

**NOT FOR PUBLIC RELEASE
UNTIL APPROVED BY THE
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**

**NOT FOR PUBLIC RELEASE
UNTIL APPROVED BY THE
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.