN.

One of the successes from 2020 was the introduction of smaller, faster unclassified ODIN hardware designed to run the current ALIS software. The new unclassified "kit" is 70% smaller than the current ALIS hardware. Due to the overwhelming success of demonstrating the new "kit" at Marine Corps Air Station Yuma in Arizona, the Marines refused to return the kit and continue to use it to this day.

We have started procuring the new ODIN hardware for new sites and fleet technical refresh with the first units fielding in July 2021. This hardware will eliminate the oldest unclassified ALIS hardware from the fleet, hardware that was initially fielded in 2008. The processing power of the new hardware will allow us to host multiple squadrons located at a single operating location on a single kit which will yield a reduction in hardware procurement costs and administrators. Development and replacement of the classified hardware will begin in 2022.

We have initiated the development of an enterprise architecture, leveraging commercial and government best practices to document the stakeholders, business processes, data, and technology to build the transformational roadmap to migrate from ALIS to ODIN. We are strengthening our partnership with our industry partners, Lockheed Martin and Pratt & Whitney, as they have deep knowledge of the existing system, while also collaborating with the Navy and Air Force to leverage their ongoing development activities to maximize our alignment with their roadmaps.

Because of the complexity of evolving from ALIS to ODIN, we have also enlisted the help from both industry and government partners who have expertise in digital transformations, cloud migration, and modernizing legacy software. We are leveraging their expertise to support the migration of the ALIS software to a government-managed cloud infrastructure, where we will modernize the software architecture using industry standards which will foster future competition as we modernize the application portfolio. Based on lessons learned from the US Services, we intend to leverage commercial off the shelf, government off the shelf and service-provided solution reuse to the maximum extent possible to take advantage of previous Government investments and drive sustainment costs down. We are currently updating the ODIN development plan based on the updated strategy, available resources, as well as inputs received from our users. We look forward to continuing to update you on ALIS and the evolution to ODIN in the coming months.

The Joint Simulation Environment (JSE) is a government-owned, state-of-the-art simulation facility designed to support operational testing of the F-35, and in the future, other U.S. weapons systems. The JSE allows operational testers to assess the F-35's mission effectiveness in battlespace scenarios that cannot be conducted on open-air test ranges, including stressing, high-density threat environments. The F-35 Initial Operational Test and Evaluation

requires 64 mission trials to be conducted in the JSE and evaluated before the Director of Operational Test and Evaluation's Beyond Low-Rate Initial Production (BLRIP) report is written. The BLRIP report must be submitted to Congress before the Full Rate Production milestone can proceed. On 2 June, the JSF Operational Test Team accomplished the final Initial Operational Test and Evaluation open air trial. The Team, comprised of over 900 personnel from the United States, United Kingdom, the Netherlands, and Australia, conducted formal open-air trials from 2018 to 2021, which consisted of 139 test missions, 463 discreet test events, 16,436 flight hours, and used 23 F-35s of all variants. Test events included 355 simulated air-to-surface attacks, 280 simulated AIM-120 shots, and 207 live and inert weapons delivery events.

Development at the JSE has been delayed over the last year due to the combined effects of technical challenges and COVID-19. The challenges of the JSE include not only its unparalleled complexity and required fidelity, but also the technical challenges associated with the integration of high fidelity models from multiple external organizations to create a comprehensive, realistic threat environment. This development work is conducted in a classified, enclosed, close-quarters environment. Telework was and is not possible, and team size has been limited in the classified work spaces. The F-35 JPO and our Service teammates continue to forge forward to mitigate these challenges to ensure F-35 achieves its Full Rate Production milestone. The JSE team has made significant technical progress over the last six months and, with participation from the Operational Test Activities, is finalizing the JSE schedule to complete IOT&E and inform the new Acquisition Program Baseline. This updated schedule will be presented to the Defense Acquisition Executive in August 2021.

As we recently informed the Committees, the F135 Power Module repair in our depot enterprise has not been keeping pace with engine removals, resulting in degraded fleet availability. These production shortfalls were driven by delays in delivering required support

equipment and technical data, along with increased work scope of Power Module repairs. These factors impacted the ability of our sole heavy maintenance Power Module repair depot at the Oklahoma City Air Logistics Complex (OC-ALC) to scale production in order to meet demand and develop the proficiency of the depot workforce to support the required repair throughput. Over the past 6 months, the program office along with our industry partner Pratt and Whitney have made great strides and progress toward our Power Module recovery plan. This has been accomplished by increasing Power Module throughput at the Heavy Maintenance Center, by increasing and accelerating the global depot capacity growth, and by reducing demand through efforts aimed at increasing engine time on wing. Specifically at the Heavy Maintenance Center at Tinker AFB, the team has made vast process improvements that have resulted in decreased engineering disposition times and work-stops, decreased production Turnaround Time (TAT), increased number of Power Modules in work, improved technician technical data sets, and an increased quantity of required support equipment and tooling. The team has also reinforced on-site leadership with the establishment of local P&W executives and the Program Management Office Assistant Product Support Manager. Likewise, the Heavy Maintenance Center is on track to establish a full second shift by November of this year. As a result, the Heavy Maintenance Center had already produced more Power Modules by May of 2021 than all of last year and are on track to exceed their calendar year production goal. To further increase Power Module repair capacity we are working to accelerate the stand up of engine repair at the Fleet Repair Center South East in Jacksonville, FL. We are also leveraging excess commercial capacity, and are accelerating the standup of organic back shop repair to support a reduction in repair time at all of our CONUS and OCONUS depots. On July 1st, the Netherlands depot produced its first fully repaired and tested Power Module and became the first F-35 OCONUS Depot to achieve Initial Depot Capability (IDC). With test support from OC-ALC, the Australian depot produced its first

Power Module in May. These OCONUS productions are a monumental accomplishment and a key contributor to our capacity growth plan. We are also focusing heavily on engineering initiatives to potentially expand damage limitations as well as leveraging the Component Improvement Program to improve reliability and availability of engine components. The results of these initiatives will drive a reduction in fleet demand by increasing engine time on wing. The actions we have taken to date have begun to show benefit, as power module production at OC-ALC as well as our ONCONUS sites have increased significantly in the last year and the projected readiness impacts, while still above our requirement, have started to stabilize. As a result of the extensive nature of our F135 initial 2,000 hour overhaul inductions beginning in 2022, we anticipate cost growth in the propulsion enterprise through the Fiscal Year Defense Plan. We are continuing to work with P&W on steps to address the projected cost growth to ensure that the F135 Propulsion System remains affordable component of the F-35 Air System.

Conclusion

The F-35 is the premier multi-mission strike fighter of choice for three U.S. services, seven International Partners, and six Foreign Military Sales customers. The F-35 routinely demonstrates its unmatched capabilities at the hands of our joint and international warfighters, performing combat operations from land and from the sea. The F-35 is vital to our future, as they become the lethal cornerstone of the Air Force, Navy, and Marine Corp tactical aviation forces.

The whole of the F-35 enterprise is laser-focused on reduction of lifecycle costs. Cost is the common enemy on this program. Every F-35 stakeholder is aggressively engaged in identifying affordability initiatives. Our team is committed to continue working closely with Congress, our warfighting customers, and industry partners, and we take pride in developing, producing, and sustaining the world's most lethal fighter aircraft. We serve with the single-minded determination that the U.S. and its allies will have the capabilities they need to win the

fight, that our warfighters will return home safely from every engagement, and that our taxpayers get the absolute best capability for their defense dollar.

Lieutenant General Eric T. Fick
Program Executive Officer for the F-35 Lightning II Joint Program

Lt. Gen. Eric T. Fick is the Program Executive Officer for the F-35 Lightning II Joint Program Office in Arlington, Virginia. The F-35 Lightning II Joint Program Office is the Department of Defense's agency responsible for developing, delivering and sustaining the F-35A/B/C, the next-generation strike aircraft weapon system for the Air Force, Navy, Marine Corps, eight international partners and four current foreign military sales customers.

Lt. Gen. Fick entered the Air Force in September of 1990 after graduating from the University of Notre Dame with a Bachelor's degree in Aerospace Engineering. He has served as a Logistics Plans and Programs Officer, F-16 Fighting Falcon Mechanical Systems Engineer, Computational Fluid Dynamics Research Engineer, Joint System Program Office Chief of Test, Air Staff Branch Chief, Deputy Chief of the Air Force Senate Liaison Office and Director of Global Reach Programs, Office of the Assistant Secretary of the Air Force for Acquisition. Lt. Gen. Fick has commanded at the squadron and group level and served twice as an Air Force Program Executive Officer. Additionally, he has logged more than 350 hours in the T-38 Talon, F-15 Eagle, F-16 and other military and civilian experimental aircraft.

Prior to his current assignment, Lt. Gen. Fick was the Deputy Program Executive Officer for the F-35 Lightning II Joint Program.

EDUCATION
1990 Bachelor of Science, Aerospace Engineering, University of Notre Dame, South Bend, Ind.
1995 Master of Science, Aeronautical Engineering, Air Force Institute of Technology, Wright-Patterson Air Force Base, Ohio (Distinguished Graduate)
1996 Squadron Officer School, Maxwell AFB, Ala.
1998 Experimental Flight Test Engineer Course, Air Force Test Pilot School, Edwards AFB, Calif. (Distinguished Graduate)
2003 Master of Military Operational Art & Science, Air Command and Staff College, Maxwell AFB, Ala. (Distinguished Graduate)
2006 Air War College, Maxwell AFB, Ala., by correspondence
2007 Program Management Office Course, PMT-352B, Eglin AFB, Fla.
2009 Master of Science, National Resource Strategy, Industrial College of the Armed Forces, Fort Lesley J. McNair, Washington, D.C. (Distinguished Graduate; Honor Graduate)
2009 Senior Acquisition Course, Industrial College of the Armed Forces, Fort Lesley J. McNair, Washington, D.C.
2010 Air Force Enterprise Leadership Seminar, University of Virginia, Darden School of Business, Charlottesville
2011 Program Manager's Course, PMT-401, Fort Belvoir, Va.
2012 Executive Program Manager's Course, PMT-402, Fort Belvoir, Va.

ASSIGNMENTS
September 1990 - March 1992, Logistics Plans and Programs Officer, Hill Air Force Base, Utah
March 1992 - March 1994, F-16 Mechanical Systems Engineer, Hill AFB, Utah
March 1994 - December 1995, Student, Air Force Institute of Technology, Wright-Patterson AFB, Ohio
December 1995 - December 1996, Computational Fluid Dynamics Engineer, Wright-Patterson AFB, Ohio
December 1996 - December 1997, Flight Test Program Manager, Wright-Patterson AFB, Ohio
December 1997 - December 1998, Student, U.S. Air Force Test Pilot School, Edwards AFB, Calif.
December 1998 - July 2000, Deputy Chief, Weapons Test Flight, Eglin AFB, Fla.
July 2000 - July 2002, Chief of Test, Counter-Air Joint System Program Office, Eglin AFB, Fla.
August 2002 - June 2003, Student, Air Command and Staff College, Maxwell AFB, Ala.
July 2003 - September 2003, Director, Direct Attack, Air Force Program Executive Office (Weapons),

Assistant Secretary of the Air Force (Acquisition), Headquarters U.S. Air Force, the Pentagon, Arlington, Va.
September 2003 - May 2004, Chief, Air Dominance Branch, Global Power Directorate, Assistant Secretary of the Air Force (Acquisition), Headquarters U.S. Air Force, the Pentagon, Arlington, Va.
May 2004 - July 2005, Deputy Chief, Air Force Senate Liaison Office, Assistant Secretary of the Air Force (Legislative Liaison), Headquarters U.S. Air Force, the Pentagon, Arlington, Va.
August 2005 – June 2006, Operations Officer, 46th Test Squadron, Eglin AFB, Fla.
July 2006 – July 2008, Commander, 46th Test Squadron, Eglin AFB, Fla.
August 2008 – June 2009, Student, Industrial College of the Armed Forces, Fort McNair, Washington, D.C.
July 2009 – August 2011, Commander, Advanced Combat Systems Group, Air Force Rapid Capabilities Office, Headquarters U.S. Air Force, the Pentagon, Arlington, Va.
September 2011 – July 2014, Program Executive Officer for Intelligence, Surveillance, Reconnaissance, and Special Operations Forces, Wright-Patterson AFB, Ohio
July 2014 – April 2016, Program Executive Officer for Fighters and Bombers, Wright-Patterson AFB, Ohio
April 2016 – May 2017, Director, Global Reach Programs, Assistant Secretary (Acquisition), the Pentagon, Arlington, Va.
May 2017 – present, Deputy Program Executive Officer, F-35 Lightning II Joint Program Office, Arlington, Va.

SUMMARY OF JOINT ASSIGNMENTS
1. May 2017 – present, Deputy Program Executive Officer, F-35 Lightning II Joint Program Office, Arlington, Va. as a brigadier and major general

FLIGHT INFORMATION
Rating: none
Flight hours: more than 350
Aircraft flown: T-38, F-15B, F-15E, F-16, F-18, Learjet-24, E-3A, KC-135R, T-39E, C-17A, C- 141C, MiG-15, T-43A, Challenger 604, C-12C, MC-130E, Bell 206, NC-130H, NU-1B, TH-6B, T-6G, Cessna Citation, CM-170, MB-326, L-039C, ASK-21, L-23, Grob-103, Schweizer 2-33

MAJOR AWARDS AND DECORATIONS
Distinguished Service Medal
Defense Superior Service Medal
Legion of Merit
Defense Meritorious Service Medal
Meritorious Service Medal with oak leaf cluster
Aerial Achievement Medal with oak leaf cluster
Joint Service Commendation Medal
Air Force Commendation Medal with oak leaf cluster
Air Force Achievement Medal
Military Outstanding Volunteer Service Medal

EFFECTIVE DATES OF PROMOTION
Second Lieutenant July 23, 1990
First Lieutenant July 23, 1992
Captain July 23, 1994
Major Sept. 1, 2001
Lieutenant Colonel May 1, 2005
Colonel Oct. 1, 2008
Brigadier General Oct. 3, 2014
Major General Aug. 3, 2018
Lieutenant General July 11, 2019

(Current as of August 2019)

United States Government Accountability Office

GAO

Testimony

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

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F-35 JOINT STRIKE FIGHTER

Cost and Schedule Risks in Modernization Program Echo Long-Standing Challenges

Statement of Jon Ludwigson, Director, Contracting and National Security Acquisitions

GAO@100

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GAO-21-105282

GAO@100 Highlights

Highlights of GAO-21-105282, a testimony before the Subcommittee on Tactical Air and Land Forces, Committee on Armed Services, House of Representatives

July 13, 2021

F-35 JOINT STRIKE FIGHTER

Cost and Schedule Risks in Modernization Program Echo Long-Standing Challenges

Why GAO Did This Study

The F-35 Lightning II Joint Strike Fighter program began development in 2001 and remains DOD's most expensive weapon system program. Currently, the program is more than 8 years delayed and $165 billion over original cost expectations. As the program progresses toward completing operational testing of the aircraft's baseline capabilities, it still faces risks. DOD is also 3 years into an effort, called Block 4, to modernize the F-35 aircraft's capabilities. Block 4 is loosely based on Agile software development processes. With this approach, DOD intends to incrementally develop, test, and deliver small groups of new capabilities every 6 months.

This testimony discusses acquisition-related risks in the F-35 program. It is based largely on findings in GAO's March 2021 and May 2020 annual reports (GAO-21-226; GAO-20-339) on F-35 acquisition.

What GAO Recommends

In March 2021, GAO made three recommendations to DOD, including that the F-35 update its Block 4 modernization schedule to reflect achievable time frames. DOD concurred. Since 2001, GAO also made a number of other recommendations to DOD to improve the acquisition of F-35 aircraft. DOD concurred with some of them, but has not yet taken actions to fully implement many of these recommendations.

View GAO-21-105282. For more information, contact Jon Ludwigson at (202) 512-4841 or ludwigsonj@gao.gov.

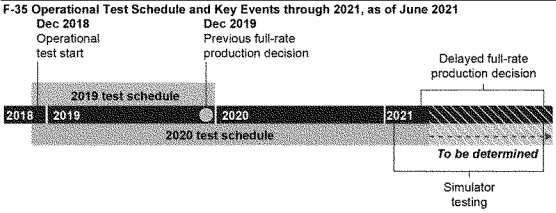
What GAO Found

While the Department of Defense (DOD) approaches its full-rate production decision point (which would formally authorize DOD's transition from development to full production), the F-35 program is producing nearly 25 percent of the total planned aircraft in low-rate initial production before satisfying the criteria for full-rate production. As it approaches this major milestone, the program has taken steps to but has not fully addressed a number of challenges, even though GAO recommended that it do so, such as the need to:

- resolve critical deficiencies with the aircraft;
- ensure critical manufacturing processes are mature;
- address supply chain issues that strain production and sustainment; and
- take steps to ensure reliability and maintainability goals are met.

Compounding these production issues is the fact that the program has not completed operational testing on the aircraft to ensure warfighters get the capabilities they require, primarily due to increasing delays with the aircraft simulator. In August 2020, the program office determined the simulator—to be used to replicate complex test scenarios that could not be accomplished in real-world environment testing—did not fully represent F-35 capabilities and could not be used for further testing until fixed. Since then, program officials have been developing a new plan to ensure the simulator works as intended. Until this happens, the full-rate production date remains undetermined (see figure).

F-35 Operational Test Schedule and Key Events through 2021, as of June 2021



Source: GAO analysis of Department of Defense data. | GAO-21-105282

At the same time that the program is resolving risks with the baseline program, DOD is encountering similar cost and schedule increases with its F-35 modernization effort. In the 3 years of Block 4 capability development, the total estimated cost of Block 4 increased from $10.6 billion to $14.4 billion. This increase is, in part, a recognition of all costs, past and future, estimated to be required to complete the effort. As GAO recommended in May 2020, DOD now reports all Block 4 costs, not just those associated with the near term. While DOD added another year to the Block 4 schedule, in March 2021 GAO found the remaining development time frame is not achievable. Unless the F-35 program accounts for historical performance in the schedule estimates, the Block 4 schedule will continue to exceed estimated time frames and stakeholders will lack reliable information on when the modernized capabilities will be delivered.

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 Joint Strike Fighter. The F-35 program is a family of fifth-generation strike fighter aircraft that integrates low-observable (stealth) technology with advanced sensors and computer networking capabilities for the U.S. Department of Defense (DOD), as well as seven international partners. The program aims to procure 2,470 F-35s to replace several other aircraft used by the Air Force, Navy, and Marine Corps to perform a wide range of missions. Currently, the program is more than 8 years delayed and $165 billion over where it originally expected to be at this point. Low-rate initial production began in 2007. To date, the program has delivered over 600 aircraft to the U.S. services, allied partners, and foreign military sales customers.

The DOD is now in the third year of a $14 billion modernization effort—known as Block 4—to upgrade the hardware and software systems of the F-35. DOD intends for Block 4 to modernize the aircraft and address new threats that emerged since the aircraft's original requirements were established in 2000. DOD uses a development approach for Block 4, referred to as Continuous Capability Development and Delivery (C2D2), loosely based on Agile software development processes. With this approach, DOD intends to incrementally deliver capabilities to the warfighter faster and more frequently than it did during the original development program.

The program wrapped up development of the F-35's original capabilities in 2018 and is undergoing operational testing to verify that the aircraft provides those baseline capabilities before moving into full-rate production. As the program moves toward completing this testing and evaluating the results, it still faces risks ahead of the full-rate production decision. We have previously reported on these and other program risks and made recommendations for improvement. DOD has taken action to address some, but not all, of our recommendations. For a list of our key recommendations and a summary of DOD's actions in response, see appendix I.

This statement discusses (1) the remaining risks with completing operational testing for the baseline program ahead of the full-rate production decision and the steps DOD is taking to mitigate them and (2) DOD's progress in developing and delivering Block 4 modernization capabilities and the program's efforts to address any remaining risks. The

statement is based on the findings from our reports on F-35 production and modernization issued in May 2020 and March 2021.[1] It also includes some observations from our July 2021 report on F-35 sustainment as well as some updated information on simulator schedule status, weapons testing, deficiencies, and supplier qualification status based on information in DOD's budget request for fiscal year 2022.[2] For the prior reports, we reviewed data provided by the contractors, the program office, and others in DOD and conducted interviews with DOD officials and contractor representatives. For more information on the specific objectives, scope, and methodology for that work, see our prior reports.

The work on which this statement is based was 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 that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

F-35 Testing Delays Led to Postponed Production Milestone

In March 2021, we found that F-35 simulator delays continue to prevent DOD from completing initial operational testing and making a decision to move to full-rate production.[3] The program office postponed a full-rate production decision from the previous plan—sometime between December 2019 and March 2021—to a future unknown date that the program will determine once it knows when the simulator will be operational. As it works toward that production milestone, the program continues to take steps to address ongoing risks such as:

- high overall open deficiencies,
- production delays and quality issues,
- efforts to address Turkey's removal from the supply chain and find new suppliers, and

[1]GAO, *F-35 Joint Strike Fighter: DOD Needs to Update Modernization Schedule and Improve Data on Software Development*, GAO-21-226 (Washington, D.C.: Mar. 18, 2021) and *F-35 Joint Strike Fighter: Actions Needed to Address Manufacturing and Modernization Risks*, GAO-20-339 (Washington, D.C.: May 12, 2020).

[2]*GAO, F-35 Sustainment: DOD Needs to Cut Billions in Estimated Costs to Achieve Affordability*, GAO-21-439 (Washington, D.C.: July 7, 2021).

[3]GAO-21-226.

- aircraft not meeting reliability and maintainability goals.

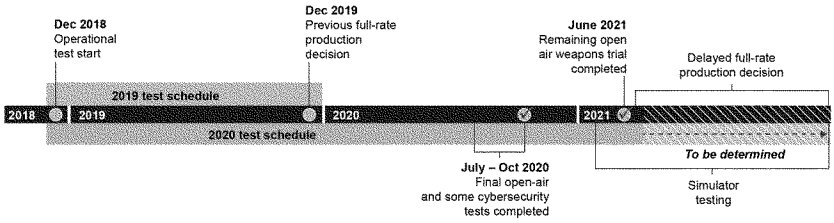
Testing Simulator Delays Drive Production Milestone Delay

We found that the program continues to delay full-rate production because of lingering issues with completing initial operational testing. After the program's 2012 rebaseline, DOD expected to wrap up initial operational testing in August 2018.[4] However, as of March 2021, it was unclear when that testing will be completed. The program did not complete its planned initial operational testing in 2021 due to delays in developing the F-35 Joint Simulation Environment, which we refer to as the aircraft simulator.[5] The simulator runs the F-35's mission systems software along with other software models (such as other weapons and modern threat systems) to provide complex test scenarios that the program cannot replicate in a real-world environment. While DOD has not set a date to complete the 64 simulated tests required to complete operational testing, the program made progress in other key testing areas. For example, the program completed the four remaining open-air tests in July 2020, the remaining initial operational cybersecurity testing on the logistics system and the aircraft in October 2020, and the final open-air weapons trial in June 2021. Figure 1 shows the test schedule as of June 2021.

[4]Since 2001, DOD significantly revised the cost and schedule goals for the program three times. DOD initiated the most recent restructuring when the program's cost for each aircraft exceeded critical thresholds. The restructuring process concluded when DOD established a new acquisition program baseline in March 2012 that increased the program's cost estimate by $162.7 billion and extended delivery schedules 5 to 6 years into the future. This March 2012 revision is the current program baseline, reflecting the cost and schedule estimates to deliver the aircraft and systems and to meet the original program requirements.

[5]The simulator is a compilation of several aircraft, weapons, and environment effects integrated as a simulation, training and test capability.

Figure 1: F-35 Operational Test Schedules and Key Events through 2021, as of June 2021



Source: GAO analysis of Department of Defense data. | GAO-21-105282

Testing officials identified technical problems with the simulator in August 2020 and have not established a time frame for fixing those problems, which has delayed the program's next production milestone decision. In March 2021, we reported that Director, Operational Test and Evaluation (DOT&E) officials told us they were not considering deferring any additional testing or granting a waiver to any test requirements needed for their final report. As a result, the F-35 program office is leading the simulator's development team in an effort to create a new schedule and to identify what steps must be taken to address the technical issues and ensure that the simulator fully represents F-35 aircraft. The program plans to release an updated simulator test schedule in August 2021, according to a program official.

Deficiencies Remain High

According to program officials, the F-35 program had 864 open deficiencies as of June 2021, which is slightly lower than the 872 we reported in March 2021. Deficiencies represent specific instances where the weapon system either does not meet requirements or where the safety, suitability, or effectiveness of the weapon system could be affected.

In June 2018, we recommended that the program resolve all critical deficiencies before making a full-rate production decision, in part, to reduce the potential for additional concurrency costs stemming from

continuing to produce aircraft before testing is complete.[6] DOD concurred with our recommendation and stated that the resolution of critical deficiencies identified during testing will be addressed prior to the full-rate production decision.[7]

Of the 864 open deficiencies, the program characterizes eight as being critical, which is three fewer than we reported in March 2021. According to program officials, at least seven of these critical deficiencies will be resolved prior to the completion of operational testing.

Aircraft and Engine Production Challenges Remain

Fewer Aircraft Delivered; More Were Late and Production Quality Concerns Remain

In 2020, the airframe contractor—Lockheed Martin—delivered fewer aircraft than originally planned, and fewer deliveries than planned are also expected in 2021. In 2020, the airframe contractor delivered 120 aircraft out of the 141 originally on contract and of those 100 were delivered late, which was more than the 17 delivered late in 2019. DOD officials attribute these late deliveries to ongoing issues we have previously reported on, such as fastener quality problems and parts shortages exacerbated by Coronavirus Disease 2019 (COVID-19) workforce restrictions. Program officials stated that Lockheed Martin conducted a supply chain assessment of impact resulting from COVID-19 and identified 37 parts challenges. According to program officials, the contractor does not expect to recover from all of these parts challenges until late 2022. To account for these COVID-19 production challenges, the F-35 program and Lockheed Martin reduced the number of aircraft to be delivered in 2020 from 141 to 124. However, even with this reduced number, Lockheed delivered four fewer aircraft than expected under its revised COVID-19 delivery plan. Furthermore, as of April 2021, the program planned for 158 aircraft deliveries in 2021. However, almost all of the aircraft delivered so far in 2021 have been late, and Lockheed Martin is not projected to deliver all 158 aircraft, according to program officials.

Although production has not met expectations to date, the F-35 program expects to produce a high number of aircraft in 2022. The most aircraft

[6]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).

[7]GAO-18-321.

the contractors have delivered in one year has been 134, which they accomplished in 2019, before many of the supply chain challenges were present. However, the program now plans for 167 deliveries in 2022, which is more than the contractors have ever delivered and 47 more aircraft, and 39 percent greater, than it delivered in 2020.

In May 2020, we identified concerns with the maturity of Lockheed Martin's production processes.[8] Specifically, we found that only about 3,000 of the over 10,000 airframe contractor's manufacturing key processes met predefined design standards for ensuring product quality. The program is already producing more aircraft during what is referred to as low-rate initial production than originally planned.[9] Statute and DOD policy states that the preliminary low-rate production quantities will be set at the development request for proposal decision point. If, at that time, low-rate initial production quantities are determined to be above 10 percent of the total quantity planned, the Secretary of Defense must explain the reasons for the increase in a report to Congress. When a program reaches the planned low-rate initial production quantity, and will be required to exceed the quantity, the program may seek approval to produce quantities above that amount.[10] According to the F-35 Acquisition Strategy, 610 aircraft are approved for low-rate production, which is nearly 25 percent of the total planned aircraft. This means that almost one-fourth of all aircraft currently anticipated to be purchased are being produced before satisfying the criteria for full-rate production. As we reported in 2020, the manufacturing processes were not meeting metrics for production consistency, indicating that the production processes are not fully mature. We recommended that DOD direct the F-35 program office to evaluate the production risks associated with critical production processes that are not in control and provide that information to Congress ahead of the full-rate production decision.[11] DOD did not concur with our recommendation, but it stated that it would keep the Congress apprised of these matters in its quarterly briefings to the defense committees. As of

[8]GAO-20-339.

[9]Low-rate initial production establishes the initial production base for the system, provides an efficient ramp-up to full-rate production, and maintains continuity in production pending operational test and evaluation completion.

[10]10 U.S.C. § 2400.

[11]GAO-20-339.

March 2021, we reported that 15 fewer critical manufacturing processes were in control than we reported in 2020.[12]

We also previously reported on long-standing supply chain challenges, such as late parts or parts shortages.[13] For example, in 2019 we reported that, with the production rate increase, the supply chain was strained to deliver parts on time, which led to parts shortages.[14] We also reported on issues the program faced with managing and moving parts around the world, which limits the warfighter's ability to maintain the aircraft.[15] In 2020, existing supply chain issues were exacerbated by COVID-19. Program officials stated that Lockheed Martin conducted a supply chain assessment of the impact of COVID-19 and identified 37 parts challenges. According to the officials, the contractor does not expect to recover from all of these parts challenges until late 2022. In July 2021, we reported that the F-35 supply chain had become more responsive but that the F-35 program was still not meeting its objectives.[16]

Despite the delays to aircraft deliveries and supply chain issues, other production metrics associated with the airframe slightly improved in 2020. Aircraft take less time to build, on average, and the contractor spends less time on scrap, rework, and repair.

Engine Deliveries Late Due to Quality Issues and Supplier Delays

In 2020, the engine contractor—Pratt & Whitney—continued to deliver fewer F-35 engines on time, which Defense Contract Management Agency officials attribute to production quality issues and parts delays. According to Lockheed Martin representatives, late delivery of these engines did not affect the aircraft delivery schedule because Pratt & Whitney builds time into its schedule to deliver the engines earlier than they are actually needed for production. As of November 2020, Pratt & Whitney had delivered 115 of 136 engines late. DOD officials stated the

[12]GAO-21-226.

[13]GAO-20-339; and 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).

[14]GAO-19-341.

[15]Within the F-35 program, U.S. services share access to spare parts along with the rest of the global fleet in the global spares pool. GAO, *F-35 Aircraft Sustainment: DOD Needs to Address Substantial Supply Chain Challenges,* GAO-19-321 (Washington, D.C.: Apr. 25, 2019).

[16]GAO-21-439.

two main issues that affected late delivery of engines are increased demand for engine parts from fielded aircraft for flaps and seals due to coating loss and COVID-19-related effects at various suppliers.[17]

Program Continues Its Efforts to Replace Turkish Suppliers

The program continues to address supplier challenges associated with the removal of Turkey from the supply chain and identified new suppliers for 1,005 parts produced in Turkey. In July 2019, DOD removed Turkey from the F-35 program due to its government's decision to procure Russian-made radar systems. The Under Secretary of Defense for Acquisition and Sustainment directed that the F-35 program establish alternative sources and stop placing orders with Turkish suppliers after March 2020.

We reported in May 2020 that Turkey's removal from the F-35 program was likely to compound existing supply chain issues.[18] To mitigate those concerns, the Under Secretary of Defense for Acquisition and Sustainment stated the F-35 program is authorized to continue accepting delivery of parts from Turkish suppliers through the end of lot 14 deliveries (scheduled to take place through 2022). In May 2020, we recommended that DOD direct the F-35 program office to evaluate supplier readiness—particularly for those replacing Turkish suppliers—along with the steps it is taking to address those risks and provide this information to Congress ahead of the full-rate production decision. DOD did not concur with our recommendation, but it stated that it would keep Congress apprised of these matters in its quarterly briefings to the defense committees.

As of May 2021, the program identified alternative suppliers for all 1,005 parts. According to program officials, all of the 817 air vehicle parts and 145 of the 188 engine parts are qualified.[19] The program estimates it will cost $108 million to establish alternative suppliers but has not negotiated these costs and, therefore, does not yet know what the cost impact will be for the parts being produced.

[17]According to Pratt & Whitney representatives, the protective coating on flaps and seals—specific parts of the engine—wears away faster than new parts can be produced. Pratt & Whitney representatives stated they plan to increase the capacity and capability of the supplier and to implement a more durable coating—one that will last the life of the part—to help mitigate this issue.

[18]GAO-20-339.

[19]According to program officials, new suppliers are required to go through qualification and testing to ensure the design integrity for their parts.

Reliability and Maintainability Is Improving but Not All Goals Are Met and Affordability Remains a Concern

We found that F-35 reliability and maintainability performance continues to improve, but the program is still not meeting all of its performance goals. The reliability and maintainability goals lay out specific quantitative metrics aimed at ensuring that an aircraft will be available for operations as opposed to out-of-service for maintenance. In April 2019, we found that the program was only meeting about half of its 24 reliability and maintainability goals. We also found that it was unlikely that the aircraft would meet their reliability and maintainability goals by the time they reached maturity.[20] We made five recommendations, including that the program office take steps to ensure those goals are met by aircraft maturity or revise those goals to be more achievable.[21] DOD concurred with our recommendations and has improved F-35 reliability and maintainability since then. As of June 2020, the program was meeting or close to meeting 17 of its 24 goals.

Program officials attribute improvements in meeting seven more reliability and maintainability metrics in 2020 to their efforts to fund and implement reliability improvement projects over the last year. Program officials stated that they increased funding from $7 million in 2019 to $40 million in 2020 and implemented 51 new reliability and maintainability improvement projects. Although the program is still not meeting seven of its 24 reliability and maintainability goals, measurable improvements in these goals can take time to manifest. For example, fielded aircraft must be modified and flown for many hours before the program can measure performance and implement further improvements, if needed.

While there have been recent improvements in reliability and maintainability metrics, affordability of the aircraft remains a major concern. We have previously reported on the F-35 program's rising estimated sustainment costs and challenges maintaining an expanding fleet. In July 2021, we reported that the military services face a substantial and growing gap between estimated sustainment costs and affordability constraints—i.e., costs per tail (aircraft) per year that the services project they can afford—totaling about $6 billion in 2036 alone.[22]

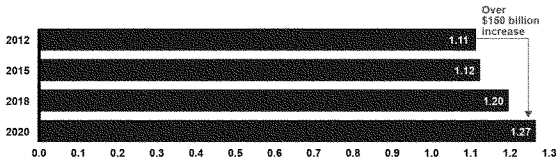
[20]The F-35 aircraft reach maturity when all variants have flown a combined 200,000 hours, with each variant flying at least 50,000 hours. The F-35A reached its planned maturity in July 2018 but is still not meeting four of its eight metrics. The F-35B and C variants have more time to meet their metrics before they reach their planned maturity in 2021 and 2024 respectively.

[21]GAO-19-341.

[22]GAO-21-439.

The services will collectively be confronted with tens of billions of dollars in sustainment costs that they project as unaffordable during the life cycle of the program. We also noted that estimated F-35 life-cycle sustainment costs increased by over $150 billion from fiscal years 2012 through 2020, as shown in figure 2.

Figure 2: Growth in F-35 Life-Cycle Sustainment Cost Estimates



Source: GAO analysis of Department of Defense data. | GAO-21-105282

[a]Then-year dollars include the effects of inflation.

Cost reductions become increasingly difficult as the program grows and matures. However, we found there is no agreed-upon approach to control the costs. In July 2021, we recommended that DOD assess and document its ability to meet the services' affordability constraints with existing or planned cost-reduction efforts and also assess and document changes in service-related program requirements (e.g., the number of aircraft purchases and flying hours) to achieve cost reductions.[23] Additionally, we recommended that DOD develop and document a program-wide plan for achieving the services' affordability constraints and that it also develop and document a risk management approach for addressing potential challenges to achieving affordability. DOD partially concurred with our recommendations and identified actions it is currently or planning to take to address them. Further, we suggested that Congress consider (1) requiring DOD to report annually on progress made in achieving the services' affordability constraints, including the actions taken and planned to reduce sustainment costs; and (2) making future F-

[23]GAO-21-439

35 aircraft procurement decisions contingent on DOD's progress in achieving its F-35 sustainment affordability constraints.[24]

Modernization Cost Estimates Are Increasing and Remaining Schedule Is Not Achievable

In March 2021, we found the F-35 program continues to experience development cost increases and schedule expansion.[25] Costs continued to rise during 2020 due to delays in schedule and challenges in developing certain technologies, among other things. In 2020, the program added a year to its Block 4 modernization schedule and now expects to extend Block 4 development into fiscal year 2027. In March 2021, we found that the schedule was not based on the contractor's demonstrated past performance but on estimates formulated at the start of the Block 4 effort, increasing the likelihood that the scheduled 2027 completion date is not achievable. In addition, the program office plans to require new metrics that should improve insight into Block 4 capability delivery and ongoing discovery of software defects.

Block 4 Development Costs Continue to Increase, Schedule Continues to Expand, and Underlying Cost Estimate Does Not Fully Reflect Leading Practices

The estimated cost for Block 4 development increased and the schedule expanded every year since the program started the development effort in 2018. In May 2020, we found that DOD's Block 4 reports to Congress did not fully represent the total estimated costs of Block 4 development.[26] DOD focused its reporting on the future year defense program and excluded costs incurred prior to 2018 and after 2024. For example, in 2018, DOD reported that Block 4 development would cost $10.6 billion for fiscal years 2018 through 2024. We recommended that the program office provide a more holistic perspective of the total Block 4 development costs to provide Congress with improved oversight of Block 4 costs.[27] In response to our recommendation, DOD reported to Congress that the program's total cost of $14.4 billion reflects not only earlier incurred costs but also an additional 3 years of Block 4 development for fiscal years 2013 through 2027. Figure 3 shows the increases in Block 4 development time frames and estimated costs.

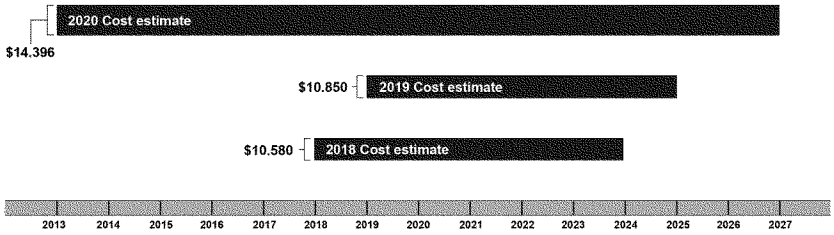
[24]GAO-21-439.

[25]GAO-21-226.

[26]These reports are required by the National Defense Authorization Act for Fiscal Year 2017, Pub. L. No. 114-328, § 224(d), (2016).

[27]GAO-20-339.

Figure 3: Block 4 Development Cost and Schedule Growth Since 2018 (fiscal year dollars in billions)



Source: GAO analysis of Department of Defense data. | GAO-21-105282

Note: The 2018 and 2019 estimates reflect a shorter time frame as DOD focused its estimates on the future year's defense program, which is DOD's projected spending for the current budget year and at least the next 4 years. The 2020 estimate includes costs for the entirety of the program, including all prior years' actual costs and the 3 additional years estimated to completion from the original 2018 estimate.

We found that the Block 4 development cost estimate increased by $3.5 billion since DOD's May 2019 Block 4 report to Congress. Over half of that increase—$1.9 billion—was cost growth within various aspects of the Block 4 development program. For example, Technology Refresh 3 (TR-3)—a critical enabler of Block 4 capabilities—costs continued to grow. According to program officials, much of the increase in TR-3 costs was because its development is more complex than originally expected.

Furthermore, in May 2020 we found that the F-35 Block 4 cost estimate used to prepare its report to Congress was missing key elements of GAO cost estimate leading practices, such as taking into account risk and uncertainty.[28] We recommended that the program office address these elements in the next update to its Block 4 cost estimate. DOD did not fully concur with these recommendations but stated it would take steps to improve future estimates.

Planned Block 4 Development Schedule Is Not Achievable

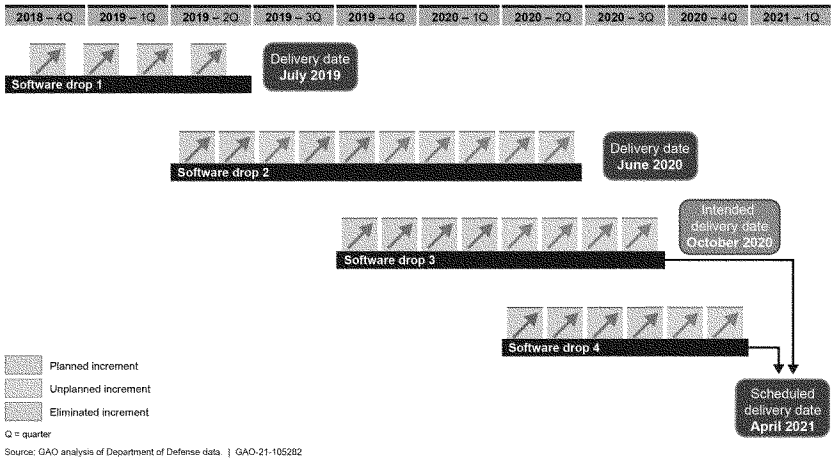
The F-35 program is more than 3 years into Block 4 development, but it has not delivered new capabilities as planned. Further, we found in March 2021 that the remaining development schedule is not based on the most recent data available and is not achievable. Under the Continuous

[28]GAO-20-339.

Capability Development and Delivery (C2D2) development approach, the F-35 program office plans to incrementally develop, test, and deliver smaller groups of capabilities to the F-35 fleet— delivered aircraft that are operating around the world—every 6 months.

Under the C2D2 approach, Lockheed Martin is to sequentially develop four software increments on the way to each 6-month software drop. These increments are intended to refine and further develop capabilities over time as each is tested by the developmental test fleet. While the program generally plans for these four increments per software drop, over the last 2 years, we found that some software drops required more increments and took longer to develop than planned, as shown in figure 4. These additional increments delayed delivery of capabilities.

Figure 4: Actual Software Increments Exceed Number of Planned Increments



We found that the more recent drops, in particular, have more increments beyond the planned four. For example, software delivered in June 2020

included 10 increments—six more than originally planned. Furthermore, the planned October 2020 software drop included eight increments—four more than planned. Lockheed Martin representatives told us that each of these added increments was to address software defects.

Including all capabilities in the first increment of a software drop provides the contractor more time to find and, as needed, address any defects before the software is fielded to the fleet. Ideally, according to the program office, the contractor would identify defects in the software lab or before the software is fielded to the developmental test aircraft. However, a November 2020 analysis conducted by a consulting firm on behalf of the program office found that between December 2017 and September 2020, 656 software defects (or 23 percent of all software defects) were identified after the software was delivered to the test aircraft. Discovering these defects late contributed to the need for additional, unplanned software increments to fix those defects.

In addition, we found that the program office had not adjusted its schedule to reflect the unplanned increments and delivery delays because it has maintained the desire to deliver software every 6 months. According to the GAO Agile Assessment Guide, a program's schedule should realistically reflect how long each activity will take and software development teams should examine historical performance to inform future estimates.[29] Program officials stated that, while the program revised its schedule to deliver capabilities later than initially planned, they had not formulated a revised schedule for delivery of future capabilities based on the contractor's demonstrated past performance.

Program officials stated that the program is currently reviewing the feasibility of its schedule. Without a software development schedule that reflects how much work can be accomplished in each increment based on historical performance, the program office will continue to experience Block 4 development delays, and capabilities will continue to be postponed into later software drops. Delays in capability development and delivery increase the risk that capabilities will be out of date by the time they are delivered, capability development costs will be higher, and capabilities will be delivered to the fleet with deficiencies. Ultimately, these delays lead to warfighters waiting longer for the capabilities they need to achieve their missions.

[29]GAO-20-590G.

To address these issues, in March 2021, we recommended that DOD ensure that the F-35 program office updates its Block 4 schedule to reflect historical performance and develop more achievable time frames for Block 4 modernization capability development and delivery. DOD concurred with this recommendation and identified actions it was taking to address it.

Program Office Is Adding New Metrics to Measure Software Quality

In March 2021, we found the Block 4 contract requires the contractor to report data on metrics for software quality, performance, cost, schedule, and staffing to the F-35 program that inform software development.[30] However, these metrics provide limited insight into aspects of software development quality under the Agile software development approach.[31] Our *Agile Assessment Guide*, which identifies key practices for Agile software development, states that clear, meaningful, actionable metrics provide managers information to measure program performance.[32] The F-35 program established the initial metrics the contractor is required to report on in its November 2018 contract. Program officials told us that Block 4 development activities, at that time, were focused on resolving deficiencies from the baseline program, rather than on developing new capabilities, which influenced the metrics in the contract.

Since the November 2018 contract award, program officials explained that, as they transitioned to developing new capabilities, they recognized the need for more information and took steps to collect other metrics on software development. For example, as we reported in March 2021, the program office worked with the contractor to obtain data on 19 metrics, in addition to those required by contract, to provide further insight into the quality and performance of software development. Despite these additions, program officials acknowledged that they are not collecting all the metrics they need to better understand program risks and make more informed management decisions, but are taking steps to do so. Program officials explained that they are using guidance provided by DOD and coordinating with other program offices that have used Agile software development to identify more informative Agile software development metrics.

[30]GAO-21-226.

[31]GAO-21-226. The F-35 program uses a new Agile-like development approach for its Block 4 software development effort and relies on software development metrics collected and reported by Lockheed Martin to monitor its software development progress.

[32]GAO-20-590G.

In March 2021, we made two recommendations aimed at improving the program's insight into the quality of software the contractor is developing, and DOD concurred with our recommendations. Program officials stated that the next iteration of the Block 4 contract, expected to be awarded in December 2021, will require new metrics that should provide better insight into on-time delivery of capabilities and software defects, two key issues hindering the program from adhering to its development schedule.

In conclusion, the F-35 is expected to serve key roles in U.S. and allied air fleets for years to come. While the program approaches its full-rate production decision point, the program is producing nearly 25 percent of the total planned aircraft in low-rate initial production before satisfying the criteria for full-rate production and with processes that are not fully mature. Nonetheless, a concerning number of challenges remain in the baseline program. Each year DOD plans to procure an increasing number of aircraft, despite manufacturing processes that are not fully mature, supply chain issues that strain production and sustainment, and a number of critical deficiencies with the aircraft. Compounding these production issues, the program has not completed testing on the baseline aircraft to ensure warfighters get the capabilities they require, primarily due to prolonged delays with completing the simulator. At the same time, the program is more than 3 years into modernizing the aircraft and is encountering similar issues as experienced in the baseline program, namely cost and schedule increases.

Looking ahead, the gap between projected sustainment costs and what the services say they can afford is already on track to widen substantially. The myriad challenges with the F-35 confound U.S. efforts to modernize its high-end tactical jet fleet to face near-peer adversaries and modern threats. Additionally, the challenges remaining in the manufacturing, supply chain, testing, and late delivery of baseline aircraft, together with the affordability and sustainment challenges, highlight the importance of having a realistic expectation of how many aircraft the contractor can produce on-time in the near-term. All of these challenges raise the importance of continued congressional oversight of the program.

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.

GAO Contact and Staff Acknowledgments

If you or your staff have any questions about this testimony, please contact Jon Ludwigson at (202) 512-4841 or ludwigsonj@gao.gov. Contact points for our Office of Congressional Relations and Public Affairs may be found on the last page of this statement.

GAO staff who made key contributions to this testimony are Justin Jaynes (Assistant Director), Jillena Roberts (Analyst in Charge), Gioia Chaouch, Laura Greifner, Roxanna Sun, and Lauren Wright. Other staff who made key contributions to the reports cited in the testimony are identified in the source products.

Appendix I: Prior GAO Reports on the F-35 Acquisition Program and Department of Defense Actions

Table 1: Prior GAO Reports on F-35 Lightning II Joint Strike Fighter and Department of Defense (DOD) Responses

Year, GAO report	Primary GAO conclusions and recommendations	DOD response and actions
2001 GAO-02-39	Critical technologies needed for key aircraft performance elements are not mature. We recommended that the program delay start of system development until critical technologies are matured to acceptable levels.	DOD did not concur with our recommendation. DOD did not delay the start of system development and demonstration stating technologies were at acceptable maturity levels and that it will manage risks in development.
2006 GAO-06-356	The program was entering production with less than 1 percent of testing complete. We recommended that the program delay investing in production until flight testing shows that the Joint Strike Fighter performs as expected.	DOD partially concurred but did not delay start of production because it believed the risk level was appropriate.
2010 GAO-10-382	Costs and schedule delays inhibited the program's ability to meet needs on time. We recommended that the program complete a comprehensive cost estimate and assess warfighter and initial operational capability requirements. We suggested that Congress require DOD to tie annual procurement requests to demonstrated progress.	DOD continued restructuring, increasing test resources, and lowering the production rate. Independent review teams evaluated aircraft and engine manufacturing processes. Cost increases later resulted in a Nunn-McCurdy breach. Military services completed the review of capability requirements, as we recommended.
2014 GAO-14-322	Delays in developmental flight testing of the F-35's critical software may hinder delivery of the warfighting capabilities to the military services. We recommended that DOD conduct an assessment of the specific capabilities that can be delivered and those that will not likely be delivered to each of the services by their established initial operational capability dates.	DOD concurred with our recommendation. On June 22, 2015, the Under Secretary of Defense for Acquisition, Technology, and Logistics issued a Joint Strike Fighter software development report, which met the intent of our recommendation.
2016 GAO-16-390	The terms and conditions of the planned block buy and managing follow-on modernization under the current baseline could present oversight challenges for Congress. We recommended that the Secretary of Defense hold a milestone B review and manage follow-on modernization as a separate major defense acquisition program.	DOD did not concur with our recommendation. DOD viewed modernization as a continuation of the existing program and the existing oversight mechanisms, including regularly scheduled high-level acquisition reviews, would be used to manage the effort.

Year, GAO report	Primary GAO conclusions and recommendations	DOD response and actions
2017 GAO-17-351	Program officials projected that the program would only need $576.2 million in fiscal year 2018 to complete baseline development. At the same time, program officials expected that more than $1.2 billion could be needed to commit to Block 4 and economic order quantity in fiscal year 2018. GAO recommended DOD use historical data to reassess the cost of completing development of Block 3F, complete Block 3F testing before soliciting contractor proposals for Block 4 development, and identify for Congress the cost and benefits associated with procuring economic order quantities of parts.	DOD did not concur with the first two recommendations and partially concurred with the third while stating that it had finalized the details of DOD and contractor investments associated with an economic order quantity purchase and would brief Congress on the details, including costs and benefits of the finalized economic order quantity approach.
2018 GAO-18-321	The program office plans to resolve a number of critical deficiencies after full-rate production. We recommended that the F-35 program office resolve all critical deficiencies before making a full-rate production decision and identify steps needed to ensure the F-35 meets reliability and maintainability requirements before each variant reaches maturity. We also suggested that Congress consider providing in future appropriations that no funds shall be available for obligation for F-35 Block 4 until DOD provides a report setting forth its complete acquisition program baseline for the Block 4 effort to the congressional defense committees.	DOD concurred with both recommendations and identified actions that it would take in response. The National Defense Authorization Act for Fiscal Year 2019 included a provision limiting DOD from obligating or expending more than 75 percent of the appropriations authorized under the Act for the F-35 continuous capability development and delivery program until 15 days after the Secretary of Defense submits to the congressional defense committees a detailed cost estimate and baseline schedule. DOD submitted its F-35 Block 4 report to Congress in May 2019, which contained cost and schedule information responding to this provision.
2019 GAO-19-341	We recommended that the Secretary of Defense ensure that the F-35 program office assess the feasibility of its required reliability and maintainability targets, identify specific and measurable reliability and maintainability objectives in its improvement plan guidance, document projects that will achieve these objectives, and prioritize funding for these improvements. We also recommended that the Secretary of Defense ensure that the F-35 program office completes its business case for the initial Block 4 capabilities under development before initiating additional development work.	DOD concurred with our four recommendations on reliability and maintainability and identified actions it would take in response. While DOD has taken some action, these recommendations are still open. DOD did not concur with our recommendation on Block 4 modernization. DOD stated that the F-35 program has adequate cost, schedule, and technical maturity knowledge to begin the development of initial Block 4 capabilities.
2020 GAO-20-339	We suggested that Congress extend DOD's Block 4 modernization reporting requirement beyond 2023 to extend to the end of the effort. We also made five recommendations to the Secretary of Defense to submit production risks to Congress prior to full-rate production, to establish a Block 4 cost estimate baseline that covers all costs, and to take other steps to improve the Block 4 cost estimate. These steps are to complete a work breakdown structure, conduct a risk and uncertainty analysis, and consider technology risk assessments to help inform the Block 4 development cost estimate.	While DOD did not concur with two of our recommendations—including to evaluate production risks and update its Block 4 cost estimate with a program-level plan—it identified actions that, if implemented, will meet the intent of these recommendations. DOD concurred with our three other recommendations.

Year, GAO report	Primary GAO conclusions and recommendations	DOD response and actions
2021 GAO-21-226	We recommended that the Secretary of Defense direct the F-35 program office to update is Block 4 schedule to reflect historical performance, to develop more achievable time frames for Block 4 modernization capability development and delivery, and to provide an accurate baseline for comparing future cost estimates. We also recommended that the F-35 program office identify and implement automated tools to enable access to real-time data for software development metrics and set software performance target values for critical software quality metrics.	DOD concurred with all three recommendations and identified actions it was taking to address them.
2021 GAO-21-439	We suggested that Congress consider requiring the Under Secretary of Defense for Acquisition and Sustainment report annually on progress in achieving the services' affordability constraints and consider making future F-35 aircraft procurement decisions contingent on DOD's progress in achieving F-35 sustainment affordability constraints. We also made 4 recommendations to the Secretary of Defense to ensure that, prior to the milestone C decision, document DOD's ability to meet the services' affordability constraints, changes in service-related program requirements, a program-wide plan for achieving affordability constraints, and a risk-management approach for addressing potential challenges to achieve affordability objectives.	DOD partially concurred with the four recommendations. DOD agreed with the substance of all four of our recommendations and identified actions it is currently or planning to take to address them. However, for each of the recommendations, DOD stated that it was uncertain if it could address the recommendation prior to a milestone C decision for the program.

Source: GAO | GAO-21-105282

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Jon Ludwigson is a Director in GAO's Contracting and National Security Acquisitions (CNSA) team. In that role, Jon oversees work spanning a variety of areas, including weapons systems acquisitions, Army modernization, the F-35 Joint Strike Fighter, and oversight of DOD research and development on related technologies.

Jon joined GAO in 1998. Before his work with CNSA, he served as an Assistant Director in the Natural Resources and Environment team where he led numerous engagements examining energy, energy market, and research and development topics. Jon's work also contributed to GAO's duplication, overlap, and fragmentation reports, as well as GAO's High Risk reports.

Jon earned a master's degree in public policy from Georgetown University and a bachelor's degree in business administration from the University of Colorado at Boulder.

Jon works in GAO's Denver Field Office.

WITNESS RESPONSES TO QUESTIONS ASKED DURING THE HEARING

JULY 13, 2021

RESPONSE TO QUESTION SUBMITTED BY MR. KAHELE

General NAHOM. AMC has examined IR suppressor technologies and it does not provide additional capability against known IR threats. Current IR countermeasure capabilities on the C–130 provide sufficient risk mitigation for known IR threats. AMC anti-manpad TTPs are very robust, have evolved over time, and continue to evolve to counter threat changes. AFSOC employs C–130 in a different flight envelope and would need to be contacted to understand the risk assessment for AFSOC C–130s. [See page 31.]

RESPONSE TO QUESTION SUBMITTED BY MR. VEASEY

General NAHOM. Digital twins are integrated multi-physics, multiscale, probabilistic simulations of an as-built system that mirror and predict activities and performance over the life of the corresponding physical twin. They are one element of modern digital engineering practices and part of the Department of the Air Force (DAF) digital transformation.

We are fully engaged and invested in a Department-wide digital transformation. We have established guidance and training for acquisition and sustainment programs, including a comprehensive digital guide, digital building code, and community knowledge sites for sharing techniques, best practices, and lessons learned.

The DAF has not directed all legacy aircraft to create full-scale digital twins; however, all programs are encouraged to embrace digital engineering practices to advance our ability to deliver and sustain warfighter capabilities. We expect our legacy system program offices to determine the need for a digital twin (in whole or in part) based on a business case analysis to inform their decision. New programs will embrace digital twin technology to reduce development and sustainment costs, optimize performance trades, and generate the contiguous digital thread to support lifecycle operations. [See page 37.]

RESPONSE TO QUESTION SUBMITTED BY DR. JACKSON

Ms. COSTELLO. No. The T–7A system does not have any supply chain challenges related to China. [See page 30.]