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# HEARING

ON

# NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2016

AND

# OVERSIGHT OF PREVIOUSLY AUTHORIZED PROGRAMS

BEFORE THE

## COMMITTEE ON ARMED SERVICES
## HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTEENTH CONGRESS

FIRST SESSION

SUBCOMMITTEE ON TACTICAL AIR
AND LAND FORCES HEARING

ON

# UPDATE ON THE F–35 JOINT STRIKE FIGHTER PROGRAM AND THE FISCAL YEAR 2016 BUDGET REQUEST

HEARING HELD
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# UPDATE ON THE F–35 JOINT STRIKE FIGHTER PROGRAM AND THE FISCAL YEAR 2016 BUDGET REQUEST

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House of Representatives,
Committee on Armed Services,
Subcommittee on Tactical Air and Land Forces,
*Washington, DC, Tuesday, April 14, 2015.*

The subcommittee met, pursuant to call, at 3:35 p.m., in room 2118, Rayburn House Office Building, Hon. Michael R. Turner (chairman of the subcommittee) presiding.

## OPENING STATEMENT OF HON. MICHAEL R. TURNER, A REPRESENTATIVE FROM OHIO, CHAIRMAN, SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

Mr. Turner. The Armed Services Tactical Air and Land Forces Subcommittee meets today in open session to receive testimony on the current status of the F–35 Joint Strike Fighter, JSF, program. This hearing continues the ongoing oversight activity conducted by the committee on the F–35 programs. The program officially began in 2001. We welcome our distinguished panel of witnesses.

We have Dr. Michael Gilmore, Director of Operational Test and Evaluation [DOT&E]; Dr. Michael J. Sullivan, Director of Acquisition and Sourcing, Government Accountability Office [GAO]; the Honorable Sean Stackley, Assistant Secretary of the Navy for Research, Development and Acquisition; Lieutenant General Christopher C. Bogdan, F–35 Program Executive Officer.

I thank all of you for your service and look forward to your testimony today.

The F–35 is a complex program. It is well known that, during its development, the F–35 program has experienced significant cost, schedule, and performance problems. Current acquisition costs are now approaching $400 billion, which, according to GAO, makes this DOD's [Department of Defense] most costly and ambitious acquisition program.

Over the last year, steady progress was achieved in development, production, and operations, but the subcommittee continues to have concerns regarding recent engine test failures and on software development and integration.

This committee, in particular this subcommittee, has maintained vigilant oversight on the F–35 program through legislation, hearings, and briefings, and, most recently, a trip to Eglin Air Force Base, Florida, to see the F–35 operations and talk to F–35 pilots and maintenance personnel.

Last year the committee required the Secretary of Defense to establish an independent team to review and assess the development of software and software integration for the F–35 program. This subcommittee may recommend a similar approach as a way to effectively review the most recent engine test failures.

I understand the substantial investment in the F–35 is more about the requirement for fifth-generation tactical fighter capability than it is about the F–35 itself. And let me underscore that. All of the members of this subcommittee are very well aware of the need for fifth-generation tactical fighter capability and the need to ensure that the F–35 is one of the most capable aircraft.

Based on the briefings and hearings held by the subcommittee, I have learned that fifth-generation tactical fighter capability is essential for maintaining air dominance and national security. Despite this critical need, that does not mean that this program should be rubber-stamped. As we have done in the past, the committee will hold this program accountable for cost, schedule, and performance.

The budget request for fiscal year 2016 includes $1.8 billion for F–35 research, development, test, and evaluation and $8.7 billion for the procurement of 57 F–35s, and $410.2 million for spares. This represents an increase of 19 aircraft and is also a $2.5 billion increase in F–35 funding from the fiscal year 2015 enacted levels.

And we all understand that we need to get to a higher production level to get the lower per-unit cost. We also understand that we have to address the issues operationally for the F–35 to ensure its best capability for the pilots and its intended needs.

We will hear today both the Director of the Operational Test and Evaluation and the GAO have concerns about the F–35 program for fiscal year 2016 and beyond. I look forward to all of our witnesses' testimony today, which will provide for a better understanding of the current status of the F–35 program.

[The prepared statement of Mr. Turner can be found in the Appendix on page 33.]

Mr. TURNER. Before we begin, I would like to turn to my good friend and colleague from California, Ms. Loretta Sanchez, for any comments that she might want to make.

**STATEMENT OF HON. LORETTA SANCHEZ, A REPRESENTATIVE FROM CALIFORNIA, RANKING MEMBER, SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES**

Ms. SANCHEZ. Thank you, Mr. Chairman. And thank you for calling this. I think this is an incredibly important project for us.

So we are looking at the 2016 budget request for the F–35 Lightning II aircraft program. It totals $10.8 billion spread across 17 separate procurement and R&D [research and development] accounts. That is an enormous amount even by the standards of the Department of Defense's budget.

The total is, for example, more than the Navy's fiscal year 2016 request for aircraft carrier and submarine construction combined. It is five times as much as the Army's fiscal year 2016 request for weapons and tracked combat vehicles. So given the scale of this proposed funding, I think it is important that we try to understand what is going on with the program.

Since World War II, America's way of war has required air superiority. And so airpower is one of the great advantages that we give to our military, especially when we are in places and it has proven time and time again. So the F–35 program, while flawed to this point, is really the key to retaining that airpower edge for the next 20 years or so. It is also going to be flown by at least 12 allied nations, all of whom are likely to be our partners in future conflicts at some point.

And so there have been some critics who have said we need to terminate this program because it is over cost, it is long overdue, and there are still problems with it. However, I believe that we are past that decision point. We have just got to make this program work.

And I think you will agree with me, Mr. Chairman, we have had many discussions on this. We have got to get this done.

Making it work is not an easy task. It is a very complicated piece of machinery, and everybody's had their fingers in it. Lots of decision have been made, and lots of decisions have been changed.

I am very still concerned about the engine fire last year, which resulted in a setback in the testing schedule. The substantive grounding also highlighted the risk of the current sole-source engine production arrangement that this program depends upon.

Secondly, the highly sophisticated software for the F–35 continues to encounter developmental delays. Both the GAO and the DOT&E have pointed out in their most recent reports that, because of the pressures on the flight testing schedule, a significant amount of test points were deferred or entirely dropped.

More specifically, the committee was recently informed by the F–35 program office at the start of development flight testing of some critical elements of the Block 3F software effort are on hold indefinitely, pending more progress on the critical fusion element of the preceding Block 2B software.

In addition to its stealth characteristics, the ability to fuse sensor feeds from other F–35s and other sources is one of the most important parts of the F–35 program. So, of course, this delay is also troubling with respect to the program.

And the operating and maintenance: The sustainability is significantly different than when we envisioned this project on the drawing boards. The GAO report noted in particular that the F–135 engine is far below reliability targets and that, as a result, the overall availability of the F–35 continues to lag significantly behind expectations.

I know that, when we have had other aircraft, new aircraft, we have had some of the same problems, not to this extent, not in this size, but we do need to get past these issues. So given all of these challenges and the very large funding request for the F–35 that we are faced with, I think it is important in today's hearing.

And this is what I would like to hear about: Is the proposed increase in F–35 production numbers, which would rise from 38 in fiscal year 2015 to 57 in fiscal year 2016, justified, given where the program is in development? What would a reduction in the numbers of aircraft look in particular to this program?

Second, we need a detailed review of what happened with that engine fire last year. I have been asking for it. I haven't heard it yet. We know that the aircraft and the engine in question were relatively new, yet a failure still occurred. Is it a manufacturing defect? Is it a design flaw? I would like to hear about that.

Third, the sensor fusion aspect of the F–35 software is a little understood, but critical, issue that is still not working as planned. What degree of risk do we face with that portion of the software? And could problems in this area turn what is the current delay of about 3 to 6 months into years?

So I look forward to getting some of the answers to these questions, gentlemen. Thank you.

And, Mr. Chairman, thank you for indulging me with the time.

Mr. TURNER. We will begin with Dr. Gilmore, being followed by Mr. Sullivan, Mr. Stackley, and General Bogdan.

Mr. Gilmore.

**STATEMENT OF J. MICHAEL GILMORE, DIRECTOR, OPERATIONAL TEST AND EVALUATION, OFFICE OF THE SECRETARY OF DEFENSE**

Dr. GILMORE. Thank you, Mr. Chairman and Congresswoman Sanchez and members of the subcommittee. I will just briefly summarize my written testimony.

Block 2B testing was extended, but is now nearing completion. The program developed an additional build to the Block 2B mission system software designed to incorporate fixes to problems, particularly in fusion of information both from the sensors on an individual aircraft as well as from the sensors on other F–35 aircraft that were highlighted in testing that was conducted in December of last year and early in 2015.

This so-called engineering test build was flown on 17 test sorties using 3 different mission systems to test aircraft in March. And although some improvement in performance was reportedly observed, distinguishing ground targets from clutter continue to be problematic.

And given the limits in the improvement seen using this engineering test build, I understand the program has decided to field the current, that is, prior to the engineering test build version, of the Block 2B software as opposed to waiting and doing additional testing with the engineering test build and to defer fixes of the software to Block 3i development and testing. If the balance of 2B testing completes in April, this would represent a delay of about 6 months relative to the program's master schedule.

Modification of early lot aircraft into a configuration usable for combat with Block 2B capabilities, a necessity brought on by the concurrency in the program, which dates to the program's initiation back in early last decade, is taking longer than planned and longer than predicted when the Department eliminated, on my recommendation, the block to the long-planned Block 2B operational utility evaluation [OUE].

These delays, as well as other problems that motivated the extension of Block 2B testing, indicate clearly that the aircraft would not have been ready to conduct the OUE by beginning training with operational pilots this past January and convinced me that the recommendation I made, which was adopted, was the correct one.

The trends and reliability metrics we track are unclear. The most recent data we have obtained generally indicate, with the exception of mean flight hours between critical failure for the F–35B, a 3-

month upward trend, which is good, from September 2014 to November 2014. However, when combined with data from the previous 3 months, they showed both declines and increases. Thus, I cannot yet conclude with confidence that reliability is continuing to improve.

Aircraft availability did show improvement at the end of 2014, as the program focused on providing greater supplies of spares and on shortening maintenance activities that had heretofore required longer aircraft downtimes. However, that trend has not been sustained so far in calendar year 2015, as the first 2 months have shown a decline. But, again, that is only 2 months. We shouldn't rush to conclusions about whether that constitutes a trend.

I have also updated my analysis of the growth and reliability needed for the F–35A and B variants to achieve their requirements based on the most recent data from November 2014. And that analysis indicates that growth and selected reliability metrics for both aircraft, the A and the B, remain insufficient to meet requirements of maturity. And there is insufficient flight hours in the C variant to preclude that—I can't do meaningful analysis at this point in development. It is still too early.

Discoveries in testing continue to occur, which should be expected in a program of this complexity, such as was highlighted regarding sensor fusion, as well as the occurrence of additional unpredicted cracking in the F–35B durability test article, which was discovered in February and caused testing to pause until repairs could be completed. Testing did restart on the 1st of April.

Flight testing of Block 3i mission systems, consisting of a Block 2B software we hosted on the upgraded set of processor hardware needed before Block 3F software can be used, we started March. And one of the mission systems test aircraft began testing the next increment of software that is called 3iR5.

Block 3F flight testing also began in March, what was limited to three single-ship test flights on one mission system's test aircraft, AF–3, prior to it being reconfigured to support late Block 3i testing. This start represents an 11-month delay relative to the program's master schedule and about a 1-month delay relative to the program's more recent projections.

Continued Block 3F testing is not scheduled until June, as the program's plans for reconfiguring aircraft in the Block 2B configuration to Block 3F are under development.

In both my annual report and my written testimony, I identified problems with the U.S. Reprogramming Laboratory, which is the government facility that is going to be used to generate what are called mission data files for the aircraft—mission data loads for the aircraft. These data loads are essential to the effective combat operations of Joint Strike Fighter.

I had identified 2 years ago shortfalls in those labs. The program office has done a study that reconfirmed those shortfalls and found new shortfalls. About 2 years ago the Secretary of Defense provided resources to correct those shortfalls, but no action has been taken.

It is my understanding, if the program office takes action very quickly, those shortfalls can be corrected in time for operational testing and, more importantly, for full operational capability, and I recommend strongly that that action be taken.

In my annual report and written testimony, I provided no review of Block 2B capabilities and limitations. The program has identified and prioritized many deficiencies for correction. Nonetheless, Block 2B aircraft will be fielded without a number of corrections of operational significance in place.

Further discovery of problems is likely, in my view, as operational units start using JSF in ways it has not previously been used. I agree with the program's assessment that there is at least 6 months' pressure in completing Block 3F, recently projected by the program to complete testing in May 2017.

While the program has worked hard to reduce the bow wave of what it calls technical debt, which are fixes to problems that were deferred from earlier mission software versions to later versions—and that continues to happen—the program is now deferring fixes, including problems with fusion and testing to Block 3i and Block 3F, which, together with the delays that have occurred in starting Block 3 testing, increase risk on the program's projected Block 3F schedule.

Thank you.

[The prepared statement of Dr. Gilmore can be found in the Appendix on page 35.]

Mr. TURNER. Mr. Sullivan, who hails from the great and historic Wright-Patterson Air Force Base.

Mr. SULLIVAN. Sorry about the Flyers this year, although they made it.

**STATEMENT OF MICHAEL J. SULLIVAN, DIRECTOR, ACQUISITION AND SOURCING MANAGEMENT, GOVERNMENT ACCOUNTABILITY OFFICE**

Mr. SULLIVAN. Chairman Turner, Ranking Member Sanchez, and members of the subcommittee, thank you for inviting me here to discuss our work on the F–35.

Let me begin by providing context for where we are today on the F–35 by briefly revisiting the past. As we all know, the program's overall cost has nearly doubled at this point since the program began in 2001 and its dates for delivering initial capabilities have been significantly delayed.

No one would argue that these problems can be traced to decisions made then to start the program with little knowledge about technologies, designs, or capabilities needed for this fifth-generation fighter aircraft.

A highly concurrent acquisition strategy over the next decade resulted in costly airframe redesigns and significant software and hardware design changes that cascaded onto the manufacturing floor and created more inefficiency.

In 2012, the program experienced a Nunn-McCurdy significant cost breach and the Department took significant action to bring realism to cost estimates, add resources to the program, and all in all establish a new baseline for cost and schedule moving forward.

So today the F–35 is on much firmer footing and is being managed in a way that has stabilized its cost. It is improving its ability to deliver aircraft more efficiently, and, most importantly, it remains the centerpiece of the Department's long-term tactical aircraft inventory and one of its highest priorities.

As we move into the future, it would be nice to be able to report that all risk is now behind the program. However, with around 40 percent of the developmental flight tests remaining, the program has already procured 179 F–35s and plans to add 339 more over the next 5 years for $50 billion, all before flight test is complete.

This concurrency between testing and buying more aircraft is risky. Recent problems with airframe durability testing and the engine, continued delays to software development and testing with the most complex portions of that software development yet to come, and other competing national security priorities which will take funding as well, all add to the significant risk that remains and will be needed to be managed very carefully.

The recent unanticipated engine and bulkhead failures are prime examples of the program's ongoing struggle with concurrency and the cost and schedule risk it brings. Programs in developmental testing should expect to encounter discoveries that require design changes, just as Dr. Gilmore stated.

However, in a concurrent testing and procurement environment, the destabilizing effects of these tests discoveries are amplified as more systems are produced and delivered, thus requiring costly design changes, retrofits, and rework.

Given these ongoing challenges, it is important that the program, the Department, and the Congress fully understand the implications of increasing F–35 procurement rates in the near term in order to make informed funding decisions.

In our estimation, the Department should provide answers to three critical questions:

First, are major test discoveries and design changes behind the program, given that testing of more complex software and capabilities still lies ahead?

Second, has the contractor's manufacturing capability and industrial base progressed enough to meet the proposed increased production rates?

And, third, is the program's current procurement plan affordable when viewed within the context of competing fiscal priorities both within and outside of the Department?

Mr. Chairman, members of the committee, that concludes my oral statement. I would be pleased to respond to any questions.

[The prepared statement of Mr. Sullivan can be found in the Appendix on page 59.]

Mr. TURNER. Thank you.

Mr. Secretary.

**STATEMENT OF HON. SEAN J. STACKLEY, ASSISTANT SECRETARY OF THE NAVY FOR RESEARCH, DEVELOPMENT AND ACQUISITION**

Secretary STACKLEY. Chairman Turner, distinguished members of the subcommittee, I thank you for the opportunity to appear before you today to testify on the F–35 Joint Strike Fighter program.

The Marine Corps variant of the Joint Strike Fighter is on track to achieve its initial operational capability, or IOC, this summer. This milestone is, of course, but a way point, for the software build called Block 2B, which the Marines will employ at IOC, provides limited warfighting capability in accordance with the program's long-planned incremental build plan.

Full warfighting capability, at least sufficient to support the final, of the services and our international partners and our foreign military sales customer nations IOCs will be delivered in a subsequent software build called Block 3F.

That notwithstanding, it should not be lost on this subcommittee, the significant challenges and adversity that the program has and will continue to overcome in order to achieve the Marines' IOC and that the milestone will be achieved more or less in accordance with the budget and schedule established by the program about 4 years ago.

Today, increasingly, the focus is on delivering the next block of capability, Block 3i, which incorporates upgraded computing hardware, but otherwise is the warfighting equivalent of Block 2B, and, therefore, assessed as relatively low risk. We have begun flight testing with Block 3i, and today we assess that we are on track to support the Air Force IOC with Block 3i capability in the summer of 2016.

Completion of the final block of capability, Block 3F, which is the capability that the services will ultimately deploy with, poses the greatest challenge to completion of the system development phase of the Joint Strike Fighter program.

Block 3F software requirements are well understood and stable. However, this block includes the most complex functionality of the three software baselines, including what is referred to as sensor fusion.

Further, coding and testing of Block 3F has been delayed as a result of the resource demands, software engineers, and lab facilities associated with supporting completion of earlier software builds.

These factors add up to the program's estimate of 4 to 6 months schedule risk with completion of Block 3F. Despite the schedule risk, we remain on track to support the Navy carrier variant IOC with Block 3F in 2018.

In parallel with completion of the system software and related flight testing leading to each of the service's IOCs, the program is managing the resolution of technical issues that have been discovered in testing; the ramp-up of production of the three aircraft variants across a large and growing industrial base that supports JSF; improvements to affordability and production; incorporation of modifications to correct deficiencies identified on earlier production aircraft; needed improvements to reliability and maintainability of the aircraft; planning and assignment of maintenance, repair, overhaul, and upgrade, or MRO&U, responsibilities across the global regions where the JSF will operate; and formulation of the program operations and support strategy with its own focus on affordability.

To briefly summarize, today's scorecard on technical issues largely reflects a large list of issues that are well understood with fixes either under development or in various stages of implementation. That said, we are wary that further technical issues are certain to emerge as we press on with system testing, and it will be critical that the program rapidly correct these deficiencies while mitigating their impact on test and production.

The most notable technical issue which emerged this past year, a rub condition between the engine rotor and rotor seal, led to an engine fire and brought flight testing to a standstill for several weeks while the root cause of the issue was being determined. We are confident that this technical issue is resolved and are proceeding with implementation of the fix across the fleet of affected aircraft.

Aircraft production is demonstrating healthy labor learning curve performance, improving quality trends, improving schedule performance and lot-over-lot unit cost reduction. This is as expected for a program at this stage.

To spur a greater cost improvement, the program, led by an industry initiative, has launched an effort referred to as Blueprint for Affordability, which has established a target unit cost for the F–35A of about $80 million by 2019.

We are embarking on similar concerted efforts in order to improve aircraft reliability, maintainability, and availability, or RM&A. Overall, performance in this area has been poor.

It is only in the past 6 months that improvements to design, parts availability, and maintenance, training, and support are starting to show needed results, providing a positive sign that we may meet our interim RM&A requirement of 60 percent aircraft availability by year's end. RM&A is a principal focus area for the program in 2015.

Lastly, the program is working closely with the services and our international partners and industry to formulate the operations and sustainment, or O&S, strategy for the Joint Strike Fighter.

The effort encompasses activities stretching from completing development of logistics tools, to standup of depot facilities, to supply chain management, engineering and software support, and determination of the business plan that will accompany each of these activities and an overarching O&S war on cost.

In summary, while maintaining its focus on achieving the services' initial operational capability milestones, the JSF program is also systematically tackling a large number of risk items and issues that confront this program across the full spectrum spanning development, test, production, operations, and sustainment.

We are experiencing improving trends in virtually all areas, but we are painstakingly aware of the significant challenges that remain ahead and are committed to meeting those challenges head-on with discipline, with rigor, and with full transparency.

Mr. Chairman, we look forward to answering your questions.

[The joint prepared statement of Secretary Stackley and General Bogdan can be found in the Appendix on page 72.]

Mr. TURNER. General Bogdan.

**STATEMENT OF LT GEN CHRISTOPHER C. BOGDAN, USAF, PROGRAM EXECUTIVE OFFICER, F–35 LIGHTNING II JOINT PROGRAM OFFICE**

General BOGDAN. Chairman Turner, distinguished members of the committee, thank you for the opportunity to address you and to discuss the F–35 Lightning II program.

My overall assessment of this very complex program is that we are making slow, but steady, progress on all fronts and each day the program is improving. However, this is not to say that we don't have risks, challenges, and some difficulties, but I am confident we will be able to overcome these problems and deliver on our commitments.

Today, in development, we've completed our Block 2 software development and are nearing completion of all flight testing necessary to field our initial warfighting capability, also known as Block 2B, which is on track to support the Marine Corps IOC this summer.

Additionally, we are currently in full-swing testing of our Block 3i software, which is on track to support Air Force IOC in the summer of 2016, and we have just begun flight testing our final version of software known as Block 3F, which will provide the full combat capability of the F–35 in late 2017 and support the U.S. Navy's IOC in 2018.

However, because we have been using our labs and test aircraft to complete both 2B and 3i testing for longer than we anticipated, flight testing of Block 3 was delayed. This delay, along with the complexity of the 3F software integration, has resulted in an additional risk of approximately 4 to 6 months for the completion of that 3F software. We are working hard to bring this potential schedule delay back in on time, and we do not believe it will impact the Navy's IOC in 2018.

We have had numerous accomplishments in 2014 in flight testing, most notably the F–35C initial sea trials aboard the USS *Nimitz,* a large-deck carrier. Our performance on the *Nimitz* in terms of carrier landings was excellent in that we completed 124 traps out of 124 attempts without a single missed landing and we completed all the planned testing on that ship with about 3 days to spare.

Additionally, we have closed and are implementing fixes for a number of past technical issues, including improvements in the helmet, the hook on our C model, our fuel dump capability, our fusion software, lightning restrictions, and night and all-weather flying.

However, this past year presented other challenges that included an engine failure on AF–27 at Eglin Air Force Base and the discovery of cracks in the main bulkheads of the B model during our durability testing. We are also carefully monitoring the development of our maintenance system, known as ALIS [Autonomic Logistics Information System], as it remains on the critical path for U.S. Marine Corps IOC, Air Force IOC, and our Block 3F capabilities.

I am prepared to provide details of these events and the impact they have had on the program or may have on the program during the Q&A [question and answer] period.

As for production in 2014, we planned to deliver 36 aircraft and we delivered 36 aircraft to our warfighters. We have now delivered a total of 130 aircraft to our operational test and training sites. The production line today is running approximately 2 months behind, but it is catching up over the past year and does not pose any long-term schedule or delivery risk to the program.

The price of the F–35s continue to decline steadily lot over lot, just as we have committed to, and I expect such reductions to continue long into the future.

Let me turn to fielding the sustainment of our fleet. As of this week, we have logged over 30,000 flight hours and flown over 18,000 sorties since our first flights in 2006. Today 130 F–35s are operating at 9 different U.S. locations. In the next 4 years, we will add 322 airplanes and over 17 new bases, including operational locations in Europe and the Pacific.

Over the past year and a half, we have put a great deal of emphasis on maintenance and sustainment activities. We started a reliability and maintainability program last year, and the effort is beginning to make a positive difference, as we have seen a steady, but slow, improvement in our aircraft availability rates and our mission-capable rates.

We also started a number of initiatives to address our spares issues, including better forecasting, more timely purchasing and contracting, and shortening repair cycles on our parts, all of which resulted in modest improvements thus far, but it will take at least another 6 to 12 months to fully recover from our spares deficit.

We also began a number of other important initiatives late in 2013 and 2014 to include our ops and sustainment Cost War Room, the Blueprint for Affordability, as Mr. Stackley mentioned, and a restructuring of the operational test program. I would be happy to discuss these initiatives in the Q&A session, also.

On the international front, the partnership remains strong and some of our partners are now flying their own jets in training and operational test sites in the United States, while others are eagerly anticipating their first jets in the next two lots of airplanes.

Additionally, last year South Korea signed a letter of acceptance and committed to buying 40 jets and Israel committed to an additional 14 jets on top of the 19 they are already purchasing.

I would like to close by saying that the program is showing steady improvements as costs continue to come down, technical issues are being resolved, and the baseline schedule is mainly holding. I believe the program is on the right track, and we will continue to deliver on our commitments we have made to warfighters, the taxpayers, and our allies. My team will continue to run this program with integrity, discipline, and transparency, and I intend to hold myself and my team accountable for the outcomes on this program.

Mr. Chairman, I look forward to the Q&A period.

[The joint prepared statement of General Bogdan and Secretary Stackley can be found in the Appendix on page 72.]

Mr. TURNER. Thank you, General.

Secretary Stackley, General Bogdan, a group of us went down to Eglin Air Force Base 2 weeks ago or so and sat down with both the pilots, the maintainers, the command, to discuss the F–35. And, as you know from my opening statement and that of the ranking member, you have full and complete support from this subcommittee and the committee on fifth-gen development.

We certainly understand some of the difficulty overall with concurrency. And, you know, it is a vogue word to mean inventiveness. Right? I mean, at the same time that we are building, we are inventing and we are trying to have a fluid process so we don't end up with a product that is stale but, at the same time, we end up with a product and we don't merely get stuck in the inventive process.

How those two converge is where Mr. Gilmore and Mr. Sullivan continue to provide us with fidelity as to how problems result. And the issues that we see in both their reports are obviously when a problem is identified, how quickly is it resolved; when a problem is identified, what is its effect on cost; when a problem is identified, how does it relate to our foreign partners and the delays, as we know, because we have to get to a ramp-up so that our overall product costs go down on a per-unit basis.

Our trip was not in questioning the overall fifth-generation commitment or capability, but to talk to those who were on the ground to get some understanding of their perspective. Some of the things that we learned were disturbing and concerning. As you know, they are down there both actively flying, actively maintaining, actively training, and then being what will be the footprint later as the F–35 is expanded elsewhere.

But one of the issues I want to talk to you about and I want to get your feedback is the Autonomic Logistics Information System, ALIS. So we had a treat. We got to sit down and watch someone actually go through the web pages of the system—and I am slowing down for effect because that is what we got to see as they got to it—and the cumbersomeness of the difficulty of going from page to page in trying to be able to enter information.

Now, the ALIS system—real quick overview—is basically the system that you plug the plane in and it is supposed to tell you what is wrong with the plane and what is not wrong with the plane. It is supposed to aid maintenance. It is supposed to give a download for logistics for acquisition of parts. It is supposed to do an overall assessment of the readiness and capability of the plane.

But we are also told it has an 80 percent false positive. They went through the process. They were telling us the purpose of the system. It sounds absolutely wonderful. Certainly I think everybody who has a Cadillac understands, you know, a system that tells you what is going on with your car, what is going on with your plane.

When we asked them how many false positives you get, I thought that they were going to tell us a high number because it is still a new system. But when they said 80, I was kind of taken aback. But then, when they showed us how difficult it was to clear 80 because of the cumbersomeness of the system, I was curious as to who is assigned to clean this up.

But what we probably have with false positives, as you know, is, one, either people get complacent and believe things are false positives and they get overly cleared or, two, we also don't know what false negatives we have and was the system not reporting.

So I would like both of you to tell us: Is what we are hearing consistent with what you are hearing? If so, what is the path forward in fixing the system and how does it represent an operational issue or impediment overall to the F–35?

Secretary STACKLEY. Yes, sir. I will start and hand it over to General Bogdan.

I don't know if the 80 percent number is exactly right, but the issue of false positive is very real. And concerns with regards to the reliability, the responsiveness, the timeliness of ALIS information for the maintainers and for the warfighter is at the top of our priority list.

We scorecard readiness for initial operational capabilities, and we look at all the attributes associated with the program. And when you look at the services' IOCs as rated by the program office and as rated by the services themselves, ALIS's performance is a very high concern, high priority, because it is not currently meeting the requirements of the warfighter in terms of the maintainability aspects on the program.

So it is a real problem. It is a known problem. The solution is not a single, simple issue. It is going after all the details inside of ALIS. It is a large, complex logistics, software-based system.

And we have been on this path for several years now, since it was first introduced and put in the hands of the maintainers, and they identified the issues with everything from data reliability to timeliness. And this false positive issue has been brought to our attention more recently.

So there is versions of software upgrades to ALIS that are planned that capture the known deficiencies. They are tested before they are turned into the field. And then, when they are put in the hands of the maintainers, we get that user feedback.

So I will tell you that the program is improving. It is not where it needs to be. Our scorecards—right now you will see red next to ALIS, which has our absolute attention. And we have got a lot of work to do, but there won't be one leap from that red to that green. It is going to be a series of upgrades to ALIS software where we are going to have to drive in those incremental improvements to get it up to the level of performance that we need.

Mr. TURNER. One footnote and then I am going to do a follow-on on A–L–I–S or "ALIS," as you were saying.

I was also shocked that there is no spell check. So while the gentleman was there typing something in, there was no indication that something was misspelled, but he had to catch it and he had to go back and fix it.

My concern is not an academic one. My concern was—because human error is human error—it is not searchable if someone makes a typographical error. If the system is supposed to be searchable, we have got to determine what is recurring in the system. So certainly that should probably be an addition to it.

But the other aspect was, as I was describing it, the downstream aspect of A–L–I–S or "ALIS" issuing a report for a part. They are very concerned about that whole system, both with the prime contractor's scale of control, the availability of those parts, the reporting back of the availability of those parts.

If there is no inventory on site, they are very concerned of the ability of their planes to continue to be able to operate and how the system itself—because it is assuming that they are not going to be able to fix it on hand and it is going to report a problem and then result in a part being delivered, that that just-in-time aspect may be a constraint on overall operation capability.

Do you have concerns there, also? General Bogdan, you are nodding.

Secretary STACKLEY. I will tell you that that is evolving. There was a vision for what ALIS would do and how this program would be sustained that was established years ago. We are past that point today.

And the operation and sustainment plan for the program is evolving and being developed today with industry, with our international partners, frankly, to do better than what you are hearing from the maintainers today on the flight line.

Mr. TURNER. Thank you.

I am then going to Timothy Walz.

Mr. WALZ. Thank you, Mr. Chairman.

Thank you all for your testimony.

I do agree that the importance of this weapon system as to our airpower and our national security strategy is pretty clear to everyone. I also appreciate your optimism, but I don't think we could come here without the skepticism that is probably healthy in any endeavor that we do.

So just a couple of things I would ask. And I am going to build on this last question on long-term viability and sustainability because the issues we are talking about are just getting us to the baseline and where we go from there.

And so, Mr. Sullivan, on several occasions, I think you have been thoughtful about it and raised long-term affordability as a key area of risk. Is that addressed? Do you see that moving in the right direction? And do you still consider—I think it is obvious and wise to think that way. But where are we headed with it?

Mr. SULLIVAN. Yes. I think there is two separate things. There is the cost estimate on the program, which is approaching $400 billion. I think that is in control.

The software issues we are talking about are going to add cost on the margins, I believe. It is mostly an issue of risk, of being able to do what they say they are going to do.

The affordability issue, from our point of view, is the funding profile that this program—that the Congress, quite frankly, is looking at over the next 20 years just for acquisition, just for—development cost is coming down now. I think development cost will be done in 3 or 4 years.

But over the next 10 or 15 years, this program is going to come to the Congress every year with—we mentioned today it is $10 billion for this fiscal year. That will get up to $15 billion in a few years, and it is going to average $12.5 billion beyond the foreseeable future.

What typically happens is that past programs that begin to run into these kind of funding issues—usually, at some point, if other national priorities have to be taken care of, there is a lot of big weapon systems that are vying for the funding. The Navy and the Army and the Air Force has its own. The tanker is one. Long-range strike is one.

Something has to give, and a lot of times it is quantities. You know, you get to a point—the F–22 is an example where they wanted to buy 750 and the funding profile was so straining that they wound up having to cut quantities.

Mr. WALZ. Is there anything that indicates to you—because I would say the members sitting here understand from sequestration to national debt, to competing priorities, nothing is going to change that.

I think the estimate is over, if you will, a 50-year lifecycle of this is $1 trillion. We are not quite halfway there yet. The fortitude to come back every year is one that I think we are going to have to think about and think about deeply.

Mr. SULLIVAN. Yes. I was just talking about the acquisition cost. Now, when you include the total ownership cost or the operation and support cost, which is right now estimated anywhere from $850 billion to a trillion dollars over 30 years, that is cost on top of that.

So some of this discussion about ALIS is interesting. Because one of the things that the Joint Strike Fighter was supposed to be able to do was have a lot of commonality across a variance and reduce a footprint, and it hasn't really come out that way. There were a lot of technologies they were counting on early in this program that I don't think they have been able to achieve.

Mr. WALZ. And I realize how difficult this is. But I can't stress enough, if it falls short in any way of achieving these things, the difficulty on those dollars are going to be even more. I mean, it has to do everything that it says it is going to do.

And so I am going to ask—and I know this is subjective, but I think it is important for us because this is looking ahead—what is this hearing going to look like in April of 2016, when we come back and hold this hearing on the F–35? How big of difference are we going to see? Is this thing going to be doing what it is supposed to do?

Secretary STACKLEY. I will take that. I will start.

A year from now we will have the Marine Corps—we will have IOC, their version of the aircraft. We will be working on completion of 3i testing and will be heavy into the 3F testing.

I think, as Mr. Sullivan described, your concerns with cost—I think at this point in the program we can see the end in sight in terms of R&D [research and development] costs. There are still some risks, and we will tackle those risks. But those aren't going to threaten the program.

What we have to do is continue to drive down cost in production, because we still have about 2,800 aircraft to manufacture and that heavy weight in terms of production costs. We have got to go at that from our side in the program to drive the costs down. That bigger issue of affordability has to deal with our budgets.

And so where will our budget be—when we are sitting here in April of 2016, where will our budget be? Will we have been sequestered? What will have happened to the top line?

You have heard the services testify with regard to the impact of sequestration. If we are sequestered, that will have an impact on this program, and that will then directly have an impact on affordability.

Mr. WALZ. I appreciate that.

My time is up, Mr. Chairman. Maybe we will get that in another member's question. Thank you.

Mr. TURNER. Thank you.

Mr. Wenstrup.

Dr. WENSTRUP. Thank you, Mr. Chairman.

When we went to Eglin, we spent some time with the pilots and asked them what are the problems that they are finding. And, you know, that is certainly the best way to find out, I think, is to actually talk to them. And I know that I think you have been briefed on it and seen the list.

And I guess kind of parlaying on what Mr. Walz asked, how many of these things that you see here—and I could go through them all; don't necessarily have to—will we be able to address in the next year?

General BOGDAN. Over the past 2 years, we have faced a number of technical issues that 2 years ago or a year ago, if you had said, "Where will you be in April of 2015?" I would have told you, "Well, I would like to have this retired and that retired and that retired."

So let me give you a list of a few of the things that we have retired and now a few of the things we are working on in 2015 when we come back next year will hopefully retire.

A year ago there was a lot of speculation and discussion about how good the helmet was going to be, the Generation III helmet, because the Generation II helmet had some shortfalls. It had a jitter problem. It had green glow problems. It had latency problems. It wasn't good enough for the warfighter.

Today I can tell you we are flight-testing the Gen III helmet right now and all indications are from the test pilots is that it is much improved, much improved. So I put a half a checkmark in that box and say, "Okay. We are controlling that."

Last year we had a major engine problem. I will tell you today we have the solution for that engine problem. It is being put into the field. And by this summer, I will have the final production version of that fix into the production line and that will be behind us.

We had a problem with lightning. We were having a problem qualifying the airplane to fly in lightning last year. That problem is basically behind us.

And, in fact, I don't know if the guys at Eglin told you, but 2 weeks ago a CF–8 flying—returning from base was struck by lightning. He was in clear air and he was struck by lightning, and absolutely nothing bad happened to the airplane.

The pilot landed the airplane. No warnings and cautions. No problems. And we could see where the lightning went into the right wing tip and came out. So lightning is another one we would put on that list of last year a problem, not a problem this year.

Fuel dumping was a problem last year because the fuel dump on the airplane comes from the bottom of the wing. And so, when you dump fuel from the bottom of the wing, there is high pressure there. It pushes the fuel up onto the wing and it sticks and it makes the wing wet. We have solved that problem.

So those are just a few of the things that a year or two ago were high on our list. What is high on our list this year?

We already talked about ALIS. ALIS has a long way to go, sir. It is a complicated 5-million-lines-of-code piece of equipment that we started treating like a piece of support equipment. It is not. It is an integral part of the weapon system.

So we have had to take steps in the last 2 years to change fundamentally the way we develop ALIS. We have applied the same techniques we used in developing software on the airplane to now developing software in ALIS. It is just going to take us some time to realize those results.

We had a problem with the hook. When we first tested the hook on a C-model a year and a half ago, we missed seven out of eight traps at Lakehurst. We went out to the boat last year and hit 124 out of 124.

So I guess what I am expressing here is we are going to have more technical problems on this program. It is a measure of a good program for you to be able to absorb those, find fixes for them, and then continue moving the ball down the field on the program. I think we are in a better position now than we ever have been to address those kind of problems.

Dr. WENSTRUP. Well, you are there and you know these things are being addressed. I think it kind of took us a little by surprise, the 80 percent, and it was said kind of casually, like, "80 percent? Like, that is far from good."

General BOGDAN. Can I make two comments about that just to kind of put it in context?

The first thing is—and that is not to mitigate the fact that we know we have a problem there—the jets down at Eglin are the oldest ones we have. They are flying 1B software and 2A software, and they are Lot 3 and 4 airplanes.

So they are flying the dogs of the fleet, quite frankly, because many of the newer lots of airplanes have many of the improvements we have learned over the last 2 to 3 years. And the newer software that we are using on the 2B airplanes is going to make that even better.

So I can understand the guys down at Eglin feeling like, "I don't have a very good airplane here after all this time, energy, and money, General Bogdan."

When it comes to the false reporting, we call those things HRCs, health reporting codes. And on any given sortie, you may get two or three or four of them.

What I believe when they are telling you 80 percent is, when you actually get a health reporting code on the airplane and you land, the ones that you get, 80 percent of them turn out to be not good, not that 80 percent of all—every flight you have got problems with the airplane that you don't know about.

What we have done is we have gone in and we have started to change the software both in ALIS and the airplane to address that. But at the same time, we now have a history of which health reporting——

Mr. TURNER. I am sorry to interject here, General Bogdan. I just want to make certain you are not confused, although I think I may be.

When they say 80 percent false positives, they mean, out of 100 items where it says there is something wrong with the plane, 80 of them are nothing is wrong with the plane, but they are given a notice that something is wrong and then they have to deal with that notice——

General BOGDAN. Correct. Correct

Mr. TURNER. By the way, Secretary Stackley cringed when you——

General BOGDAN. No. You got that right, but here is what I am trying to say.

The other important question that they should have told you was each airplane, when it lands, only has about four or five health reporting codes a sortie.

Mr. TURNER. We saw the list. I mean, the point here being that, if something is telling you 80 percent of the time wrong information, it is suspect. Right?

General BOGDAN. Yes, sir. And I am going to go check that 80 percent number and get back to you. And it is a problem. We know it is a problem, and we have to address it.

[The information referred to can be found in the Appendix on page 95.]

Mr. TURNER. Thank you.

With that, Ms. Duckworth.

Ms. DUCKWORTH. Thank you, Mr. Chairman.

I find it comforting that—or maybe not so comforting to think that the question I really wanted to talk about was ALIS and it is one that is of concern to the chairman. As a former aviator and, also, a logistics officer, let's talk maintenance and logistics and ALIS.

I am concerned that the manpower it takes to clear every single one of those false positives—false negatives is driving up maintenance costs and now you have got more and more man-hours or person-hours or airmen-hours or contractor-hours that have to clear every single one of those.

In addition, whether it is 80 percent or whatever it is, I would like to know—and you don't have to give it to me today because I doubt, General, that you have it—how often are you getting a circle red X or a red X status on aircraft that is driving down the aircraft availability for missions and for different mission profiles? Because now, even if it is a false positive, you are affecting mission readiness for the aircraft.

And you talked about problems with the system in the past, not necessarily ALIS, but problems that have been fixed, last year the helmets—Generation II and Generation III helmets.

Is there a timeline in place to fix all of these problems with ALIS? Do you have benchmarks in place: "In 6 months you will have X number of lines of codes fixed and within a year we will be at this point"?

And then the final question is—one of the issues is not even software. We are talking about the size, bulk, and weight. My understanding is, during the carrier integration phase, ALIS could not deploy and, instead, the USS *Hornet* [USS *Wasp*] had to rely upon the ALIS system at Fort Worth, Texas, for logistical support because it was too bulky to deploy onto the [*Wasp*], which, you know, as someone who flew small aircraft, if you couldn't carry it in the aircraft or sling-loaded under the aircraft, it didn't go with you. The idea that you would have an integral part of your maintenance system that can't even fit on the USS [*Wasp*] is very, very troubling to me.

General BOGDAN. Yes, ma'am. Relative to the plan, we absolutely do have a plan for ALIS. As I said before, until about 2 years ago, we weren't treating ALIS much other than a piece of support equipment. We now recognize that it could be its own weapons system.

So we have put all the system's engineering discipline, the software metrics—the same kind of things we did for the airplane we are doing for ALIS. So, as an example, this summer the U.S. Marine Corps will declare IOC with a version of ALIS we call 2.01. Today in the field we have Version 1.03. So there is an upgrade program going on.

The U.S. Air Force next summer will get 2.02 because we are doing incremental upgrades on ALIS. I will take it for the record that we will show you that integrated and incremental plan to improve ALIS.

Relative to the deployability of ALIS, you are spot on, ma'am. Today ALIS sits in a squadron and it is a rack of computers that weighs probably 800 to 1,000 pounds. We recognized a year and a half ago that was not going to work for deploying forces.

So today we are redesigning ALIS into what we call a Version 2 deployable version. That will be ready for the Marine Corps this July. It is two-man portable. It comes in about three or four different racks. They take it apart and—two men can put it back together and take it apart.

In the future, we will build all of the ALIS system in this deployable configuration and we will get rid of the old 1,000-pound racks we have at the squadrons now. But you are right on, ma'am.

Ms. DUCKWORTH. I would like to make several requests, General.

I would like to know what you think will be the point of acceptable for ALIS's performance, 80 percent—whatever you said. I am sorry to be all up your tailpipe in this, but we have gotten to the point where Members of Congress are really concerned.

So what are you determining to be acceptable? When will you get there for the software system? You already told me what acceptable is for the size. Right? You said July, two-man portable.

And then I would like to know what the maintenance cost has been due to the false positives and how much of that cost will be decreased and what you expect that cost to be in terms of increased manpower hours for both your uniformed personnel as well as for the contractors and all the maintenance that comes about with having to clear every one of those codes.

General BOGDAN. That is a great set of questions, ma'am. I will take them for the record and we will plan on having that discussion after this hearing.

[The information referred to can be found in the Appendix on page 95.]

Ms. DUCKWORTH. Thank you.

I yield back, Mr. Chairman.

Mr. TURNER. Ms. McSally.

Ms. MCSALLY. Thank you, Mr. Chairman.

Thank you, gentlemen, for your testimony.

Dr. Gilmore, in your testimony, you talk about the limitations of the F–35 in close air support. Specifically, you mentioned that the aircraft will need to be under the direct control of a forward air controller using voice communications, there is no ability to use an infrared pointer, there is no ability to have night vision capability—this reminds me of something before the A–10, by the way, not after the A–10—only have 20 to 30 minutes time on station, the current 2B would only have two weapons, but, then, even the follow-on is only going to have 180 bullets even if you are mounting the external gun.

And so I am concerned about the capabilities in the close air support, forward air control, and combat search and rescue mission that the F–35 is going to be serving as it replaces aircraft like the A–10.

So how many of these shortfalls—and I just mentioned a few of them—will actually be fixed in the 3F? And how many are just inherent, like the 20 minutes time on station and the lack of really total weapons capability?

When you think of close air support aircraft like the A–10, it is the survivability, the lethality, which means weapons load, and the loiter time that really make it capable to keep Americans alive. And I am concerned on the second and the third I mentioned, loiter time and lethality as far as weapons load.

And, also, are any tests, including survivability—you know, can they take hits like the A–10 can of a SAM [surface-to-air missile] and triple-A [anti-aircraft artillery], small arms, and still be able to fly back? Are you testing those types of things in a low-threat, so to speak, close air support environment, which is what we have been doing the last 25 years?

Dr. GILMORE. With regard to the time on station, the numbers you quoted were for the F–35B, and that was 20 to 30 minutes. Now, you can extend that by refueling with tankers, but then, of course, you have to plan for the tankers.

The F–35A would have up to about 45 minutes on station. That compares with about 90 minutes on station for the A–10. And that is something that will—you know, that is a limitation that will persist because of, you know, the engine and other aspects—aerodynamic aspects of the aircraft.

With regard to some of the other limitations that are discussed in my testimony, like, for example, the deficiencies in the digital communications, you know, there are problems with the nine-line message. Not all elements of it are accurate at this point. It doesn't work correctly.

And so it will require some voice communications if you are performing CAS [close air support], if you are trying to do that with a Block 2B aircraft, and—you know, as opposed to the—you know, the digital nine-line that you can use in the A–10, the Harrier, and the F–16. Those problems are, you know, planned to be corrected in Block 3F.

Ms. MCSALLY. Okay.

Dr. GILMORE. Block 3F will provide additional weapons loads and mixed weapons loads as well as external weapons. So the weapons load will increase in Block 3F.

Some of the other problems that, you know, will probably—if you are using a Block 2B aircraft, would require greater coordination with a forward air controller will, based on what the program hopes to achieve in Block 3F, you know, be fixed.

And, in fact, if everything that is realized in Block 3F is realized, I think it would be safe to say that you will have much better situational awareness in a F–35 than you would in an A–10, again, if all these Block 3F capabilities are realized, but the Block 2B capability is going to be limited.

Ms. MCSALLY. Great.

And the survivability piece, I mean, are you——

Dr. GILMORE. We are——

Ms. MCSALLY [continuing]. Evaluating its ability to take small arms, triple-A, SAM hits and still be able to fly back?

Dr. GILMORE. Yes. My annual report describes some of the testing that has been done, you know, testing against hits by certain kinds of weapons that, you know, could be employed against the aircraft if it were flying low as well as if we are engaged in air-to-air combat.

The aircraft has some vulnerabilities that you would have to expect a high-performance aircraft to have. And the A–10 is going to be able to—you know, can take hits that an F–35 couldn't take.

But I don't think that the plan for having the F–35 conduct CAS is equivalent in all operational aspects to the way the A–10 would conduct CAS, and the plan would probably be for the F–35 to stand off more from many of these threats that the A–10 does not stand off from.

So, you know, the survivability of the F–35 against some of these threats isn't going to be as good as the A–10, but I think the operators would say that they wouldn't use the F–35 the same way they would use the A–10 to do close air support.

Ms. MCSALLY. And thank you. My time is expired.

But I will share, as a former A–10 pilot and squadron commander, there are times and there will still be times in the future when you must get down and dirty with the guys on the ground, who are often on the run, unable to give you their coordinates, and you have to visually be able to see where are the good guys and the bad guys.

And so you cannot stand off in all CAS scenarios even in the future, and that is a concern I have with the limited capabilities in replacing the A–10. But my time's expired.

Dr. GILMORE. And I agree with you, Congresswoman.

Ms. MCSALLY. Thank you.

Thank you, Mr. Chairman.

Mr. TURNER. Turning to Joe Wilson.

Mr. WILSON. Thank you, Mr. Chairman.

And, Dr. Gilmore, tomorrow we are having a full committee hearing on the risk of losing military technology superiority and its implication for U.S. policy, strategy, and posture in the Asia-Pacific.

What is your opinion of the continued development and production of the F–35 program as critical to our military in maintaining its technological superiority?

Dr. GILMORE. That is for me?

Mr. WILSON. Yes.

Dr. GILMORE. I have stated previously—in fact, the last time I testified on Joint Strike Fighter was before the Appropriations Subcommittee on Defense in the Senate—that the Department has no choice but to make the F–35 work.

It is critical to the future of tactical combat aviation in the Department and in the United States. And as far as I can tell and, as Mr. Stackley and General Bogdan have indicated, they and the Department are committed to making it work.

However, as has also been mentioned by the chairman and others, this is an extremely complex undertaking. And I think the best way to characterize what is happening here is that the best projections that excellent program managers like General Bogdan make can be undone by the complexity and the unknowns that we continue to face. And so we can expect those kinds of unknowns to continue to arise and to have to deal with them.

And so it is going to, in my judgment—and I don't regard this as a horribly profound observation—it is going to take longer to get this job done than anybody—and cost more than anybody now projects, but it is an important job to do.

Mr. WILSON. Well, thank you very much for your clarity.

And, General Bogdan, the F–35 is the only fifth-generation aircraft in production today. Please highlight for us what the F–35 fifth-generation capabilities will bring to the fight.

General BOGDAN. Congressman, the essence of the F–35 and what it can do for us and our allies now and in the future is a combination of different characteristics about the airplane, one of them being stealth, meaning, although not impossible to detect, very, very, very difficult to detect.

And once you detect an airplane, you have to go through the kill chain to shoot it out of the sky, and this airplane, with its combination of stealth, electronic attack, electronic warfare capabilities, and its sensors, is very, very good at knocking pieces of that kill chain out.

So it is a very survivable airplane in the most heavily defended, complex target environments where we wouldn't otherwise be able to bring other legacy airplanes. So it does that.

The second thing it does is its combination of sensors, when working properly and fused properly, provides a picture of the battlespace that is unprecedented for our pilots today. And the ability to see the battlespace in that clarity and to take that picture and send it off board to other airplanes and other platforms is a valuable, valuable tool.

So the combination of the F–35 being able to go where no other airplanes can go and its ability to see the battlespace in that kind of clarity creates an advantage for the United States that is critical in future air dominance.

Mr. WILSON. And, again, thank you for your clarity on that.

And, Secretary Stackley, I previously represented Marine Corps Air Station Beaufort, and they have just been—the community is so supportive and so enthusiastic about F–35Bs being located there. They are located.

What is the current status of deployment there? And what is the future?

Secretary STACKLEY. Yes, sir. Thanks for the question.

Right now at Beaufort I think we have about a dozen aircraft on site. It will be a training command near term, long term. That dozen or so aircraft will build up to a total of 50 across 2 squadrons, and you will see the Marine Corps training there.

In the near term, you will see our partners—the U.K., Italy—training there, and that will be a long-term presence just like it is today for Marine Corps aviation training with this program. It is a critical part of the future of the Marine Corps here.

Mr. WILSON. Well, I always like to point out that Beaufort has the right meteorological conditions, and that is very good weather, temperate, and very warm people.

So thank you very much.

Mr. TURNER. Mr. Knight.

Mr. KNIGHT. Thank you, Mr. Chair. And I will just make a couple comments.

I appreciate you changing the flight pattern for the Joint Strike Fighter because now it gets to fly over my house about 10 times a week, and I love the sound of freedom, and it is always nice to see that.

I will remind the members that the F–16, our last multi-role fighter, went through about 138 versions and probably 15 or 16 blocks. So they call it "test flight" for a reason. It is not proven flight. It is test flight.

We are going into a new generation. It is a new technology. It is a new way for the warfighter to be further into the battle, further undetected into the battle. And so the F–35 is something new for the warfighter.

Those are all the nice things I am going to say. But I am going to piggyback on Congressman Walz.

I am a freshman. And in a year I am sure I am going to be sitting here and we are going to be talking about the F–35. And the F–35 is a program that is talked about in every one of our districts. Whether we have a base, whether we have an aircraft, it is talked about in every one of our districts.

So not just hitting the test points, but being able to go past the test points and get on to the next issue that maybe a test program is having, and the faster that we can get on to a program that they see our Marines flying, that they see the Navy flying and, of course, our airmen flying is the best factor that we can talk about.

So in a year, I am going to have great things to talk about the F–35, but I am hoping that we are going to have a lot of these points that the general said—that we are going to be knocking out and moving on.

And then my last, last thing is our international partners. You don't have a great multi-role fighter in America without international partners and a good sale program to our international partners. That might be 40, that might be 45, percent. But that is one of the best and most motivating factors for any multi-role fighter, whether it be our F–16 or back to our F–4.

So those are all the nice things I will say about the F–35. And I know it is hitting a lot of the test points. I talk to the pilots and the mechanics at Edwards probably on a weekly basis. And it is moving very quickly, and these last 6 months have been very, very good for the program.

Thank you, Mr. Chair.

Mr. TURNER. Ms. Graham.

Ms. GRAHAM. Thank you, Mr. Chairman.

Thank you all for being here.

Just last month I had the opportunity to go on a congressional delegation trip to Eglin to familiarize myself with the F–35 program, and it was a wonderful opportunity. I was there with Chairman Turner and my fellow Floridian, Congressman Jeff Miller. And we share—our districts are right next to one another. And so we have the ability to share the unique training that is available in the Gulf of Mexico.

And so my question goes to Dr. Gilmore, to the training opportunities in the Eglin Gulf training areas, and I am specifically interested in ensuring that the test ranges remain and have the capacity to test our F–35s and other future-generation capabilities.

So can you please talk about what the Department has been doing to test F–35s at the Gulf Test Range and, also, the efforts the Department is undertaking to ensure that our ranges, and this range in particular, are upgraded so that they can do the necessary tests on this fighter and future generations of fighters.

Dr. GILMORE. The activities at Eglin have been focused on training with the early blocks of software, which has been noted, until Block 2B, don't provide any combat capabilities.

So the training opportunities have been limited not because of any limitations in Eglin's infrastructure or capabilities, but because of what the aircraft up to this point have offered.

Now, with Block 2B and beyond, the training opportunities, just because of the capabilities that will be provided, will be greater and there will be greater advantage taken of the capabilities of Eglin to serve as a training range.

I think, as you know, most of the flight testing that we have been discussing here both for flight sciences and the aerodynamic performance of the aircraft as well as the performance of the missions systems has been taking place at Edwards Air Force Base.

And that continues to be the plan because of certain unique assets that exist out there that are critical to testing the capabilities of this fifth-generation aircraft. And so I would expect that, in the future, Edwards and, you know, the Western Test Range will continue to play a very important role in testing.

Some of the weapons testing can be done at Eglin, and I expect that there will be more of that testing that is done in the future as well as training that is done at Eglin.

So, you know, there is a mix of kind of testing that is done and there are certain unique aspects out on the Western Test Range that really—that don't exist anywhere else that are the reason that most of that testing has been occurring out there. And, in fact, a large part—not all, but a large part—of the operational testing will take place at Edwards as well.

Ms. GRAHAM. Can you just disclose without entering into any classified areas what is unique about Edwards that is not present at the Eglin test range?

Dr. GILMORE. The things that I am discussing that are unique I would have to discuss with you——

Ms. GRAHAM. Okay.

Dr. GILMORE. [continuing]. In the appropriate venue.

Ms. GRAHAM. I understand.

Dr. GILMORE. So I can't really discuss them in an open——

Ms. GRAHAM. Well, I appreciate that.

I would just like to ditto my colleague about how wonderful it is in north Florida. We have nice people, warm weather, and great opportunities to test these incredible air——

Dr. GILMORE. And there will be testing and there can be weapons delivery events that are done there in the future, but there are certain unique aspects to the Western Test and Training Range. They have a test and training——

Ms. GRAHAM. Right.

Dr. GILMORE. [continuing]. Range there, too. But I would be happy to discuss it with you in the appropriate forum.

Ms. GRAHAM. I appreciate that, Doctor. Thank you for your time.

Thank you. I yield back the balance of my time. Thank you.

Mr. TURNER. Mr. Jones.

Mr. JONES. Mr. Chairman, thank you very much.

I wanted to be here for this hearing, and I am sorry I had to leave.

But, obviously, Cherry Point Marine Air Station is in my district, and as somebody said earlier, the F–35 is of great importance to many of us around the country.

This was an article in Business Insider on March 27th of this year, "The Marine Corps want[ing] to put flawed new fighter jets into service is the biggest F–35 story right now."

You have touched on some of this. But I have spent 13 years of my life finding out more about the V–22 than I ever thought I would learn about anything.

I was here at the time that the Marine Corps came forward, Commandant Jim Jones, saying that, "We have got to have the V–22. The V–22 is going to replace the helicopters, heelicopters, from the Vietnam war, and we have got to have it."

I saw at that point what I was hoping—and no this is not talking about you—but the fact that the Marine Corps was so desperate to get the V–22 that a lot of decisions were made like not fulfilling the testing of the vortex ring state and how that would impact the V–22. They scrapped that testing to save $50 million.

The plane that crashed that I have gotten involved in was the crash on April the 8th in Marana, Arizona, where 19 marines were burned to death—the co-pilot's wife lives in my district, Connie Gruber. Her husband was Brooks Gruber. The pilot John Brow's wife, Trish, lives in Steny Hoyer's district—and in trying to get the Marine Corps to write a letter to the wives saying that, "At the time of this accident, we did not understand the vortex ring state. We didn't know how it would impact in a certain situation. So, therefore, the press release that we sent out the first month of that accident was very misleading, but the press has always picked it up as pilot error."

Now, what am I trying to get to? What I want to make sure—and I think each one of you have done a great job, what little bit of time I was here today. And I have read many, many articles all around about the V–22, the positive and the negatives.

But I hope that, if we are going to put the pilots up and put them into certain situations, that we know the best that we can know, that we are not going to jeopardize their lives, because I have seen the pain with Connie Gruber and Trish Brow that they have carried for 15 years because of misinformation about that accident.

And my hope is, with the F–35—and you have done a great job of explaining today, and I know the chairman's been very involved in this—but let's not be so in a hurry to prove that we are right with this F–35 that we would jeopardize any pilot from anywhere.

And I want to—with the minute and 30 seconds I have left, I really would like for you to—each one—in a very short period of time tell the American people that we are not going to jeopardize our pilots to prove a point that we have got to have the F–35.

General BOGDAN. Sir, I will go first.

I have been an Air Force pilot for 31 years and have over 3,300 hours in 40 different kinds of airplanes. I would never ever ask a pilot to do anything in the F–35 that I wouldn't do myself.

Mr. JONES. Fair enough.

General BOGDAN. Safety in this program is our number one priority. I have independent air worthiness authorities that watch what we do. And I would never jeopardize a maintainer or a flier's life just to prove a point about a program. It is not worth it.

Mr. JONES. That is why I respect you.

General BOGDAN. And I won't do it.

Mr. JONES. I wish that had happened in the year 2000. But I saw the dishonesty at that time to prove a point, and that is why I feel so passionately and strong, and that is why I appreciate you, sir, for what you just said. Thank you.

Secretary STACKLEY. Sir, I can only echo what General Bogdan had to say. Safety is a top priority on this as well as, frankly, all of our weapons systems developments.

We do not compromise on air worthiness. Our standards are high and we do not compromise on those standards. And as far as bringing those standards to bear on this program, we have got our best and brightest working on this.

Mr. SULLIVAN. Well, I think, you know, speaking as one of the agencies that does oversight on this, I have a lot of confidence in the program manager and the services to be able to deliver a very, very safe aircraft.

And I think that this committee is a part of all of that. It is very important. GAO oversight is important. And it maybe was not as good as it should have been back in those days, and that is one thing that—I think this committee, the Congress, and DOT [Department of Transportation] and even GAO are very important to the process.

Dr. GILMORE. The combat capability of Block 2B aircraft are going to be limited and there are going to be lots of work-arounds that are required for pilots and for the maintainers. And that is already been discussed.

So what I am trying to do is—and I know that the program office is trying to do this as well—but what I am trying to do is to make the operators as aware as I can of what they do have and what they won't have.

And in Block 2B, unfortunately, there will be—if you ever wanted to use it in combat—and my understanding is, associated with the initial operational capability, the Marines hold out the prospect that they would use it in combat—I will continue to seek to assure that those pilots understand what they don't have as well as what they do have. And in Block 2B there will be a lot of what they don't have.

Mr. JONES. Thank you, sir.

Thank you, Chairman.

Mr. TURNER. Mr. Walz.

Mr. WALZ. Thank you, Mr. Chairman.

And I would just do a quick follow-up. And I would like to get on this—and I think I heard my colleague and friend, Mr. Knight. When he talks about test flights, I listen. As we all know, his family holds an important position in American aviation history and test flights. And I think he is right.

And I want to get on this issue about we can't expect a perfect product right out of the gate, but there is a question I want to follow up on this June 23rd fire.

That was a relatively new aircraft. The way I understand it, it had 160 hours of flight time. It was flown inside its designated flight envelope; so, the pilot wasn't at fault. But despite all this, we had a new aircraft forming at a very easy place where it should have been. We lost the aircraft and nearly lost the pilot.

So, General Bogdan, here is my question to you. We have been—the way I understand it, we were informed that the root cause was the F–35 last year was a lack of accuracy in the Pratt & Whitney's model on how the engine would behave under flight conditions on that specific aircraft. Specifically, the model did not apparently account for the rubbing you talked about between certain internal portions of the engine under flight conditions.

Here is my questions to you. If that part of the model was not accurate, despite many years and the billions of dollars, what other parts of the engine performance could be inaccurate? And where is that high risk, in your opinion?

And, secondly on this, the Marine Corps' version we are going to see later this year, am I correct that it is going to perform lower than what the expectations are? This is a test flight moving to that. So it is at 5.5 g's [force of gravity].

Are you worried that the modeling is not taking into account, when this gets pushed further and further into its flight envelope, what is going to happen, General?

General BOGDAN. Great question, Congressman.

You are precisely right that the original Pratt & Whitney model did not anticipate the amount of heat that would be generated when those two parts of the engine that do rub—and we intended on them rubbing, and they do rub when the airplane's maneuvering—but we did not nearly expect the kind of heat generation we saw because their model, again, failed to capture that.

So what we did with the independent air worthiness authorities that work outside of my program office—they put their best and brightest in the Navy and the Air Force on this to get to that root cause.

And one of the requirements we had before we ever designed a fix for the engine for that specific problem was to go back and take a look at those models and decide where else was there in terms of risk in those models.

And the independent air worthiness authorities at NAVAIR [Naval Air Systems Command] and LCMC [Life Cycle Management Command] had to come and say that they understood where those models were adequate and where they weren't and what Pratt was going to do to improve that before they would even allow us to put the fix on the airplane to get back in the air.

Mr. WALZ. Were there improvements made to their model? Did you find things that——

General BOGDAN. Oh, yes, sir. There were a number of improvements, not the least of which was we looked at all the materials—all the material properties in the engine and revalidated whether the characteristics of those properties, in terms of heating and friction, were accurate and appropriate for what we knew to be the case.

Additionally, a fighter engine moves. It moves this way. It moves this way. And it moves this way. We had to make sure that that model, which was describing how much the touching and rubbing would occur, was accurate, also, before we put those airplanes back in flight. That was part of the reason why the planes were grounded for as long as they were.

Mr. WALZ. So later this summer, when they go and they push that to 5.5 g's and they start pushing ahead of that, you are, I'm certain, as you said—and I know this to be the case—you are not going to put one of those——

General BOGDAN. Sure. We took the fix from—the interim fix from that engine mishap and we flight-tested it at Edwards on both engine variants and we took it up to the maximum g limit of the airplane, which is greater than what the Marine Corps is going to be allowed to do this summer.

Mr. WALZ. And, in this case, we didn't have a loss of life. So is it your assessment this is what test flights do? We learned a lot from this, we are better off, and it——

General BOGDAN. What I would tell you, sir, is no surprise discovery is good. But if you are going to have them, it is better to have them on the ground and it is better to have them early in a program before you have had thousands of engines out there.

Mr. WALZ. Okay.

General BOGDAN. So, from that perspective, we are okay. And I am just—we are just blessed that that pilot is okay.

Mr. WALZ. Great.

I yield back, Mr. Chairman. Thank you for the additional time.

Mr. TURNER. Thank you, gentlemen. Thank you for your attention to this very important program. We know that you all have important responsibilities. And thank you for continuing to keep this committee informed as we look to trying to assist in the overall process.

With that, we will be adjourned.

[Whereupon, at 5:03 p.m., the subcommittee was adjourned.]

# APPENDIX

APRIL 14, 2015

# PREPARED STATEMENTS SUBMITTED FOR THE RECORD

April 14, 2015

**Statement of the Honorable Michael Turner**
**Chairman, Subcommittee on Tactical Air and Land Forces**
**Hearing on the F-35 Joint Strike Fighter Program**
**April 14, 2015**

The hearing will come to order.

The subcommittee meets today in open session to receive testimony on the current status of the F-35 Joint Strike Fighter (JSF) program.

This hearing continues the ongoing oversight activity conducted by the committee on the F-35 program since the program officially began in 2001.

We welcome our distinguished panel of witnesses:

- **Dr. Michael Gilmore, Director of Operational Test and Evaluation;**

- **Mr. Michael J. Sullivan, Director of Acquisition and Sourcing, Government Accountability Office (GAO);**

- **The Honorable Sean Stackley, Assistant Secretary of the Navy for Research, Development and Acquisition; and,**

- **Lieutenant General Christopher C. Bogdan**
  **F-35 Program Executive Officer.**

I thank you all for your service and look forward to your testimony today.

The F-35 is a complex program. It's well known that during its development the F-35 program has experienced significant cost, schedule, and performance problems.

Current acquisition costs are now approaching $400 billion, which according to GAO makes this DOD's most costly and ambitious acquisition program.

Over the last year, steady progress was achieved in development, production, and operations, but the subcommittee continues to have concerns regarding recent engine test failures and on software development and integration.

This committee, and in particular this subcommittee, has maintained vigilant oversight on the F-35 program through legislation, hearings, and briefings, and most recently a trip to Eglin Air Force Base, Florida to see F-35 operations and talk to F-35 pilots and maintenance personnel.

Last year, the committee required the Secretary of Defense to establish an independent team to review and assess the development of software and software integration for the F-35 program. The subcommittee may recommend a similar approach as a way to effectively review the most recent engine test failures.

I understand the substantial investment in the F-35 is more about the requirement for fifth generation tactical fighter capability than it is about the F-35 itself.

Based on the briefings and hearings held by this subcommittee, I have learned that fifth generation tactical fighter capability is essential for maintaining Air Dominance and national security.

Despite this critical need, that does not mean this program should be rubber stamped. As we have done in the past, the committee will hold this program accountable for cost, schedule, and performance.

The budget request for FY16 includes $1.8 billion for F-35 research, development, test and evaluation, and $8.7 billion for the procurement of 57 F-35s; and $410.2 million for spares. This represents an increase of 19 aircraft and is also a $2.5 billion increase in F-35 funding from FY15 enacted levels.

As we will hear today, both the Director of Operational Test and Evaluation and the GAO have concerns about the F-35 program for fiscal year 2016 and beyond.

I look forward to all of our witness' testimony today which will provide for a better understanding of the current status of the F-35 program.

Before we begin, I would like to turn to my good friend and colleague from California, Ms. Loretta Sanchez, for any comments she may want to make.

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COMMITTEE ON ARMED SERVICES
U.S. HOUSE OF REPRESENTATIVES

**STATEMENT**

**BY**

**J. MICHAEL GILMORE**

**DIRECTOR, OPERATIONAL TEST AND EVALUATION**

**OFFICE OF THE SECRETARY OF DEFENSE**

**BEFORE THE**

**HOUSE ARMED SERVICE COMMITTEE**

**TACTICAL AIR AND LAND FORCES SUBCOMMITTEE**

NOT FOR PUBLIC RELEASE
UNTIL APPROVED BY THE
COMMITTEE ON ARMED SERVICES
U.S. HOUSE OF REPRESENTATIVES
HASC – MARCH 5, 2015

**J. Michael Gilmore**

**Director, Operational Test and Evaluation (DOT&E)**

**Office of the Secretary of Defense**

**Introduction**

Mr. Chairman, my testimony reviews the progress made in flight and ground testing over the past year and provides an update to my fiscal year (FY)14 Annual Report on the Joint Strike Fighter (JSF) program.

**Test Progress and Demonstrated Capability 2014**

In the past year, the program focused on completing F-35 Joint Strike Fighter (JSF) Block 2B development and flight testing in an effort to provide limited combat capability to the fielded early production aircraft and to support the Marine Corps plans for declaring Initial Operational Capability (IOC) later this year. The test centers sustained flight operations at nearly the planned pace through the end of December, despite stoppages and restrictions placed on the test fleet of aircraft.

However, in spite of this focused effort, the program was not able to accomplish its goal of completing Block 2B flight testing by the end of October 2014, as was planned. Slower than planned progress in mission systems, weapons integration, and F-35B flight sciences testing delayed the completion of the testing, which is yet to be completed, required for Block 2B fleet release. Fleet release will make Block 2B missions systems available for use by operational pilots in operational aircraft which are not monitored by a control room engineering team, as are flight test aircraft. Notwithstanding an additional delay in completing testing of Block 2B missions systems relative to the information provided in my Annual Report, the Program Office currently projects fleet release of Block 2B, which is a prerequisite for Marine Corps IOC, to occur in July 2015. Restrictions imposed on the test fleet as a result of the engine failure in June

2014 blocked the execution of some test points and slowed progress in mission systems and flight sciences testing from July through the end of the year. These restrictions have gradually been relaxed for test aircraft. Throughout the year, the program reduced the amount of growth in test points, or additional testing executed beyond that envisioned by the approved test plan, from that experienced in previous years (which had been observed as high as 124 percent over a 12-month period). However, the program still experienced an average growth of 86 percent in Block 2B mission systems testing throughout calendar year (CY) 14, which is higher than the planned rate of 43 percent. This meant that the program executed almost twice as many test points to accomplish the planned Block 2B mission systems task. These additional points were necessary to characterize performance, collect data valuable in creating fixes to deficiencies, and determine if fixes were successfully implemented. This growth in needed test points due to discoveries as testing unfolds is to be expected in a development program as complex as JSF. Late in 2014 and into 2015, the program also worked to reduce the amount of planned testing remaining to achieve the Block 2B fleet release. Testing was determined by the program as no longer applicable to the Block 2B fleet release, but either needed for Block 3F, or no longer required. As of the end January 2015, the program had redesignated 160 of the 350 remaining baseline test points as no longer required, and an additional 150 points as "highly desirable," but to be completed only if the program is able to do so consistent with other priorities.

In the FY13 Annual Report, I estimated the program might not complete Block 2B testing until between May and November 2015, depending on the level of growth in testing, while assuming the program would continue test point productivity equal to that of the preceding 12 months, and that it would accomplish all of the testing planned at that time. The combination of the actions described above taken by the program to restrict the execution of additional testing, defer or delete planned test points, sustain slightly better productivity in terms of test points executed per flight, and maintain higher capacity for Block 2B mission systems testing than previously planned by delaying conversion of three aircraft to Block 3i, all have enabled the program to complete much of the testing now judged to be necessary for Block 2B fleet release by the end of February 2015. Nonetheless, in the middle of February, the program decided to generate an additional Block 2B software version, relative to its previous plan, that is scheduled to be delivered to flight test in March, to address deficiencies identified from flight testing. As a result, the program now plans to complete Block 2B flight testing in June, 2015, which is eight months later than expected in the program's prior Block 2B fleet release plans. The effect of flight testing of this additional software build on fleet release and the plans for the Marine Corps to declare IOC is not known to DOT&E. In my view, the program office should be commended for taking this action to correct deficiencies of operational significance revealed through ongoing testing.

In March of last year, I recommended to the Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) that the Block 2B Operational Utility Evaluation (OUE), which was planned to occur in mid-2015, should not be conducted. Instead, resources should be focused on conducting limited assessments of Block 2B capability and re-allocated to assure the completion of development and testing of Block 3i and Block 3F capabilities. In April, in coordination with the Service Acquisition Executives and the JSF Program Executive Officer, the USD(AT&L) agreed with my recommendation and approved substantially revising and down-scoping the content of the operational test period that had been allocated for the Block 2B OUE in the program's Test and Evaluation Master Plan. The JSF Operational Test Team, JSF Program Office, and the Services' operational test agencies began re-planning the Block 2B operational test period and activities. I made this recommendation after reviewing several factors: limited operational suitability, an inability to prepare pilots with adequate training and approved tactics on the planned schedule, and the deferral of fixes for operationally-relevant deficiencies to Block 3. It was also clear in March that aircraft availability for operational testing would be driven by the long timelines required to modify and retrofit the early production operational test aircraft to the full Block 2B configuration, which would not be complete until mid-2016. I assessed that delaying the Block 2B OUE until late 2016, as opposed to cancelling it, would have a significant negative effect on the program's ability to complete development of the full Block 3F combat capability in a timely manner.

Two key factors leading to my recommendation did not improve over the course of the year. First, in addition to late completion of Block 2B flight testing, the program's most recent aircraft depot modification plans would not make operational test and evaluation (OT&E) aircraft available in the full Block 2B configuration until January 2017, four months later than indicated in my annual report. This additional delay has occurred because the program has given priority to assuring the F-35B aircraft supporting the Marine Corps IOC have completed all needed modifications. Although five of the six F-35A OT&E aircraft assigned to the Edwards Air Force Base test squadron have been partially converted to the Block 2B configuration (i.e., full modification has not been completed) and are being flown with Block 2B software, the aircraft are still under operational limitations that restrict their utility. For example, these aircraft are currently restricted to maneuvers not exceeding 3 g's due to the limitation imposed on the fleet from the engine failure in June 2014. (Fully capable F-35A aircraft are to be able to maneuver at up to 9 g's.) The aircraft are also restricted from steep dives (greater than 50,000 feet per minute) due to fuel tank pressurization limitations. Additional restrictions include the prohibitions of: operating the weapon bay doors in flight, using the night vision camera display in the helmet, and night flying in instrument meteorological conditions. These limitations prevent the use of realistic combat tactics, which would have been necessary for conducting the OUE. Second, the mission data loads previously planned for release in mid-2015 will not complete the planned lab and flight testing until early 2016. The mission data loads enable the aircraft's sensors to search for, identify, and locate threat radio frequency emissions, a capability critical to the aircraft's combat effectiveness. The loads are being produced by a government laboratory, the U.S. Reprogramming Lab (USRL), which, it now is certain, is not adequately equipped for the task for Block 2B, Block 3F or beyond.

I need to emphasize problems caused by the deficiencies in the USRL, which I referred to in my annual report. Early in the program, a decision was made jointly by the contractor and the government to outfit the USRL facilities by simply replicating the planned mission systems development lab at Lockheed Martin, in Fort Worth, Texas. Apparently, between 2002 and 2008, the assumption was that the mission data file generation and mission data load testing capability needed by the USRL was essentially equivalent to, or perhaps a subset of, that needed for mission systems software integration. I reported my concerns to USD (AT&L) regarding significant shortfalls in the two laboratories' capabilities two years ago, and the program now recognizes significant shortfalls do indeed exist. In particular, the program now agrees that the USRL, as delivered by the contractor, has neither adequate hardware nor software for mission data load development and generation. For example, in addition to significant shortfalls in needed hardware, the software tools for generating mission data files were delivered with severe "bugs" that cannot be quickly remedied, which are preventing engineers from generating the mission data loads needed to quickly detect and accurately identify radiofrequency emissions. It is essential to act quickly to correct these shortfalls, as I have recently recommended to the USD (AT&L), to assure effective mission data loads for Block 3F, fully-combat-capable aircraft can be generated. My understanding is that the program believes funding constraints are an obstacle to making the necessary corrections. In my view, it would be a serious mistake to underfund and/or delay the needed corrections, as they are critical to the success of the F-35 in combat.

The performance of Block 2B aircraft presently completing flight test will provide limited combat capability to operational units. Block 2B aircraft are limited to internal carriage of two short-range air-to-surface bombs of the same type and two medium-range air-to-air missiles; external weapons, mixed loads of weapons, gun employment, stand-off air-to-surface weapons, and more air-to-air missile capability are planned for Block 3F. Weapons integration testing has provided valuable information about system deficiencies that must be corrected in Block 3F in order to provide the F-35 autonomous targeting capability. Weapons delivery events in developmental testing to date have been characterized by significant involvement of the test control team to assist in target acquisition and identification and monitoring of sensor performance, such as radar search volume and target track stability. Fusion of own-ship and flight-member information continues to be problematic. Until these problems are resolved, it will be difficult for F-35 aircraft to operate either autonomously or with other aircraft systems to build situation awareness and simultaneously engage multiple air and surface targets, which is the requirement. Recent tests of multi-ship operations indicated debilitating clutter on the cockpit displays of the F-35 aircraft contributing to poor battlespace awareness and significantly detracting from target identification, location, and weapons employment. Mission systems performance problems combine with the problems I have identified with the mission data load generation and testing to increase pilot workload in discerning actual targets, prioritizing threats, and employing weapons. There are also several gaps of lesser operational significance between the Block 2B capabilities that have been planned for release to the fleet and the capability currently available in F-35 aircraft, such as lack of an infrared pointer and variable message format communications for close air support missions, lack of short-range radar target acquisition modes, and stable formation secure communication networks, all of which are useful in a variety of combat situations. Finally, though the Block 2B fleet release is planned to result in limited 5.5 g maneuver capability for the F-35B, and 7 g for the F-35A, current operating limitations are much more restrictive for F-35s that are not flight test aircraft. The restrictions on non-test aircraft (i.e. fielded, operational and training aircraft) due to the engine failure which occurred in June 2014 may be relaxed from the current 3 g limitation if the production aircraft are modified with pre-trenched stators or a "rub-in" flight procedure is completed. Additional restrictions due to a fuel siphon tank overpressure problem discovered last year may limit maneuverability by restricting g-load as a function of fuel weight as well. The details of the restrictions for fleet aircraft are still be determined by the Program Office and the operational impact is not known. There are also operating limitations associated with carriage of weapons, both air-to-air and air-to-surface, which persist until the weapons are expended; these limitations, which have been imposed in part based on results of the ongoing test program, affect self-defense and target attack capabilities. The fact that these problems exist notwithstanding the Program Office's best efforts is, in my view, not surprising given the decision early in the last decade to begin producing F-35 aircraft prior to testing.

To meet contract specification requirements, the program structures flight testing to provide data for the purpose of closing individual success criteria. As of January 21, there are 263 success criteria remaining to be closed that are aligned with the Block 2B fleet release, which is planned by the program to occur by July 2015. This number is only slightly less than the 288 success criteria that were closed in the last three years, since February 2012, and is an indication of the challenges that remain to successfully complete Block 2B fielding.

Because of the limited combat capability being provided in Block 2B, if the F-35 will be used in combat it will need the support of a command and control system that will direct target acquisition and control weapons employment for the limited weapons carriage available. If opposed, the F-35 Block 2B aircraft would need to avoid threat engagements and require augmentation by other friendly forces. In a Close Air Support (CAS) mission, for example, F-35B aircraft will need to operate under the direct control of a forward air controller, using voice communications to receive target information and clearance to attack. This is because of the combined effects of digital communications deficiencies, lack of infrared pointer capability, limited ability to detect infrared pointer indications by a controller, and inability to confirm coordinates loaded to GPS-aided weapons. If F-35 aircraft are employed at night for combat, pilots will have no night vision capability available due to the restriction on using the current night vision camera, which is planned to be subsequently upgraded after aircraft are retrofitted with Block 3i, using the Generation III helmet. In general, using Block 2B F-35 aircraft, pilots would operate much like early fourth generation aircraft using cockpit panel displays, with the distributed aperture system providing limited situational awareness of the horizon, and heads-up display symbology produced on the helmet. An F-35B, assuming, a 250-nautical mile ingress to a CAS area contact point would have approximately 20-30 minutes to organize with the controller and execute an attack using its two air-to-surface weapons. This would have to be above or outside of threat engagement zones. By comparison, an Air Force A-10 would have approximately one and one half hours of time in the CAS area under the same conditions, but would be able to autonomously acquire and identify targets, while using datalink to receive and/or pass target and situation awareness information. An A-10 would also be able to employ at least four air-to-surface weapons, including the ability to carry a mixed load of ordnance and employ its internal gun, which provides very useful flexibility in the CAS role. Although F-35 loiter time can be extended by air refueling, operational planners would have to provide sufficient tankers to make this happen. The F-35 fuel burn rate is very high compared to legacy strike fighters, at least 60 percent higher than the F-16C and 180 percent higher than the A-10. This creates a burden on the air refueling resources if used to increase F-35 loiter time.

Of course, the F-35 is designed to do more missions than CAS, which is the primary mission for which the A-10 was designed. Also, F-35 development is not complete. If the capabilities stated in the Operational Requirements Document (ORD) are realized, Block 3F F-35 aircraft will have the ability to carry weapons externally, for an increased payload, as well as a gun. For example, a Block 3F F-35A aircraft could carry six GBU-12 laser-guided bombs (vice two in Block 2B) along with four air-to-air missiles (two AIM-120C and two AIM-9X). Fusion of information from on-board sensors and data from off-board aircraft (both F-35 aircraft in formation via the multi-function advanced data link (MADL) and other aircraft via Link 16) is planned to be much more capable and would provide better battlespace awareness than that being fielded with Block 2B and better than the capability of an A-10.

Block 3i was not planned to incorporate any new capability or fixes from the Block 2B development/fleet release. Though it eventually began in May 2014, Block 3i flight test progress began five months late as a result of hardware deficiencies, and has progressed more slowly than expected. As of the end of February, the program had completed only 25 percent of the baseline Block 3i test points and further testing was blocked as the test centers were awaiting the next iteration of Block 3i software. The first increment of Block 3i capability, designated 3iR1, is the initial release to Lot 6 aircraft and includes only Block 2A capability (no combat capability and inherently less capable than the final Block 2B fleet release). Subsequent increments of Block 3i software are planned to have additional capability. The second iteration of Block 3i software, 3iR4, included the capability to test the new Generation III Helmet-Mounted Display System (Gen III HMDS). The Edwards Air Force Base test center flew four test missions with 3iR4 on AF-3 in September 2014, accomplishing regression test points and some initial test points from the Gen III HMD test plan. This was the first testing of the new HMDS on F-35 test aircraft. The test team discovered deficiencies, particularly in the stability of the new display management computer – helmet (DMCH), and suspended further testing until software that fixes the deficiencies in the helmet system can be provided to the prime contractor and included in an updated load of mission systems software. The third increment of Block 3i software – version 3iR5 – will be used to provide production software for Lot 7 aircraft, the first lot to be delivered with the Gen III HMDS, which is planned to start delivery in July 2015. The program plans for the production software to have the equivalent capabilities as Block 2B and intends to deliver 3iR5 software to flight test in March, seven months later than in the baseline schedule approved in early 2013. It is not clear whether the delay in releasing 3iR5 software to flight test is due to problems in developing the software and testing it in the lab, or whether the program needs to continue development of the Block 2B software at the expense of continuing Block 3i and Block 3F development. Regardless of the reason, since Block 2B development and flight test was not completed as planned in October, the completion of Block 3i testing will be delayed if the equivalent capabilities from Block 2B development are to be realized in Block 3i. Assuming the program is able to restart Block 3i flight testing in March, plans adjusted in February – to allow

Block 2B flight testing to continue to June – show Block 3i testing completing between October and December 2015, which is eight to ten months later than the baseline master schedule completion date of February 2015. Additional time may be needed to address corrections to deficiencies identified in the Gen III HMDS and will add risk to the schedule.

The program needs to complete Block 2B development and flight test so it can transition fully to Block 3i, and focus on Block 3F in order to complete Block 3F development and test in late 2017. The program already acknowledges four to six months "pressure" on the end of Block 3F development and test, which is meant to provide "full warfighting capability." The test centers and contractor are completing detailed planning of Block 3F flight test. The test plan currently has approximately 7,000 test points. Plans completed after the 2012 rebaselining of the program showed the start of Block 3F flight testing in May 2014 and completion in February 2017, a span of 33 months. However, current program plans are to start Block 3F flight test in March 2015, simultaneous with the restart of Block 3i flight testing. If historical capacity to achieve test points remains consistent through the completion of Block 3F, and no additional testing is needed, Block 3F developmental testing would complete no earlier than October 2017, which represents at least eight months of schedule pressure.

**Carrier Integration**

Ship Integration and Suitability Testing for the F-35B and F-35C is underway. Following two previous periods of testing – one in October 2011 and one in August 2013 – the Marine Corps plans to conduct another test period on the USS *Wasp* in May 2015 to assess ship integration and suitability issues, using non-instrumented production F-35B aircraft and a non-deployable version of the Autonomic Logistics Information System (ALIS) standard operating unit (SOU) Version 1 installed on the vessel. Originally a part of the Block 2B OUE, this deployment has been re-scoped to support plans for the Marine Corps IOC later in 2015. The plans call for up to six production aircraft for the deployment, scheduled to take place in May 2015. These aircraft are not instrumented (as test aircraft are) and will allow the USS *Wasp* to operate its radars and communications systems in a representative manner since there is no concern with electromagnetic interference with flight test instrumentation. Nonetheless, the flight operations will not be representative of combat operations, unless the flight clearance and associated certifications enabling the deployment include clearances for weapons carriage and employment. These clearances are expected at fleet release, scheduled for July 2015, after the deployment. Maintenance will be mostly military, but with contractor logistics support in line with expected 2015 shore-based operations, such as having contractors perform propulsion data downloads after each flight. Maintenance operations will be conducted using some non-operationally representative support equipment, such as the Multifunction Analyzer Transmitter Receiver Interface Exerciser (MATRIX) laptop computer, a contractor-developed tool used for monitoring and troubleshooting electronic messages from the air vehicle during start up and shut down. The MATRIX is currently being used at field locations, but not part of production-representative maintenance concept of operations. Another example is the combined generator/air conditioning cart designed to support developmental flight testing, but used at fielded locations until production standard air and power carts are available. Maintenance activity will be limited to that required for basic flight operations, staging necessary support equipment for engine and lift fan removals only to check if space permits, and loading and downloading demonstrations of inert ordnance on the flight deck. These limitations are not representative of deployed combat operations.

For the F-35C, carrier-based ship suitability testing is divided into three phases. The first phase, DT-1, consisted of initial sea trials to examine the compatibility of F-35C with a CVN class ship and to assess initial carrier take-off and landing envelopes with steady deck conditions, a subset of the operational environment to be explored in future testing. DT-1 was conducted November 3 - 15, 2014; it was initially scheduled to begin in July. During DT-1, the test team completed 33 test flights (39.2 flight hours) and 124 arrested landings, of 124 attempts, including one night flight with two catapult launches and two arrested landings. No other aircraft deployed to the carrier, except transient aircraft needed for logistical support. All landings were flown without the aid of the Joint Precision Approach Landing System, which is planned for integration on the F-35C in Block 3F. No ALIS equipment was installed on the carrier. Instead, the test team created a network connection from the ship to the major contractor in Fort Worth to process necessary maintenance actions. The program expects to release a formal test report in March. The second and third phases, DT-2 and DT-3, consist of ship-borne operations with an expanded envelope, e.g., nighttime approaches, higher sea states than observed in DT-1 (if available), and asymmetrical external stores loading. DT-2 is currently planned for August 2015 and will expand the carrier operating envelope and include engine maintenance operations below deck, but likely with the same "reach back" ALIS architecture used for DT-1. The third set of sea trials is planned for CY16 and will be the first trials with ALIS on the ship.

**Fielded Aircraft Availability**

Aircraft monthly availability averaged 41 percent for the 12-month period ending November 2014 in the training and operational fleet, with a rapid increase in reported availability occurring between September and October. Prior to this increase, monthly availability rates remained relatively consistent in the 30 to 40 percent range for the two years ending September

2014. In October, availability achieved 50 percent for the first time in program history. The 11 percent jump in availability from 39 percent in September 2014 was also one of the largest month to month increases in program history. Availability reached 54 percent in November. The program established a goal of 60 percent availability by the end of 2014, but preliminary data indicate it did not meet this goal.

Aircraft availability rates by operating location for the 12-month period ending November 2014 are summarized in the table below. The first column indicates the average availability achieved for the whole period, while the maximum and minimum columns represent the range of monthly availabilities reported over the period. The number of aircraft assigned at the end of the reporting period is shown as an indicator of potential variance in the rates. Sites are arranged in order of when each site began operation of any variant of the F-35, and then arranged by variant for sites operating more than one variant.

| F-35 Availability for 12-month period ending November 2014[1] | | | | |
|---|---|---|---|---|
| Operational Site | Average | Max | Min | Aircraft Assigned |
| Whole Fleet | 41% | 54% | 35% | 93[2] |
| Eglin F-35A | 42% | 59% | 35% | 28 |
| Eglin F-35B | 41% | 54% | 26% | 9 |
| Eglin F-35C | 54% | 79% | 24% | 10 |
| Yuma F-35B | 35% | 53% | 24% | 16 |
| Edwards F-35A | 44% | 59% | 19% | 6 |
| Nellis F-35A | 33% | 77% | 19% | 4 |
| Luke F-35A[3] | 48% | 57% | 23% | 13 |
| Beaufort F-35B[4] | 26% | 35% | 4% | 6 |

NOTES:
1. Data do not include flight test aircraft
2. Total includes 1 OT F-35B at Edwards that is not broken out in table
3. Luke F-35A data began in April 2014
4. Beaufort F-35B data began in July 2014

The program tracks aircraft availability by assigning non-available aircraft one of three categories of status: Not Mission Capable for Maintenance (NMC-M); Not Mission Capable for

Supply (NMC-S); and in depot. The program added the third category for tracking fleet status in January 2014 as the number of aircraft entering the depot for modifications, or receiving modifications or repair by a depot field team at the home station, began to increase. Prior to January 2014, these aircraft were assigned as Non-Possessed (NP) or Out Of Reporting (OOR) for depot-level actions under an NMC-M status. The program established new goals for all three of these unavailable statuses for 2014. The NMC-M goal is 15 percent, NMC-S is 10 percent, and depot status is 15 percent.

- The NMC-M rate averaged 25 percent for the 12-month period ending November 2014. The program showed an improving trend in NMC-M at the end of 2014. In September, NMC-M was 28 percent, but in October, it dropped (improved) to 24 percent, and in November, it further improved to 18 percent. A substantial amount of NMC-M down time continues to be the result of field maintenance organizations waiting for technical dispositions or guidance from the contractor on how to address a maintenance issue that has grounded an aircraft. These action requests (AR) are a result of incomplete or inadequate technical information in the field, in the form of Joint Technical Data (JTD). While JTD validation has progressed, the complexity of ARs is increasing, leading to longer times to receive final resolution. Reducing the rate of ARs or decreasing the response time to the ARs will improve (lower) NMC-M rates. NMC-M rates are also negatively influenced by long cure times for both Low Observable (LO) and non-LO materials. These items are the top two drivers for Elapsed Maintenance Time (EMT) on the aircraft by a wide margin. LO cure times account for sealants, coatings, and putties used to directly repair damage to the outer mold line, or to restore LO performance margins after maintenance that breaks the outer mold line. The latter can happen when a non-"quick-access" panel is removed to facilitate replacement of a failed component behind the panel, and an LO restoration is required after the panel is reattached. Non-LO cure time is accounted for by adhesives used to secure attaching hardware to the aircraft, such as nut plates and brackets, as well as internal sealants and gasket materials. The Program Office is addressing long cure times by introducing new materials with much shorter cure times.

- Over the 12-month period ending November 2014, the NMC-S rate displayed an improving trend, beginning at 26 percent in December 2013 and decreasing to rates in the high 10s to low 20s by mid-2014. In 2013, the Program Office predicted that better contracting performance and the maturing supply system would result in improved supply support resulting in lower NMC-S rates by late 2014. Although the trend is favorable, the rate of improvement is not yet fast enough to allow the program to achieve their goal of 10 percent NMC-S by the end of 2014. If the current trend continues, the program could reach this target around mid-2015.
- A large portion of the fleet began cycling through the depot for modifications made necessary by concurrent development, reducing overall fleet availability. The program began reporting the percentage of the fleet in depot status starting January 2014 at 13 percent, and since then it has risen to as high as18 percent as of July 2014. Current plans show over 10 percent of the operational aircraft inventory will be in depot status, either at a dedicated facility or being worked on

by a depot field team at the home station, through at least mid-2015. All of the necessary depot-level modifications may not yet be identified, as testing and development are not complete. Although depot modifications reduce overall fleet availability, they potentially improve availability once the aircraft is out of depot by replacing low reliability components with improved versions, such as the 270 Volt Battery Charger and Control Unit. Any increased availability from reliability improvements will take time to manifest in the fleet-wide metrics, with significant improvement becoming evident only after the majority of aircraft have been modified.

Low availability rates, in part due to inadequate reliability, are preventing the fleet of fielded operational F-35 aircraft (all variants) from achieving planned, Service-funded flying hour goals. Original Service plans were based on F-35 squadrons ramping up to a steady state, fixed number of flight hours per tail per month, allowing for the projection of total fleet flight hours. In November 2013, a new "modelled achievable" flight hour projection was created because low availability was preventing the realization of bed-down plan flight hours. The revised model used selected actual fleet maintenance and supply data, and also made assumptions about the evolution over time of the many factors affecting availability to predict the number of flight hours the fleet could generate in the future. By October 30, 2014, the fleet had flown approximately 72 percent of the modelled achievable hours because availability had not increased in accordance with assumptions. In November 2014, the Program Office made another "modelled achievable" flight hour projection. This new projection used actual flight hours achieved at the beginning of November 2014 and made assumptions about future availability rates similar to the assumptions incorporated in the November 2013 projection to predict future fleet flight hours, but also used updated fleet supply and maintenance data. The fleet flight hours achieved since then, through the end of February, appear to be tracking to this new model, but are well below the original bed-down plan, as can be seen in the table below.

| F-35 Fleet Planned vs. Achieved Flight Hours as of February 26, 2015 | | | |
|---|---|---|---|
| Variant | Original Bed Down Plan Cumulative Flight Hours | | |
| | Estimated Planned | Achieved | % Planned |
| F-35A | 16,000 | 8,934 | 56% |
| F-35B | 10,000 | 7,588 | 76% |
| F-35C | 3,000 | 1,419 | 47% |
| Total | 29,000 | 17,941 | 62% |

**F-35 Reliability**

Aircraft reliability is assessed using a variety of metrics, each characterizing a unique aspect of overall weapon system reliability.

- Mean Flight Hours Between Critical Failures (MFHBCF). This metric includes all failures that render the aircraft not safe to fly, and any equipment failures that would prevent the completion of a defined F-35 mission. It includes failures discovered in the air and on the ground.
- Mean Flight Hours Between Removal (MFHBR). This metric gives an indication of the degree of necessary logistical support and is frequently used in determining associated costs. It includes any removal of an item from the aircraft for replacement with a new item from the supply chain. Not all removals are failures, and some failures can be fixed on aircraft without a removal. For example, some removed items are later determined to have not failed when tested at the repair site. Other components can be removed due to excessive signs of wear before a failure, such as worn tires.

- Mean Flight Hours Between Maintenance Events, unscheduled (MFHBME). This metric is useful primarily for evaluating maintenance workload. It includes all failures, whether inherent or induced by maintenance actions, that lead to maintenance and all unscheduled inspections and servicing actions.
- Mean Flight Hours Between Failure, Design Controllable (MFHBF_DC). This metric includes failures of components due to design flaws under the purview of the contractor, such as the inability to withstand loads encountered in normal operation.

The F-35 program developed reliability growth projections for each variant throughout the development period as a function of accumulated flight hours. These projections are shown as growth curves and were established to compare observed reliability with target numbers to meet the threshold requirement at maturity, defined by 75,000 flight hours for the F-35A and F-35B, and by 50,000 flight hours for the F-35C; and 200,000 cumulative fleet flight hours. In November 2013, the program discontinued reporting against these curves for all ORD reliability metrics, and retained only the curve for MFHBF_DC, which is the only reliability metric included in the JSF Contract Specification (JCS). The growth curves for the other metrics have been re-constructed analytically and are used below for comparison to achieved values. As of the end of November 2014 the F-35, including both operational and flight test aircraft, had accumulated approximately 22,000 flight hours, or slightly more than 11 percent of the total 200,000 hour maturity mark defined in the ORD. By variant, the F-35A had achieved around 11,000 flight hours, or nearly 15 percent of the total 75,000 hours for its variant specific maturity. The F-35B accumulated approximately 8,300 hours, or slightly more than 11 percent of its 75,000 hours to maturity. The F-35C achieved just over 2,700 hours, or over 5 percent of its 50,000 hours to maturity.

The most recent reported and projected interim goal of MFHBCF, with associated flight hours, are shown in the table below. Threshold at maturity, and the values reported in the prior five months are shown for comparison.

| F-35 Reliability: MFHBCF (hours) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ORD Threshold | | | Values as of November 29, 2014 | | | Prior Observed MFHBCF (3 Mos. Rolling Windows) | | | | |
| Variant | MFHBCF | Flight Hours | Observed MFHBCF (3 Mos. Rolling Window) | Cumulative Flight Hours | Interim Goal to Meet ORD Threshold MFHBCF | JUN 2014 | JUL 2014 | AUG 2014 | SEP 2014 | OCT 2014 |
| F-35A | 20 | 75,000 | 10.8 | 10,979 | 15.4 | 6.6 | 6.3 | 8.2 | 8.4 | 10.4 |
| F-35B | 12 | 75,000 | 6.2 | 8,329 | 8.8 | 8.7 | 7.3 | 7.5 | 6.3 | 6.3 |
| F-35C | 14 | 50,000 | 7.3 | 2,727 | 9.6 | 6.5 | 8.4 | 8.3 | 6.0 | 7.0 |

Similar tables showing the current reported and projected interim goals, plus the reported values for the prior five months for comparison, for MFHBR, MFHBME and MFHBF_DC for all three variants are provided in the tables below. MFHBF_DC is a contract specification and its Joint Contract Specification (JCS) requirement value is shown in lieu of an ORD threshold.

| F-35 Reliability: MFHBR (hours) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ORD Threshold | | | Values as of November 29, 2014 | | | Prior Observed MFHBR (3 Mos. Rolling Windows) | | | | |
| Variant | MFHBR | Flight Hours | Observed MFHBR (3 Mos. Rolling Window) | Cumulative Flight Hours | Interim Goal to Meet ORD Threshold MFHBR | JUN 2014 | JUL 2014 | AUG 2014 | SEP 2014 | OCT 2014 |
| F-35A | 6.5 | 75,000 | 4.3 | 10,979 | 5.0 | 3.9 | 3.1 | 3.1 | 2.9 | 4.0 |
| F-35B | 6.0 | 75,000 | 2.8 | 8,329 | 4.4 | 3.1 | 2.8 | 2.5 | 2.4 | 2.6 |
| F-35C | 6.0 | 50,000 | 3.3 | 2,727 | 4.1 | 2.9 | 2.7 | 2.3 | 2.3 | 2.7 |

| F-35 Reliability: MFHBME (hours) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ORD Threshold | | | Values as of November 29, 2014 | | | Prior Observed MFHBME (3 Mos. Rolling Windows) | | | | |
| Variant | MFHBME | Flight Hours | Observed MFHBME (3 Mos. Rolling Window) | Cumulative Flight Hours | Interim Goal to Meet ORD Threshold MFHBME | JUN 2014 | JUL 2014 | AUG 2014 | SEP 2014 | OCT 2014 |
| F-35A | 2.0 | 75,000 | 1.09 | 10,979 | 1.5 | 0.92 | 0.82 | 0.85 | 0.83 | 1.03 |
| F-35B | 1.5 | 75,000 | 1.02 | 8,329 | 1.1 | 1.16 | 1.05 | 0.96 | 0.89 | 0.98 |
| F-35C | 1.5 | 50,000 | 1.09 | 2,727 | 1.0 | 0.88 | 0.93 | 0.84 | 0.81 | 0.93 |

| F-35 Reliability: MFHBF_DC (hours) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Contract Specification Requirement | | | Values as of November 29, 2014 | | | Prior Observed MFHBF_DC (3 Mos. Rolling Windows) | | | | |
| Variant | MFHBF_ DC | Flight Hours | Observed MFHBF_DC (3 Mos. Rolling Window) | Cumulative Flight Hours | Interim Goal to Meet Contract Specification MFHBF_DC | JUN 2014 | JUL 2014 | AUG 2014 | SEP 2014 | OCT 2014 |
| F-35A | 6.0 | 75,000 | 4.9 | 10,979 | 4.3 | 4.8 | 4.0 | 4.0 | 3.9 | 4.7 |
| F-35B | 4.0 | 75,000 | 4.2 | 8,329 | 2.8 | 4.6 | 3.7 | 3.5 | 3.4 | 3.8 |
| F-35C | 4.0 | 50,000 | 4.5 | 2,727 | 2.5 | 3.4 | 3.3 | 3.6 | 3.3 | 4.2 |

The trends in the reliability metrics we track are unclear. The most recent data we have obtained generally indicate, with the exception of Mean Flight Hours Between Critical Failure for the F-35B, a three-month upward trend from September 2014 through November 2014. However, when combined with data from the previous three months, the data show both declines and increases, indicating we cannot yet conclude with confidence that reliability is significantly improving. Comparing observed values to interim goals to meet ORD or contract specification requirements at maturity, only for mean flight hours between design controllable failure did all three variants exceed the interim goal. Amongst the rest of the metrics, only the F-35C was ahead of an interim goal, and that was for mean flight hour between maintenance events.

DOT&E will continue to update reliability growth analyses as additional reliability data become available.

**J. Michael Gilmore**
**Director of Operational Test and Evaluation**

Dr. J. Michael Gilmore was sworn in as Director of Operational Test and Evaluation on September 23, 2009. A Presidential appointee confirmed by the United States Senate, he serves as the senior advisor to the Secretary of Defense on operational and live fire test and evaluation of Department of Defense weapon systems.

Prior to his current appointment, Dr. Gilmore was the Assistant Director for National Security at the Congressional Budget Office (CBO). In this position, he was responsible for CBO's National Security Division, which performs analyses of major policy and program issues in national defense, international affairs, and veterans' affairs. Specific areas of investigation included the long-term implications of current defense policies and programs, the implications of transformation for equipping and operating U.S. military forces, the effectiveness and costs of alternative approaches to modernizing U.S. military forces, and the resource demands associated with operating and supporting U.S. military forces.

Dr. Gilmore is a former Deputy Director of General Purpose Programs within the Office of the Secretary of Defense, Program Analysis and Evaluation (OSD(PA&E)). As the Deputy Director, he was responsible for developing, formulating, and implementing Secretary of Defense policies on all aspects of Department of Defense general purpose programs, including analyzing the operational effectiveness and costs of U.S. conventional military forces and supporting programs. Before serving as a Deputy Director, Dr. Gilmore served as the Division Director of Operations Analysis and Procurement Planning, within the Office of the Deputy Director, Resource Analysis and prior to that as an Analyst for Strategic Defensive and Space Programs Division, Office of the Deputy Director, Strategic and Space Programs. Dr. Gilmore's service with Program Analysis and Evaluation covered 11 years.

Early in his career, Dr. Gilmore worked at the Lawrence Livermore National Laboratory, Livermore, California performing research in their magnetic fusion energy program. He has also worked as an Analyst with the Falcon Associates, McLean, VA, and the McDonnell Douglas Washington Studies and Analysis Group, where he became Manager, Electronic Systems Company Analysis.

A native of Ohio and resident of Virginia, Dr. Gilmore is a graduate of The Massachusetts Institute of Technology, Cambridge, Massachusetts, where he earned a B.S. in Physics. He subsequently earned a M.S. and Ph.D. in Nuclear Engineering from the University of Wisconsin, Madison, Wisconsin.

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Testimony

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# F-35 JOINT STRIKE FIGHTER

## Observations on Program Progress

Statement of Michael J. Sullivan, Director
Acquisition and Sourcing Management

GAO-15-429T

Chairman Turner, Ranking Member Sanchez, and Members of the Subcommittee:

Thank you for the opportunity to discuss our work on the F-35 Lightning II, also known as the Joint Strike Fighter (JSF). With estimated acquisition costs of nearly $400 billion, the F-35 is the Department of Defense's (DOD) most costly acquisition program. Through this program, DOD is developing and fielding a family of strike fighter aircraft, integrating low observable (stealth) technologies with advanced sensors and computer networking capabilities for the United States Air Force, Navy, and Marine Corps, as well as eight international partners.[1] The F-35 family is comprised of the F-35A conventional takeoff and landing variant, the F-35B short takeoff and vertical landing variant, and the F-35C carrier-suitable variant. Over time, the program has made a number of changes affecting the planned quantities and associated costs.[2] According to current projections, the U.S. portion of the program will require acquisition funding of $12.4 billion a year, on average, from now through 2038 to complete development and procurement of 2,457 aircraft. DOD also estimates that the F-35 fleet will cost around $1 trillion to operate and support over its lifetime, which poses significant long-term affordability challenges for the department.

As we have reported in the past, the F-35 program's significant cost, schedule, and performance problems can largely be traced to (1) decisions made at key junctures without adequate product knowledge and (2) a highly concurrent acquisition strategy with significant overlap among development activities, flight testing, and production. [3] This testimony is based on our April 2015 report which is being released

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

[2]An overview of changes in program cost and quantity from 2001 through 2014 can be found in app. I.

[3]GAO, *Joint Strike Fighter: Restructuring Places Program on Firmer Footing, but Progress Still Lags,* GAO-11-325 (Washington, D.C.: Apr. 7, 2011); *Joint Strike Fighter: DOD Actions Needed to Further Enhance Restructuring and Address Affordability Risk,* GAO-12-437 (Washington, D.C.: June 14, 2012); *Joint Strike Fighter: Current Outlook Is Improved, but Long-Term Affordability is a Major Concern,* GAO-13-309 (Washington, DC.: Mar. 11, 2013).

today. Our work was conducted in response to a provision of the National Defense Authorization Act for Fiscal Year 2010, which requires us to review the F-35 acquisition program annually for 6 years.[4] For this review we assessed (1) development and testing progress, (2) manufacturing and supply chain performance, and (3) cost and affordability.

For our April 2015 report, we reviewed and analyzed program briefings, management reports, test data and results, and internal program analyses. To assess the reliability of the cost, manufacturing, and supply chain performance data we reviewed the supporting documentation and discussed the data with DOD; Lockheed Martin, the aircraft contractor; and Pratt and Whitney, the engine contractor. We determined that all of the data we used were sufficiently reliable for the purposes of our work. We also discussed ongoing manufacturing process improvements with contracting and Defense Contract Management Agency (DCMA) officials. We conducted this work in accordance with generally accepted government auditing standards.

In brief, recent F-35 technical challenges forced DOD to make unexpected changes to its development and testing plans over the past year and ultimately delay key developmental and operational test activities. The key technical challenges affecting the program were a structural failure on the F-35B durability test aircraft, an engine failure, and a higher-than-expected amount of test point growth largely to address software rework. In addition, the F-35 system reliability has been limited by poor engine reliability which will take additional time and resources to achieve reliability goals. With flight testing of more complex software and advanced capabilities still ahead, additional discoveries during testing and subsequent design changes are likely. At the same time, DOD plans to significantly increase production rates over the next 5 years. Design changes needed to address new technical problems or improve engine reliability while the program continues to buy new aircraft will likely result in additional retrofits, cost increases, and schedule delays. Lockheed Martin has made progress in manufacturing the aircraft and delivered 36 aircraft last year, as planned. Higher-than-expected part shortages and manufacturing rework continue and could pose significant challenges as the program increases production rates. However, based on our ongoing work, we believe that affordability remains the biggest

[4]Pub. L. No. 111-84, § 244 (2009).

challenge facing the program. From fiscal years 2015 to 2019, planned annual funding increases from $8 billion to around $12 billion, then shortly thereafter reaches $14 billion and remains between $14 and $15 billion for nearly a decade. We are concerned that the program will be unable to receive and sustain such a high and unprecedented level of annual funding over this extended period, especially with other significant fiscal demands weighing on DOD and the nation.

## Recent Technical Challenges Will Likely Result in Future Cost Growth and Schedule Delays

DOD continued to experience development and testing discoveries over the past year, largely due to a structural failure on the F-35B durability test aircraft, an engine failure, and more software test growth than expected. Together, these factors led to adjustments in the program's test schedule. The program's test resources and aircraft capabilities were reprioritized and test points were deferred or eliminated in order to mitigate some of the schedule risk. In the end, the program still had to delay the completion of some developmental test activities. Also, decisions were made to restructure a Block 2B operational test event that was planned for 2015. While these changes allowed the program to accomplish nearly the same number of test points it had planned for the year, not all of the specific test activities scheduled were completed. As a result, the completion of developmental flight testing for the three blocks of software that provide warfighting capability—Block 2B, Block 3i, and Block 3F—has been delayed 3 to 6 months.

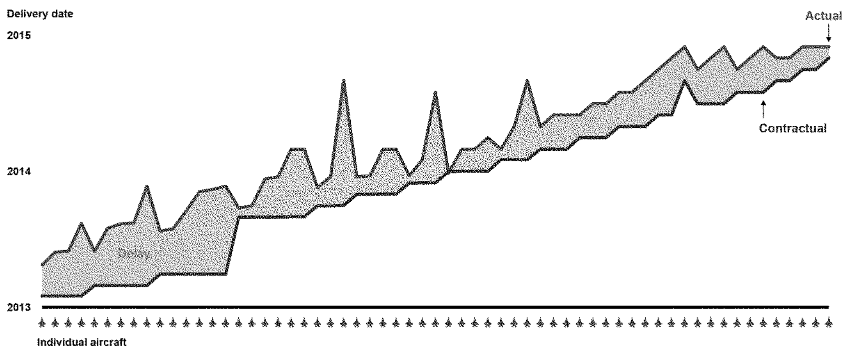
We believe that DOD has a long way to go to achieve its engine reliability goals as engine reliability at this time is extremely poor. Reliability is a function of how well a system design performs over a specified period of time without failure, degradation, or need of repair. Poor reliability with the engine has limited the program's overall reliability progress. According to program and contractor officials, the overall reliability of the aircraft had been improving over the past year. In contrast, engine reliability remained relatively steady over the same time period and remained below expected levels. We believe that improving the F-35 engine reliability to achieve established reliability goals will likely require more time and resources than originally planned.

While DOD is addressing these unanticipated technical issues and working to improve engine reliability, it is also planning to significantly increase aircraft procurement over the next 5 years. As of December 2014, DOD plans to steeply increase procurement from 38 aircraft in 2015 to 90 aircraft in 2019. By the time developmental flight testing is finished—currently expected to occur in 2017—DOD will have procured a cumulative total of 340 aircraft. During this same time, the program plans to flight test the F-35's full warfighting capabilities—Block 3F—which are expected to demonstrate capabilities needed to perform in more demanding and stressing environments. While DOD has taken steps over the past few years to reduce concurrency, the program's strategy still contains a noteworthy overlap between the completion of flight testing and the increase in aircraft procurement rates. With the flight testing of the more complex software and advanced capabilities still ahead and reliability improvements needed, we believe that it is almost certain that the program will discover more technical problems. Depending on the nature and significance of the discoveries, we are concerned that the program may need additional time and money to incorporate design changes and retrofit aircraft.

## While Manufacturing Progress Continues, Planned Production Increases Could Be Challenging in the Near Term

Lockheed Martin delivered 36 aircraft in 2014, bringing the total number of production aircraft delivered since production deliveries began in 2011 to 110 aircraft—none of which were delivered with warfighting capabilities. Although Lockheed Martin continues to deliver aircraft later than planned, delivery performance is trending in the right direction and Lockheed Martin expects to begin meeting contracted delivery dates sometime in 2015 (see figure 1). Improving delivery performance will be imperative as the United States and international aircraft deliveries are expected to exceed 90 aircraft per year within the next 5 years.

**Figure 1: Trend of F-35 Joint Strike Fighter Contractual Delivery Dates Compared to Actual Delivery Dates**




Source: GAO analysis based on Department of Defense and contractor data. | GAO-15-429T

Note: This figure includes deliveries to the United States and all foreign partners.

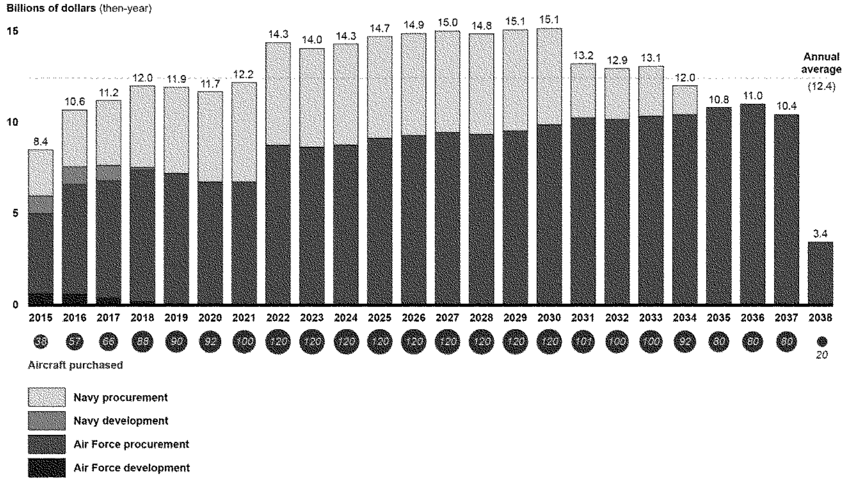
Manufacturing efficiency is improving as the number of hours needed to build aircraft is trending down over time. The number of major engineering design changes has also continued to decline over time, and is currently tracking closer to the program's plan. The reduction in engineering design changes over time has been one of the keys to improving Lockheed Martin's manufacturing performance. Lockheed Martin has made this progress despite increases in the percentage of time it has spent correcting manufacturing defects. For example, the percentage of time spent on scrap, rework, and repair increased from 13.8 percent to 14.9 percent between the two most recently completed production lots. Lockheed Martin attributes most of the rework time to fixing misplaced brackets and uneven seams.

Suppliers continued to deliver parts late, resulting in part shortages. We are concerned that if these trends continue, Lockheed Martin could have difficulty improving its manufacturing efficiency at its expected rates. Over the past year, the number of part shortages increased, including severe shortages that caused workarounds or work stoppages. A similar condition exists at Pratt & Whitney, the engine manufacturer. Pratt & Whitney is experiencing challenges with part shortages and supplier quality with nearly 45 percent of its key suppliers delivering parts late over the past year. Both Lockheed Martin and Pratt & Whitney officials stated that they are addressing these supplier performance problems. We believe that if these problems are not resolved they will likely be amplified as production rates increase over the next 5 years.

## Affordability Concerns Will Continue to Challenge Procurement Plans

To execute its current procurement plan, the F-35 program will need to request and obtain, on average, $12.4 billion annually in acquisition funds for more than two decades. Regardless of any future increases in program costs, continued investment of this magnitude in one program—estimated at roughly $300 billion over the next 24 years—must be viewed within the context of DOD's other investment priorities as well as other fiscal needs facing the nation. The F-35 program will have to compete for funding with many other large, high-priority defense programs, including a new bomber, tanker, submarine, and aircraft carrier, as well as other government priorities external to DOD's budget. In a time of austere budgets, we believe fully funding all of the department's priorities at the same time will undoubtedly force DOD to continue to make difficult trade-off decisions. The F-35 program's latest planned funding profile for development and procurement—as of December 2014—is shown in figure 2. In our April 2015 report we recommended that DOD conduct an affordability analysis of the program's current procurement plan that reflects various assumptions about future technical progress and funding availability, and DOD agreed with our recommendation.

**Figure 2: F-35 Joint Strike Fighter Budgeted Development and Procurement Costs by Service, 2015-2038**




Source: GAO analysis of Department of Defense data. | GAO-15-429T

Note: Annual projected cost estimates expressed in then-year dollars reflect inflation assumptions made by a program.

From fiscal years 2015 to 2019, DOD plans to increase development and procurement funding for the F-35 from around $8 billion to around $12 billion, an investment of more than $54 billion over that 5-year period. This funding reflects the U.S. military services' plans to significantly increase annual aircraft procurements from 38 in 2015 to 90 in 2019. Annual U.S. procurements peak at 120 aircraft in 2022, and will require between $14 and $15 billion annually for nearly a decade. During that same time, DOD will be operating and sustaining an increasing number of fielded F-35 aircraft. Officials from the Office of the Secretary of Defense have stated that the current F-35 sustainment strategy, with cost estimates around $1 trillion over the life cycle of the program, is not affordable; and in a September 2014 report, we found that DOD's estimates may not reflect the most likely sustainment costs.[5] When acquisition and sustainment funds are combined, annual funding requirements could easily approach $30 billion in some years.

In conclusion, as the Congress considers DOD's proposed increases in F-35 annual procurements over the next 5 years, we believe that several key areas of risk remain. First, with more demanding and complex testing still to be done, the program faces the risk that new technical problems—including those related to software—will be discovered and additional design changes will be needed. Second, while Lockheed Martin's manufacturing capabilities and efficiency have continued to improve, the extent to which the improvement is enough to meet the demands of the increased production rates remains uncertain. Finally, it is unclear whether DOD's current procurement plan is affordable in the context of the fiscal pressures, both internal and external, facing DOD.

Chairman Turner, Ranking Member Sanchez, 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 Michael Sullivan, Director, Acquisition and Sourcing Management at (202) 512-4841 or sullivanm@gao.gov. Contact points for our Office of Congressional Relations and Public Affairs may be found on the last page of this statement. GAO staff who made key contributions to this testimony are Travis J. Masters, Assistant Director; Peter W. Anderson; Marvin Bonner; Matthew Lea; Megan Porter; and Abby Volk.

[5] GAO- *F-35 Sustainment: Need for Affordable Strategy, Greater Attention to Risks, and Improved Cost Estimates,* GAO-14-778 (Washington, D.C.: September 23, 2014).

# Appendix I: Changes in Reported F-35 Joint Strike Fighter Cost, Quantity, and Deliveries, 2001-2014

| | October 2001 Initial Baseline | March 2012 Latest Baseline | December 2014 Estimates | Change from 2001 to 2012 | Change from 2012 to 2014 |
|---|---|---|---|---|---|
| **Expected quantities (number of aircraft)** | | | | | |
| Developmental quantities | 14 | 14 | 14 | 0% | 0% |
| Procurement quantities | 2,852 | 2,443 | 2,443 | -14 | 0 |
| **Total quantities** | **2,866** | **2,457** | **2,457** | **-14** | **0** |
| **Cost estimates (then-year dollars in billions)[a]** | | | | | |
| Development | $34.4 | $55.2 | $54.9 | 60% | -0.5% |
| Procurement | 196.6 | 335.7 | 331.6 | 71 | -1.2 |
| Military construction | 2.0 | 4.8 | 4.6 | 140 | -4.2 |
| **Total program acquisition** | **233.0** | **395.7** | **391.1** | **70** | **-1.2** |
| **Unit cost estimates (then-year dollars in millions)[a]** | | | | | |
| Program acquisition | $81 | $161 | $159 | 99% | -1.2% |
| Average procurement | 69 | 137 | 136 | 99 | -0.7 |
| **Estimated delivery and production dates** | | | | | |
| Initial operational capability | 2010-2012 | Undetermined | 2015-2018 | Undetermined | 5-6 years |
| Full-rate production | 2012 | 2019 | 2019 | 7 years | 0 years |

Source: GAO analysis of DOD data. | GAO-15-429T

[a]Annual projected cost estimates expressed in then-year dollars reflect inflation assumptions made by a program.

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Mr. Sullivan currently serves as Director, Acquisition and Sourcing Management, at the U.S. Government Accountability Office. This group has responsibility for examining the effectiveness of DOD's acquisition and procurement practices in meeting its mission performance objectives and requirements. In addition to directing reviews of major weapon system acquisitions such as the Joint Strike Fighter, F-22, Global Hawk, and various other major weapon acquisition programs, Mr. Sullivan has developed and directs a body of work examining how the Department of Defense can apply best practices to the nation's largest and most technically advanced weapon systems acquisition system. This work has spanned a broad range of issues critical to the successful delivery of systems, including technology development; product development; transition to production; software development; program management; requirement-setting; cost estimating; and strategic portfolio management. The findings and recommendations from this work have played a major role in the department's recent acquisition policy revisions. Most recently, he has directed the GAO's annual assessment of major weapon systems programs for the Congress and GAO's work with Congress in establishing acquisition policy reforms. His team also provides the Congress with early warning on technical and management challenges facing these investments.

Mr. Sullivan has been with GAO for 29 years. He received a bachelor's degree in Political Science from Indiana University and a Masters Degree in Public Administration from the School of Public and Environmental Affairs, Indiana University.

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

STATEMENT OF

THE HONORABLE SEAN J. STACKLEY
ASSISTANT SECRETARY OF THE NAVY
(RESEARCH, DEVELOPMENT AND ACQUISITION)

AND

LT GENERAL CHRISTOPHER C. BOGDAN
PROGRAM EXECUTIVE OFFICER, F-35

BEFORE THE

TACTICAL AIR AND LAND FORCES SUBCOMMITTEE

OF THE

HOUSE ARMED SERVICES COMMITTEE

ON

F-35 PROGRAM REVIEW

APRIL 14, 2015

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

## I. Introduction

Chairman Turner, Ranking Member Sanchez and distinguished Members of the Committee. Thank you for the opportunity to address this committee regarding the F-35 Lightning II.

The F-35 Lightning II is the Department of Defense`s largest acquisition program, and it is of vital importance to our Nation's security. The F-35 will form the backbone of U.S. air combat superiority for decades to come. It will replace the legacy tactical fighter fleets of the Air Force, Navy, and Marine Corps with a dominant, multirole, fifth-generation aircraft, capable of projecting U.S. power and deterring potential adversaries. For our international partners and Foreign Military Sales (FMS) customers, who are participating in the program, the F-35 will become a linchpin for future coalition operations and will help to close a crucial capability gap that will enhance the strength of our security alliances.

The F-35 program is executing well across the entire spectrum of acquisition, to include development and design, flight test, production, fielding and base stand-up, sustainment of fielded aircraft, and building a global sustainment enterprise. It is indeed a very big, complex, rapidly growing and accelerating program that is moving in the right direction. Our overall assessment is that the program is making solid and steady progress on all aspects and improving each day. However, this is not to say the program does not have risks, challenges, and some difficulties, but we are confident the program will be able to overcome these problems and deliver on our commitments. Today we will give you a detailed update on the progress that has been made over the past year, providing a balanced look at where the program stands, pointing out both the accomplishments and the setbacks.

## II. Development

Let us begin by discussing the development program. As you know, an independent team conducted a thorough technical baseline review in 2010, which allowed for the re-baselining of the development and test program in 2011 after breaching both the cost and schedule thresholds Congress put in place. Since that realistic baseline was created, the program has been executing to it for the past four years – on cost and on schedule.

Today, the program is nearing the completion of Block 2 software development and is close to completing all flight testing necessary to field our initial warfighting capability, also known as Block 2B. This block of capability will deliver to support the U.S. Marine Corps' Initial Operational Capability (IOC) this summer. Additionally, the program has begun flight test with our Block 3i software. We expect the 3i software, which is the Block 2B capability re-hosted on improved hardware, to be ready by the end of calendar year 2015. The U.S. Air Force will declare IOC with the Block 3i capabilities between August and December 2016.

The final block of F-35 development program capability, known as Block 3F, is planned for delivery in the fall of 2017. Block 3F testing has begun. However, as a result of the emphasis being placed on completing Block 2B and 3i testing, we have slowed Block 3F testing. We expect to fully resume Block 3F testing this summer. As a result of this delayed flight testing, the program estimates there is a risk to completing Block 3F on time -- believing it is now about 4-6 months later than expected. This delay is not expected to impact U.S. Navy IOC in 2018 or other partner's capabilities, because: (1) the program has some time to improve on this schedule delay with better systems engineering and software process improvements; and (2) the program did build some realistic margin into the original schedule for the need date of this Block 3F software.

As for flight testing, the program will be complete with all Block 2B flight testing this spring, will continue Block 3i flight testing, and, as stated before, begin Block 3F flight testing this summer. There were numerous accomplishments this year in flight testing, most notably, completion of a very successful initial F-35C ship suitability sea trial aboard the USS NIMITZ, a large deck carrier. This initial sea trial was quite successful in proving that the F-35C can be embarked and employed on Navy carriers – an important step for our Naval warfighters. Our performance on the USS NIMITZ in terms of carrier landings, also known as "traps", was superb in that we made 124 traps out of 124 attempts without a single missed landing.

In addition to resolving the F-35C arresting hook issue, the program has resolved or has plans in place for resolution of other past lingering technical issues to include the Helmet Mounted Display System (HMDS), fly at night and Instrument Meteorological Conditions (IMC), Fuel Dump, and Lightning Protection.

As previously reported, in September 2013, during F-35B full-scale durability testing we experienced a significant bulkhead crack at 9,056 Equivalent Flight Hours

(EFH), which is 1,056 beyond its first lifetime. The A-model and C-model have not experienced such bulkhead cracking during testing, with the A-model at approximately 13,300 Equivalent Flight Hours (EFH) and the C-model at approximately 11,000 EFH. The durability testing was stopped on the B-model and a root cause investigation was conducted. The goal of durability testing is to apply cyclic loads to the airframe to simulate fleet usage. Durability testing is conducted early in the development of any new aircraft to avoid costly sustainment issues later in the life of the aircraft. We require 8,000 EFH of aircraft service life verified by testing of two lifetimes (16,000 EFH). Once root causes had been established, redesign efforts for the bulkheads began. A number of locations were identified as requiring redesign to meet the intended life, and most were addressed using standard techniques such as material thickening or cold working. However, as the redesign matured, two locations were identified that would not meet the full life requirement without significant redesign to the aircraft. An alternative service life improvement method (known as laser shock peening) that has been successfully used for the primary airframe structure on another legacy aircraft is currently being qualified to address these redesign shortfalls. This method will be available for both production and retrofit applications. The full-life design solution for the F-35B model bulkheads is scheduled to be available for production for LRIP 11 aircraft deliveries.

There was no immediate airworthiness concern for fielded and test aircraft because of the high hours accrued on this test article at the time of discovery. It will not impact the U.S. Marine Corps ability to meet IOC in 2015. Additionally, due to the differences between the bulkhead forging materials of the F-35B (Aluminum) and the F-35A/C (Titanium), we have yet to see the same cracking issues with the A and C models at the equivalent flight hours.

As you are most likely well aware, the Director, Operational Test and Evaluation (DOT&E) performed another independent assessment of the F-35 Program. This was conducted with the F-35 Program Office's full cooperation and unfettered access to information on the F-35 Program. Although the report is factually accurate, we do not believe it tells the full story as not enough credit is given for progress that has been made in reducing risk on the program. There were no surprise findings in the report, in fact, we agree and have taken action on 6 of the 8 recommendations in the report and we are reviewing the other two for action.

With regards to F-35A Dual Capable Aircraft (DCA), we are continuing to execute a risk reduction strategy to prepare for DCA integration during Block 4 Follow-on Development. Our risk reduction efforts include developing a detailed planning schedule for B61 integration on the aircraft, maturing the nuclear architecture design, refining the cost estimate, conducting Nuclear Certification Requirements planning, and performing the initial Concept of Operations (CONOPS) documentation. To remain in sync with the B61-12 program, planning efforts are underway for the addition of several captive-carry, environmental flight tests of the B61-12 during Summer 2015, the results of which will be used to influence the design of the weapon. All F-35 DCA Risk Reduction activities, dealing with the weapons buy, will be complete by the Summer 2015. DCA integration begins as part of Follow-on Development. All software development, flight test, and nuclear certification activities will be conducted across Block 4 development, resulting in an F-35 design certification no later than 2023. The Air Force will lead an operational certification process following design certification that is expected to be completed no earlier than 2025.

## III. Production

In 2014, per our production plan, the program delivered 36 aircraft to our customers, and as of today has, delivered 130 aircraft to our test, operational and training sites. Today, the production line is running approximately two months behind schedule. But due to government/industry manufacturing management initiatives, production deliveries are improving and the current delays do not pose any long-term schedule or delivery risk to the program.

As the program increases production over the next four years, we are watching to make sure the supply base, as well as Lockheed Martin and Pratt & Whitney, are ready for this production ramp increase and conduct continuous production readiness reviews to reduce any production risks.

From a business perspective, the program recently awarded the contract for the 8$^{th}$ Production Lot of 43 airplanes and is preparing to begin negotiations on Lots 9 and 10, which will be negotiated together; much like was done for Lots 6 and 7. We are also looking forward to beginning negotiations for Lot 11 in 2016.

The price of F-35s continues to decline steadily Lot after Lot. For example, the price of a Lot 7 F-35A was 4.3 percent less than a Lot 6 F-35A aircraft and a Lot 8 F-35A aircraft was 3.6 percent less than a Lot 7 F-35A, including the engine and profit for both contractors. Reductions are expected to continue into the future, leveraging the program's on-going affordability initiatives. By 2019, the expected price of an F-35A model, with an engine, and including profit, is between $80 and $85 million dollars, in 2019 dollars.

The program is also seeing the quality of the aircraft and engines improve and the number of hours required to build the aircraft and engines decline – although more progress needs to be made here. These have been important factors in the continued price reduction and future on-time delivery of aircraft and engines. The F-35 program is committed to providing a quality product to our warfighter, partner nations, and foreign military customers. This begins with establishing the appropriate contractual requirements and program plans, ensuring contractor flow-down to its supply chain, and monitoring execution through robust performance metrics. The program continues to work closely with the Defense Contract Management Agency and the prime contractors to address process discipline, attention to detail and adherence to established and robust procedures which are critical to product integrity.

On a final note concerning production, as you know, the program is also building two Final Assembly and Checkout Facilities (FACOs) – one in Italy and one in Japan. Today there are aircraft being built on the production line at the FACO in Italy and, sometime this year, the Japanese will begin building their own F-35s at their FACO in Japan. We are not anticipating problems with either facility at this time.

Continuing on this international theme, the nation of South Korea signed a commitment to purchase 40 F-35A aircraft starting in Lot 10 and last year Israel added 14 more F-35As to their original 19-aircraft order, with a future additional purchase in two to three years. Additionally, Canada has decided to wait until after its national elections before it addresses its fighter replacement program, although it remains a full partner on the F-35 program. Also, Denmark, a full partner in the program, is expected to make its final fighter replacement selection sometime in the summer of 2015.

**IV. Sustainment**

As of April 1, 2015, the program has logged more than 29,000 flight hours and flown over 18,000 sorties since our first flight in 2006. Today over 130 operational, test, and training jets are operating at nine sites. Additionally, the program has completed all F-35A deliveries to Eglin Air Force Base (AFB), has started deliveries to Luke AFB, which is the main training base for the Air Force and partners, including Australia's first two F-35As. The program has also started F-35B pilot training at Marine Corps Air Station Beaufort. In the next four years we will add another seventeen operating bases to the F-35 enterprise across all three regions, North America, the Pacific and Europe.

One of the major areas of concern with maintenance and sustainment over the past 18 months has been the ability to have aircraft that are available and ready to fly. The metrics used to measure this are called Aircraft Availability and Mission Capable rates. Aircraft availability is a measure, in percentage, of how many aircraft are available in the hands of the warfighter on any given day – meaning they are not in maintenance or being modified. Mission capable rate is the percentage of available aircraft that are capable of flying particular missions, having passed all their pre-flight maintenance and pilot checks. Typical aircraft availability rates for mature aircraft range from 60 to 75 percent, and typical mission capable rates for mature aircraft range from 70 to 80 percent. In 2013, these measures were not good; Aircraft Availability was around 35 percent and Mission Capable rates were around 40-45 percent. As a result, in 2014, we began a dedicated Reliability and Maintainability program, along with a focused look at our maintenance procedures known as "Operationalizing the F-35." These programs incorporated aircraft design improvements, repair improvements on parts that are broken, better maintenance procedures and manuals, and better, more available spare parts. All of this has resulted in steady improvements over the past year and a half. Our focused efforts improved Aircraft Availability and Mission Capable rates late last year, hitting levels of approximately 55 percent and 65 percent, respectively. Although we have more work to do to improve on these metrics, the current set of initiatives seems to have started a positive trend.

These programs have also had significant cost benefits and reductions in the long run when looking at the Program's overall life-cycle Operating and Sustaining costs. Along with these two programs, our team has also established a Cost War Room with a goal of reducing the overall Operating and Sustaining life-cycle cost of the program by 30 percent. The Cost War Room identifies, and then executes, cost reduction initiatives from across the entire spectrum of the program, including funding the design of newer, less expensive, more reliable parts and tooling, improving maintenance procedures and manuals, and even looking at different places and different industry partners in terms of repairing parts. Since the Cost War Room was stood up in 2013, the program has reduced the overall life-cycle Operating and Sustaining cost estimate nearly 9 percent based on the Department of Defense Office of Cost Assessment and Program Evaluation estimates and we will continue to drive the life-cycle costs down.

The final topic concerning Maintenance and Sustainment we would like to address is the establishment of the Global Sustainment posture across Europe, Asia-Pacific, and North America. In 2014, the program began the process for assigning the repair capabilities to our partner and FMS customers across these three regions. The first of these assignments were announced at the end of 2014 and included the regional Maintenance, Repair, Overhaul, and Upgrade (MRO&U) capabilities for airframes and engines for both the European and Pacific Regions. These initial MRO&U assignments will support near-term F-35 airframe and engine overseas operations and maintenance and will be reviewed and updated in approximately five years. In the European region, F-35 initial airframe MRO&U capability will be provided by Italy by 2018. Should additional airframe MRO&U capability be required, the UK would be assigned to supplement the existing capability. In the European region, engine heavy maintenance will initially be provided by Turkey, also in 2018, with The Netherlands and Norway providing additional capability approximately 2-3 years after Turkey's initial capability. In the Pacific region, F-35 airframe MRO&U capability will be provided by Japan for the

Northern Pacific and Australia for the Southern Pacific, with both capabilities required by early 2018. For F-35 engine heavy maintenance in the Pacific, the initial capability will be provided by Australia by early 2018, with Japan providing additional capability 3-5 years later.

The program will continue this process in 2015 and 2016 with the Department of Defense assigning to our partners and FMS customers, other repair capabilities, such as landing gear, electrical and hydraulic systems, maintenance of support equipment, and warehousing for the global supply chain.

**V. Risks and Challenges**

Now we would like to shift gears and discuss some of the challenges and risks the program has encountered.

As a program, the biggest technical concern is still the development and integration of software. The aircraft alone has approximately eight million lines of code, with another 16 million lines of code on the off-board systems. This is an order of magnitude greater than any other aircraft in the world and represents a complex, sometimes tricky, and often frustrating element in the program. The discipline the program instilled several years ago in the way software is developed, lab tested, flight tested, measured and controlled by the program office, has produced much better and more predictable results over the past two years. The program is in the final stages of flight test for Block 2B software as stated before, and we are happy to say that the program will deliver Block 2B with the software capability that was promised, although there are a number of workarounds and deficiencies that will need to be corrected in the future. Block 3i is on the same path to deliver the capabilities as promised, although technical issues have caused 3i to be delayed. However, the program had planned for some difficulties in Block 3i development and built margin into the schedule for this work. Currently Block 3i will deliver in time for production aircraft and to meet Air Force IOC. Block 3F has the most software risk facing the program today. The Block 3F software must take information from other sources, such as other non-F-35 aircraft, satellites, and ground stations, and fuse this information with F-35 information, giving the pilot a complete and accurate picture of the battlespace. This multi-platform fusion, as it is called, is the hardest thing the program has to accomplish with Block 3F, and it is being closely watched. The combination of starting Block 3F flight testing late and the technical challenges of this fusion software is the source of the program estimate that Block 3F may deliver 4-6 months late.

This past year presented some other significant challenges, including the engine failure that occurred last summer and our continuing efforts with our Autonomic Logistics Information System, known as ALIS.

On June 23, 2014, an F-35A on take-off roll experienced a failure to the third stage rotor, which "liberated" engine parts – sending them through a fuel tank, which caught fire. Thankfully, the pilot successfully aborted the take-off and exited the aircraft with no injuries. The entire fleet was grounded on July 3, 2014, but flight operations were restored in a limited capacity on July14, 2014. Return to flight imposed additional restrictions on flight operations, including limiting maneuverability in certain parts of the flight envelope (specifically Mach and g-forces the pilot could demand of the aircraft), as well as inspections of the engine after every three flight hours. This additional workload and aircraft limitations slowed the pace of developmental testing and added to the maintenance burden in the operational units. Throughout the summer and into the fall, the Joint Program Office (JPO), Service System Commands and industry worked diligently to analyze the problem, prioritize test assets and open the flight envelope in a safe, methodical fashion. This enabled the enterprise to continue flight testing in portions of the envelope previously restricted, providing some relief to the maintainers in the field.

One key improvement was to increase the inspection interval from three to thirteen flight hours for the operational fleet. The program was able to determine root cause, and developed an interim solution: a “pre-trenched” rub material that will be implemented in the field starting later this year. Pratt and Whitney has agreed to cover the costs for the repairs to engines in the field and the cut-in of the solution to the production line, while the program office will pay for the design activity as per the development contract. The program continues its work on a long-term fix to the engine and expects to review and select from the design solutions this spring, followed by design and qualification testing, and finally, incorporation of the solution into the production line. This work is expected to be completed in 2015.

Another technical risk the program continues to monitor is ALIS. For too long, the program treated this crucial element of the F-35 weapon systems as a piece of support equipment instead of the very complex, software intensive, total logistics and maintenance system it is. This is now being addressed by treating ALIS as if it were its own "weapon system". The program has added new disciplined systems engineering processes that include periodic design reviews, a new leadership structure, improved lab infrastructure and testing to include warfighter involvement, and a more structured software delivery plan and associated metrics. The program has seen solid improvements in ALIS over the past two years with better and faster incremental fixes, including updates made with the fielded versions of the software in 2014. In 2015, the program will field additional capability including a deployable version of ALIS in support of U.S. Marine Corps IOC and in 2016 will add capability which the Air Force requires for its IOC. To summarize, we remain confident that all these technical risks and developmental issues are on the path to successful mitigation and resolution, although the ALIS system as a whole remains behind schedule.

## VI. Affordability

Affordability remains our number one priority. We have made it clear to the program management team and the F-35 industrial base that the program must finish development within the time and money the program has, must continue to drive the cost of producing F-35s down, and must continue to attack the long term life cycle costs of the F-35 weapon system. It is absolutely critical that we make this weapon system affordable. To that end, the program has engaged in a multi-pronged approach to reduce costs across production, operations and support.

First, the program has an agreement with our contractor partners Lockheed Martin, Northrup Grumman and BAE Systems on reducing aircraft production costs through an effort the program has termed the "Blueprint for Affordability," and reducing cost on the F135 engine through Pratt & Whitney's current "War on Cost" efforts and future planned Blueprint for Affordability activities. The goal is to reduce the flyaway cost of the F-35A to between $80 and $85 million dollars by 2019, which is anticipated to commensurately decrease the cost of the F-35B and F-35C variants. The effort involves the contractors investing funds upfront on cost reduction initiatives mutually agreed upon by the government and the contractor. This arrangement motivates the contractors to accrue savings as quickly as possible in order to recoup their investment, and the government benefits by realizing cost savings at the time of contract award. This arrangement also proves out the cost reduction initiative process before the government invests future money into this effort. The combination of Blueprint for Affordability, the Cost War Room efforts of the JPO, and the reliability and maintainability program have provided a viable path to reducing both the production cost of the aircraft and the long-term operations and sustainment costs of the F-35 weapon system.

## VII. Conclusion

In summary, the F-35 program is showing steady progress in all areas – including development, flight test, production, maintenance, and stand-up of the global sustainment enterprise. We believe the program is on the right track and we will continue to deliver on the commitments the program has made to the F-35 Enterprise. As with any big, complex development program, we will face challenges and obstacles. However, we believe the program has the ability to overcome any current and future issues, and the superb capabilities of the F-35 are well within reach for all of us.

Additionally, we intend to continue leading the program with integrity, discipline, transparency and accountability. We will hold ourselves and our program team accountable for the outcomes on this program. We recognize the responsibility the program has been given to provide the backbone of the U.S. and allied fighter capability with the F-35 for generations to come, and that your sons and daughters, grandsons and granddaughters may someday take this aircraft into harm's way to defend our freedom and way of life. It is a responsibility we never forget.

Thank you again for this opportunity to discuss the F-35. We look forward to answering any questions you have.

**The Honorable Sean J. Stackley**
**Assistant Secretary of the Navy**
**(Research, Development and Acquisition)**
**7/28/2008 - Present**

Sean J. Stackley assumed the duties of assistant secretary of the Navy (ASN) (Research, Development & Acquisition (RDA)) following his confirmation by the Senate in July 2008. As the Navy's acquisition executive, Mr. Stackley is responsible for the research, development and acquisition of Navy and Marine Corps platforms and warfare systems which includes oversight of more than 100,000 people and an annual budget in excess of $50 billion.

Prior to his appointment to ASN (RDA), Mr. Stackley served as a professional staff member of the Senate Armed Services Committee. During his tenure with the Committee, he was responsible for overseeing Navy and Marine Corps programs, U.S. Transportation Command matters and related policy for the Seapower Subcommittee. He also advised on Navy and Marine Corps operations & maintenance, science & technology and acquisition policy.

Mr. Stackley began his career as a Navy surface warfare officer, serving in engineering and combat systems assignments aboard USS John Young (DD 973). Upon completing his warfare qualifications, he was designated as an engineering duty officer and served in a series of industrial, fleet, program office and headquarters assignments in ship design and construction, maintenance, logistics and acquisition policy.

From 2001 to 2005, Mr. Stackley served as the Navy's LPD 17 program manager, with responsibility for all aspects of procurement for this major ship program. Having served earlier in his career as production officer for the USS Arleigh Burke (DDG 51) and project Naval architect overseeing structural design for the Canadian Patrol Frigate, HMCS Halifax (FFH 330), he had the unique experience of having performed a principal role in the design, construction, test and delivery of three first-of-class warships.

Mr. Stackley was commissioned and graduated with distinction from the United States Naval Academy in 1979, with a Bachelor of Science in Mechanical Engineering. He holds the degrees of Ocean Engineer and Master of Science, Mechanical Engineering from the Massachusetts Institute of Technology. Mr. Stackley earned certification as professional engineer, Commonwealth of Virginia, in 1994.

Updated: 14 January 2011

**Lieutenant General Christopher C. Bogdan**

Lt. Gen. Christopher C. Bogdan is the Program Executive Officer for the F-35 Lightning II Joint Program Office in Arlington, Va. The F-35 Lightning II Joint Program Office is the Department of Defense's agency responsible for developing and acquiring the F-35A/B/C, the next-generation strike aircraft weapon system for the Navy, Air Force, Marines, and many allied nations.

General Bogdan was commissioned in 1983 from the U.S. Air Force Academy. He has served as an operational pilot, test pilot, staff officer, executive officer, acquisition program manager, and program director. He is a command pilot and experimental test pilot with more than 3,200 flying hours in more than 35 aircraft types, including the KC-135, FB-111A, B-2 and F-16. He has commanded at the squadron and group levels, and served as the executive officer to the Commander, Electronic Systems Center, and to the Commander, Air Force Materiel Command.

General Bogdan also served as the Program Executive Officer for the KC-46 Tanker Modernization Directorate, Wright-Patterson AFB, Ohio.

Prior to his current assignment, General Bogdan was Deputy Program Executive Officer for the F-35 Lightning II Joint Program Office in Arlington, Va.

**EDUCATION**

1983 Distinguished graduate, Bachelor of Science degree in aeronautical engineering, U.S. Air Force Academy, Colorado Springs, Colo.
1989 Distinguished graduate, Squadron Officer School, Maxwell AFB, Ala.
1990 Distinguished graduate, USAF Test Pilot School, Edwards AFB, Calif.
1994 Master of Science degree in engineering management, with distinction, California State University, Northridge
1995 Distinguished graduate, Air Command and Staff College, Maxwell AFB, Ala.
1998 Air War College, by correspondence
2000 Distinguished graduate, Master of Science degree in national resource strategy, Industrial College of the Armed Forces, Fort Lesley J. McNair, Washington, D.C.
2005 Advanced Program Managers Course, Defense Systems Management College, Fort Belvoir, Va.
2006 U.S. Air Force Senior Leadership Course, Center for Creative Leadership, Greensboro, N.C.
2007 National Security Management Course, Maxwell School of Citizenship, Syracuse University, N.Y.
2013 Cyber Operations Executive Course, Air University, Maxwell AFB, Ala.

**ASSIGNMENTS**

1. July 1983 - June 1984, student, undergraduate pilot training, Reese AFB, Texas
2. June 1984 - November 1984, pilot, KC-135 crew training, Castle AFB, Calif.
3. November 1984 - March 1987, pilot, KC-135A and T-37A, 509th Air Refueling Squadron, Pease AFB, N.H.
4. March 1987 - April 1988, pilot, FB-111A Crew Training, Plattsburgh AFB, NY
5. April 1988 - June 1990, FB-111A instructor pilot, 393rd Bomb Squadron, Pease AFB, N.H.
6. June1990 - June 1991, student, Class 90B, U.S. Air Force Test Pilot School, Edwards AFB, Calif.
7. June 1991 - December 1991, experimental test pilot, 6512th Test Operations Squadron, Edwards AFB, Calif.
8. December 1991 - June 1995, B-2 experimental test pilot, B-2 Chief of Training, B-2 Test Program Manager and Assistant Deputy for Operations, 420th Flight Test Squadron, Edwards AFB, Calif.
9. June 1995 - June 1996, student, Air Command and Staff College, Maxwell AFB, Ala.
10. June 1996 - May1997, Program Manager, Theater Missile Defense Systems, Special Projects Program Office, Electronic Systems Center, Hanscom AFB, Mass.
11. May 1997 - June 1999, executive officer to the Commander, Electronic Systems Center, Hanscom AFB, Mass.
12. June 1999 - June 2000, student, Industrial College of the Armed Forces, Fort Lesley J. McNair, Washington, D.C.
13. June 2000 - May 2001, Deputy Commander, 412th Operations Group, Edwards AFB, Calif.
14. May 2001 - July 2002, Commander, 645th Materiel Squadron, Wright-Patterson AFB, Ohio
15. July 2002 - September 2003, executive officer to the Commander, Air Force Materiel Command, Wright- Patterson AFB, Ohio
16. September 2003 - June 2005, Commander, Special Operations Forces Systems Group, Wright-Patterson AFB, Ohio

17. June 2005 - May 2006, Deputy Director, Directorate of Global Power, Office of the Assistant Secretary of the Air Force for Acquisition, Headquarters U.S. Air Force, Washington, D.C.
18. May 2006 - May 2008, Senior Military Assistant to the Deputy Under Secretary of Defense for Acquisition and Technology, Office of the Secretary of Defense, Washington, D.C.
19. May 2008 - May 2009, Senior Military Assistant to the Under Secretary of Defense for Acquisition, Technology and Logistics, Office of the Secretary of Defense, Washington, D.C.
20. June 2009 – July 2012, KC-46 Program Executive Officer and Program Director, KC-46 Tanker Modernization Directorate, Aeronautical Systems Center, Wright-Patterson AFB, Ohio
21. July 2012 – December 2012, Deputy Program Executive Officer for the F-35 Lightning II Joint Program Office, Arlington, Va.
22. December 2012 – present, Program Executive Officer for the F-35 Lightning II Joint Program Office, Arlington, Va.

**SUMMARY OF JOINT ASSIGNMENTS**
May 2006 - May 2009, Senior Military Assistant to Deputy Under Secretary of Defense for Acquisition and Technology, and Senior Military Assistant to the Under Secretary of Defense for Acquisition, Technology and Logistics, Office of the Secretary of Defense, Washington, D.C.

**FLIGHT INFORMATION**
Rating: Command pilot, parachutist
Flight hours: More than 3,200
Aircraft flown: KC-135A/E, FB-111A, F-16A/B, B-2A, T-37A, T-38, B707, RC-135, T-39A and 25 other aircraft types

**MAJOR AWARDS AND DECORATIONS**
Defense Superior Service Medal
Legion of Merit
Meritorious Service Medal with six oak leaf clusters
Air Force Commendation Medal
Air Force Aerial Achievement Medal
Air Force Achievement Medal

**OTHER ACHIEVEMENTS**
Outstanding Cadet in Aeronautical Engineering, U.S. Air Force Academy
British Marshall Scholarship National Finalist
Rhodes Scholar Candidate, U.S. Air Force Academy
Distinguished graduate, KC-135 Training
Outstanding graduate, FB-111A Flight Instructor Course
Company Grade Officer of the Year, Air Force Flight Test Center

**PROFESSIONAL CERTIFICATIONS**
Program Management, Level III, Acquisition Professional Development Program
Test and Evaluation, Level III, APDP

**EFFECTIVE DATES OF PROMOTION**
Second Lieutenant June 1, 1983
First Lieutenant June 1, 1985
Captain June 1, 1987
Major March 1, 1995
Lieutenant Colonel Sept. 1, 1998
Colonel Aug. 1, 2002
Brigadier General Dec. 9, 2008
Major General Nov. 18, 2011
Lieutenant General Dec. 6, 2012

(Current as of December 2013)

## WITNESS RESPONSES TO QUESTIONS ASKED DURING THE HEARING

APRIL 14, 2015

## RESPONSE TO QUESTION SUBMITTED BY DR. WENSTRUP

General BOGDAN. Yes, we agree this is a valid concern/problem.

The F–35 air system is experiencing some "false" Health Reporting Codes (HRCs) generated by the aircraft, then downloaded and filtered in ALIS. This is manifested in the early software versions (Block 1B and Block 2A) of the F–35 software. Many of the aircraft-generated HRCs do not require maintenance action (false codes) but do generate work orders that cause unnecessary administrative burden for maintainers and pilots to close out the action. The release of Block 2B software has resulted in a significant improvement of these false codes over earlier Block 1B/2A versions.

The "80% false positive" figure is related to the work-orders that ALIS automatically generates after each flight. As an example, a given aircraft may generate 20 HRCs after a flight. Of those 20, any number of them (50%, or 10, in this example) may be automatically flagged as not valid and removed by systems within ALIS—this function is called the Nuisance Filter List (NFL). The remaining 10 HRCs would result in work-orders requiring maintenance personnel action. This is where the reports of "80% false positives" comes into play—eight of these work-orders are potentially false positives and require a maintainer to take administrative steps to close. The final two would be "legitimate" work-orders that warrant maintenance actions.

Both the aircraft (false HRCs) and ALIS (proper filtering) contribute to this issue. Valid HRC software fixes are being addressed in the aircraft software via Software Product Anomaly Reports. With these software updates, "false" work orders for the maintenance personnel will continue to be reduced with each aircraft software release. The JPO is also updating the ALIS software to improve correlation of HRCs and consolidation of work orders. The ultimate goal with the improvements of both the aircraft off-board prognostics health monitoring system and ALIS software is negligible false positives by the end of 3rd Quarter of 2017. [See page 18.]

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## RESPONSE TO QUESTIONS SUBMITTED BY MS. DUCKWORTH

General BOGDAN. A deployable version of ALIS (Standard Operating Unit Version 2—SOUv2) is part of ALIS version 2.0.1 being fielded this summer to support to the U.S. Marine Corps Initial Operational Capability (IOC). A SOUv2 deployable system was fielded to Flight Test (FT) on May 3, 2015, to undergo a series of tests, including a formal Logistics Test and Evaluation process that will test all aspects of the Sortie Generation Process. ALIS version 2.0.2 is currently in work to support the U.S. Air Force IOC in Aug 2016. ALIS version 3.0 releases are planned to complete the ALIS capabilities required within the development program by October 2017. Each release will have an increasingly comprehensive testing regimen throughout the development process, including configuration item testing, integration testing, functional testing, information assurance testing, and deployment to flight test. User-defined performance standards and system level performance benchmarks are evaluated during integration and functional testing in the lab, as well as during flight test.

The F–35 performance requirement for false-positives (false alarms) is 50 flight hours between false alarms. In comparison to other platforms, this performance is 2 to 25 times more stringent, e.g., 1.8 hours for P–8 Poseidon and 23 hours for F–18 E/F Super Hornet. A zero-percent false-positive is not a realistic expectation. However, the ultimate goal from the improvements in off-board prognostics health monitoring and ALIS software is to achieve negligible false positives by the end of 3rd Quarter 2017.

An initial study on the impact of the current, "less than required" false-positive ratio was performed in January 2015 and showed a minimal increase in overall manpower needed to maintain war-time sortie generation rate and availability. Specifically, the findings were that for a squadron of 10 aircraft requiring 77 maintainers, one additional maintainer would be needed due to the current false-positive ratio. A follow-on study is being performed to refine the impact analysis accounting for other maintainability factors (e.g., average repair time), and will include associated costs. Results are expected in summer 2015.

The JPO stands ready to brief the committee members or their staffs on the full ALIS development and fielding plan. [See page 19.]

## QUESTIONS SUBMITTED BY MEMBERS POST HEARING

APRIL 14, 2015

## QUESTIONS SUBMITTED BY MR. TURNER

Mr. TURNER. The program had planned to conduct a Block 2B operational evaluation that would have provided some operational performance information prior to the Marine Corps declaring an initial operational capability. a. What knowledge/information about aircraft performance would that evaluation have provided? b. In your view does deferring this operational evaluation increase risk to the Marine Corps ability to use the aircraft with 2B capabilities? c. What was the rationale for deferring the evaluation?

Dr. GILMORE. a. The Block 2B OUE test design included an evaluation of mission effectiveness in air-to-surface attack, close air support, defensive counter-air warfare, and suppression/destruction of enemy air defenses in a limited threat environment. It also included an evaluation of the operational suitability of the F–35A and F–35B.

b. The Marine Corps IOC decision is not and was not ever dependent on the execution of, or reporting the results of, the Block 2B OUE. The Block 2B OUE was an event-driven operational test, which the program could not enter until entrance criteria were met. Having said that, it is also important to note that the combat capabilities of the Block 2B aircraft will be very limited, and that the opportunities during the next year or more to understand the implications for combat of those limitations using operational testing will also be very limited.

c. The decision to eliminate the Block 2B OUE was based on the assessment that the program could not satisfy the criteria to enter the test with sufficient numbers of operationally representative aircraft in the Block 2B configuration or trained pilots and maintenance personnel until mid-2016. Delaying the OUE until that time would have a significant negative impact on the program's ability to complete development of the full Block 3F set of capabilities in a timely manner.

Mr. TURNER. Your latest annual report raises concerns about the progress of the program in meeting some of its key reliability requirements. a. From DOT&E's perspective, what are the key reliability problems facing the program? Do you believe the program is taking adequate steps to address these problems? If not, what steps do you believe are needed? b. Current program plans indicate that IOT&E is scheduled to begin in 2019. Do you believe the program will be able to meet this schedule? What do you see as the primary challenges to beginning IOT&E on time? What are your primary concerns as the F–35 program prepares for IOT&E?

Dr. GILMORE. a. Reliability has not been improving at a fast enough rate to allow most of the Operational Requirements Document (ORD) derived metrics to meet expectations at maturity, with some exceptions. The contract specification reliability metrics, however, have been improving at an adequate rate. The program has identified several high driver components that contribute to lower than expected system reliability and recently established a reliability improvement program and growth plan. It is too soon to evaluate how well the plan is being executed and whether sufficient reliability growth is being realized. The program must continually run the process of identifying and tackling high drivers, since individual component reliabilities will likely change with the operational use of the aircraft as new capabilities are added to fleet operations. b. The current schedule of the program of record indicates IOT&E will begin in late 2017, not 2019. The program is not likely to be able to meet this schedule. The primary challenges and concerns for entering IOT&E are: completing the modifications/retrofit of the early production OT aircraft, completing testing of the fixes to problems discovered thus far in Block 2B and Block 3i testing which have been deferred to Block 3F, correcting deficiencies that will inevitably be discovered in Block 3F testing, completing the technical data materials needed for Service personnel to maintain the aircraft, improving the functions of the Autonomic Logistics Information System, and improving aircraft availability through improved reliability.

Mr. TURNER. What are risks to Block 2B Fleet release occurring in mid-2015?

Dr. GILMORE. Regarding the risk that Block 2B fleet release will occur in mid-2015: The program has completed the necessary Block 2B development and testing to support an air worthiness certification that allows the aircraft to be operated in the field. This air worthiness certification, when completed and released to the fleet later this year, will have significant aircraft operating limitations on all variants, limiting the utility of these Block 2B aircraft for combat.

The test teams and the Program Office have done an admirable job of identifying the residual deficiencies that will affect combat performance. We won't have high confidence in the released capabilities to the field, however, because the operational test units will be able to only perform a few tactics development and operational test events envisioned between now and the end of 2015; this is primarily due to the problem of low aircraft availability. Continued discovery of deficiencies is likely well after the fleet release. It will be important for operational commands to carefully consider the limitations and level of confidence in the released capabilities before tasking F–35 units.

The early production aircraft in Lots 3 through 5 all require extensive, depot-level modifications to assume the full Block 2B configuration. This process has only recently begun. Although Marine Corps operational aircraft have been prioritized and are planned to receive modifications this year, many aircraft, in particular the operational test aircraft, will not be complete all of the Block 2B modifications until early 2017.

Mr. TURNER. What are risks to completing Block 3F such that IOT&E can at least begin in early 2018?

Dr. GILMORE. Risks to completing Block 3F so that IOT&E can begin in early 2018 include: Block 3F mission systems software integration on the program's current timeline will be challenging. The first release to flight test occurred in March, but Block 3F testing was suspended after only three flights as the program focused test aircraft on Block 3i flight testing. Block 3F testing is not planned to restart until late summer 2015, at which time only a year will remain until the final release of 3F software is planned to enter flight test. By comparison, Block 2B took over two years from the first to final release. Block 3F mission systems flight test is currently planned to be a 26 month span. It is likely to take longer, ending in mid-2018. Block 3F includes a significant amount of weapons testing so that weapons can be added beyond the limited capabilities of Block 2B, which includes internal carriage and employment of only two air-to-ground weapons and one air-to-air missile integrated in Block 2B. Block 3F will add external carriage of these weapons, SDB, JSOW, and AIM–9X, and the gun. This additional weapons testing is a significant risk area for Block 3F. Corrections to deficiencies in fusion which inhibit efficient employment in complex mission environments needed for the intended "full warfighting" capability is also a significant risk area. Additional modifications are needed for Lot 3–8 aircraft to become the Block 3F configuration. The plan for installing these modifications is still under construction, and all the hardware modification kits are not yet on contract. The program has indicated that it is likely that these aircraft will be undergoing modifications as late as mid-2018, which could delay the start of IOT&E (because the start date of IOT&E depends on availability of OT aircraft in production representative configurations). Improving suitability by completing the technical data materials needed for Service personnel to maintain the aircraft, improving the functions of the Autonomic Logistics Information System, and improving aircraft availability through improved reliability.

Mr. TURNER. What more can be done or focused on to improve operational suitability?

Dr. GILMORE. The program has focused on improving aircraft availability through increased spare parts, trying to make maintenance more efficient, and attention to failures that create down-time and long cycles of repair. Operational usage will be changing with the release of combat capability, even for training with the new capability. The program needs to add to its campaign a rigorous approach to improving the reliability of components that affect mission success—in other words, attack the high drivers of operational mission failures in offensive and defensive systems and air vehicle components—not just attack the high drivers of maintenance down time and high cost. The program has claimed to be "turning the corner on maintainability". This is an impossible assessment to make since the fleet of aircraft are still operating in non-combat configurations, unable to actuate weapons bay or countermeasure system doors, load or drop bombs, load or shoot missiles, and may complete the authorized, limited training missions without the use of aircraft sensors.

Mr. TURNER. What concerns do you have regarding the June 2014 engine failure?

Dr. GILMORE. The program has done a good job of explaining what happened but we do not fully understand why this happened. We do not understand what occurred differently than expected during the relatively restricted flight maneuvers on the flight prior to the engine failure that set up the failure event. The effect on engine performance and reliability with the modified stators is not well understood. We understand the engine contractor has acknowledged limitations in their models, particularly associated with axial movement within the engine, and have updated those models as a result of the engine failure. It is not clear what exactly the models did not correctly predict in the original design and use of the aircraft that turned out to be incorrect, or how the modeling was improved. We should also determine through additional analysis if the containment of the damage is sufficient, given the nature of the failure. In this case, the pilot was able to stop the aircraft and safely get away from the burning airframe. However, inflight failures of this kind should be examined to determine if the uncontained damage is tolerable from an aircraft vulnerability perspective.

Mr. TURNER. Do you feel that the program should pause further development and fix the deficiencies in Block 2B before moving on to Block 3F?

Dr. GILMORE. No, the program should not pause further development to fix deficiencies in Block 2B before moving on to Block 3F. The program should do what it is doing now: determine what fixes are absolutely essential to the Services for fielding Block 2B capability for the USMC and for fielding Block 3i capability for the USAF, provide a solution, and focus on transitioning to Block 3F. The end-product of SDD depends, in part on two important hardware changes that are necessary for Block 3F capabilities: a) Technology Refresh 2 processors, and, b) Gen 3 helmet. The program needs to transition test aircraft, and the development team, from Block 2B configuration to support testing of these systems as soon as possible. Remaining Block 2B deficiencies can be worked on in the new hardware.

Mr. TURNER. In your statement, you highlight the likelihood of future cost growth and schedule delays for the F–35 program. Please explain your concerns?

Mr. SULLIVAN. The program's acquisition strategy still contains a noteworthy overlap between flight testing and aircraft procurement. As we found in April 2015, with about 2 years and 40 percent of the developmental test program remaining, DOD is planning to significantly increase F–35 procurements over the next 5 years, from 38 aircraft per year to 90 aircraft per year.[1] Over that same timeframe, DOD will be conducting developmental and operational flight testing of the aircraft's full warfighting capabilities—known as Block 3F—which are needed to perform in more demanding and stressing environments. With this complex and demanding testing still ahead, it is almost certain that the F–35 program will encounter additional discoveries, and depending on the nature and significance of those discoveries, the program could need additional time and money to incorporate design changes, retrofit aircraft, and complete testing.

Mr. TURNER. Your statement mentioned that the program is making progress with manufacturing, however, you caution about challenges the program still faces. Please explain why you feel there is a need for caution.

Mr. SULLIVAN. In April 2015, we found that Lockheed Martin continued to deliver more aircraft, the number of manufacturing hours needed to build each aircraft continued to decline, and efficiency rates continued to improve. However, we also found that a number of suppliers continued to deliver parts late to Lockheed Martin resulting in part shortages and inefficiencies on the production line. From 2013 to 2014, the average number of part shortage occurrences at Lockheed Martin's manufacturing facility increased by 33 percent. If not adequately addressed, these part shortages will likely continue and the manufacturing inefficiencies will be amplified as production rates increase over the next 5 years.

Mr. TURNER. In this testimony as well as in the past, you have consistently raised long-term affordability as a key area of risk. In your opinion, has the department addressed this concern?

Mr. SULLIVAN. Our analysis indicates that the F–35 program will require an average of $12.4 billion per year through 2038 to finish the current development program—expected to end in 2017—and procure all of the remaining United States aircraft. DOD plans to steeply increase its funding requests over the next 5 years to support a planned increase in aircraft procurement, and then projects that it will need between $14 and $15 billion annually for nearly a decade. Given other significant fiscal demands weighing on the nation, and other costly, high priority acquisition efforts, like the KC–46A Tanker, the Long Range Strike Bomber, the DDG–51 Class Destroyer, and the Ohio Class submarine replacement competing for limited resources, it is unlikely that the program will be able to receive and sustain such high and unprecedented levels of funding over this extended period. In a time of austere budgets, we believe fully funding all of the department's priorities at the same time will undoubtedly force DOD to continue to make difficult trade-off decisions. DOD has not fully addressed our affordability concerns, and for that reason we recommended in our April 2015 report that DOD conduct an affordability anal-

[1] GAO, F–35 Joint Strike Fighter: Assessment Needed to Address Affordability Challenges, GAO–15–364 (Washington, D.C.: Apr. 14, 2015).

ysis of the program's current procurement plan that reflects various assumptions about future technical progress and funding availability.

Mr. TURNER. GAO and DOT&E have both noted that the program has made progress but still faces challenges as it moves into later stages of flight testing while at the same time significantly increasing production rates. a. What do you see as biggest challenges facing the F–35 program going forward? b. Do you have concerns with the engine's reliability and costs; software development and flight testing; manufacturing and quality rates and supplier performance? Please explain. c. Do you believe the program will complete the developmental testing in 2017 as currently planned, and within current estimated costs? d. To what extent does your assessment account for the impacts of potential future test failures, like the ones encountered this year with the engine and bulkhead?

Mr. SULLIVAN. We believe that the two biggest challenges facing the program are affordability and concurrency. Our analysis indicates that the program will require an average of $12.4 billion per year through 2038 to finish the current development program—expected to end in 2017—and procure all of the remaining United States aircraft. DOD plans to steeply increase its funding over the next 5 years to support a planned increase in aircraft procurement, and then projects that it will need between $14 and $15 billion annually for nearly a decade. Given other significant fiscal demands weighing on the nation, and other costly, high priority acquisition efforts, like the KC–46A Tanker, the Long Range Strike Bomber, the CVN–78 Ford Class Aircraft Carrier, and the Ohio Class submarine replacement competing for limited resources, it is unlikely that the program will be able to receive and sustain such high and unprecedented levels of funding over this extended period. In addition, with more demanding and complex testing still to be done, the program faces the risk that new technical problems—including those related to software—will be discovered and additional design changes will be needed. As we found in April 2015, with about 2 years and 40 percent of the developmental test program remaining, DOD is planning to significantly increase F–35 procurements over the next 5 years, from 38 aircraft per year to 90 aircraft per year. Over that same timeframe, DOD will be conducting developmental and operational flight testing of the aircraft's full warfighting capabilities—known as Block 3F—which are needed to perform in more demanding and stressing environments. With this complex and demanding testing still ahead, it is almost certain that the F–35 program will encounter additional discoveries, and depending on the nature and significance of those discoveries, the program could need additional time and money to incorporate design changes, retrofit aircraft, and complete testing.

We believe that the F–35 program continues to face challenges in several key areas. First, as we found in April 2015, F–35 engine reliability had been consistently worse than the program expected, and improving engine reliability would likely require additional design changes and retrofits, which typically translate into additional cost. At the time, Pratt and Whitney—the engine contractor—officials had identified a number of design changes that they believed would improve the engine's reliability. Some of those changes had been funded and were being incorporated into the engine design, worked into production, and being retrofitted onto fielded engines. Several other design changes had been identified, but were not yet funded. In addition to these reliability improvements, the program was also in the process of developing design changes to address the root cause of a significant engine failure and fire that occurred in July 2014. Second, while the F–35 program has made progress in software development and flight testing, we believe that cost and schedule risks still remain. F–35 software development has been consistently behind schedule and has needed more rework than expected to address deficiencies found during flight testing. For example, the program experienced a higher than expected amount of test point growth in 2014—nearly twice what was expected—largely because of software rework. If these trends continue the program will face cost and schedule challenges as it works through the complex and demanding Block 3F software development and flight testing. Finally, in April 2015, we found that Lockheed Martin continued to deliver more aircraft, the number of manufacturing hours needed to build each aircraft continued to decline and efficiency rates continued to improve. However, time spent on scrap, rework, and repair, as well as the average number of part shortage occurrences at Lockheed Martin's facility, have been higher than expected. We are concerned that if these trends continue, Lockheed Martin could have difficulty improving its manufacturing efficiency at its expected rates. We believe that if these problems are not resolved they will likely be amplified as production rates increase over the next 5 years.

Whether or not the program will complete developmental testing in 2017 primarily depends on DOD's ability to complete Block 3F software development and to execute the flight test program as planned. At the time of our April 2015 report, DOD expected to complete the final 40 percent of F–35 developmental testing by 2017. Over that timeframe, the test program will be focused on flight testing the aircraft's full warfighting capabilities—known as Block 3F—which are needed to perform in more demanding and stressing environments. With this complex and demanding testing still ahead, it is almost certain that the F–35 program will encounter additional discoveries. If these additional discoveries turn out to be significant, like the bulkhead and engine discoveries in 2014, the program's plan to complete developmental testing in 2017 would be at risk, and additional time and money would be needed to incorporate design changes, retrofit aircraft, and complete testing.

Mr. TURNER. GAO and others continue to raise concerns about the long term affordability of the F–35 acquisition program, noting that as procurement ramps up over the next 5 years annual funding requests are projected to increase significantly and by 2021 reach $15 billion and stay at that level for a decade. At the same time other high profile DOD programs will be competing for funds, including the KC–46A Tanker, new bomber, and the Ohio class submarine replacement. a. What are the key factors driving the current F–35 procurement plans–production rate levels and funding levels? b. Given federal budget constraints and the competition for funding within DOD, do you believe that sustained annual funding of that magnitude is going to be achievable? c. Has the Department considered different procurement options, and if so, what has been considered? Are there any viable alternatives if the current plan is not affordable?

Secretary STACKLEY. The Department continues to fully support the F–35 Lightning II program. We plan to steadily increase production for the U.S. Services, reaching full rate production of 120 aircraft per year by 2022, with the Department of Navy intending to procure 20 F–35B and 20 F–35C aircraft per year. Ramping up to this rate of production is necessary to provide the dominant, fifth-generation aircraft capable of Anti-access/Area Denial (A2/AD) operations and to begin replacement of our aging combat aircraft fleet. Given continued support for the program by Congress and other stakeholders, plus its technical progress and steadily declining costs, we are confident that sustained annual funding for the program is achievable and necessary. F–35 prices, including engine and profit, have steadily declined lot after lot, reaching 3–4 percent reductions per year for the last two years. Increased procurement rates are key factor in year-over-year cost reduction and any future procurement reductions could drive up per-unit cost. Price reductions are expected to continue, leveraging on-going initiatives, such as the Blueprint for Affordability, engine War on Cost, and Cost War Room. By 2019, the price of an F–35A model is expected to be between 80 and 85 million dollars, with commensurate cost reductions for F–35B and F–35C. The Department continues to study the correct force mix and successfully engage in initiatives to drive down costs. To maintain our air superiority advantage, it is a national imperative to recapitalize our aging legacy fighter fleet, and there is no alternative to the F–35 with its unique 5th generation survivability and lethality to maintain that advantage against emerging threats.

Mr. TURNER. In Mr. Sullivan's testimony he notes strong concerns about the reliability and potential implications related to the F–135 engine. a. Has the program identified the root cause of the engine fire that occurred in June 2014, and has a long-term solution been identified to fix the problem? If so please describe the root cause and discuss the cost, schedule, and performance implications related to the identified solution(s)? b. Has the Department called upon outside experts to validate the root cause and/or proposed solution? When do you expect to have verified through flight testing that the problem has been fully resolved? c. Engine reliability has been a concern for some time, what steps are you taking to improve the overall reliability of the engine? What are the cost implications and will those costs be borne by the government or the contractor?

General BOGDAN. A. Yes. The root cause of the incident was unpredicted, excessive heat generated by two parts of the fan rubbing which caused part of the fan rotor to break. The debris from the rotor exiting the engine fan case resulted in significant damage to the engine and aircraft. Pratt & Whitney has developed an interim fix that opens the clearance between those parts which results in negligible performance loss. Engines on flight test assets have received the retrofit. The long-term solution is pending material testing soon to begin with a projected down-select of a fix in 2nd Quarter, CY 2015. To date, $5.6M has been allocated from System Development and Demonstration (SDD) management reserve to cover non-recurring engineering costs. The program's development cost and schedule baseline contained margin to address these types of technical discovery and the completion of SDD is still expected in Oct 2017.

B. The Department has not called on outside experts. The root cause and proposed solution were vetted through independent propulsion experts from the Air Force, Department of the Navy and Pratt & Whitney. The interim fix remains a candidate as do two alternate rub systems. The interim fix has been validated through flight test and will be delivered in new production engines starting this month. New production parts are expected to be available for new production engines after flight test by mid-2016 if the interim fix is not chosen. While the interim fix has not demonstrated any measurable deficiencies, there is a concern that a minor loss in fuel efficiency or durability may manifest later in an engine's useful life which is why we continue to entertain an alternative design as a final fix.

C. With the exception of the before mentioned failure at Eglin AFB, the F135 engine has performed well. The high maintenance drivers on both F–35A/C and F–35B models have been identified, solutions to most have been developed and validated in SDD, and will be incorporated into production. The data indicates that the F–35A/C engines will recover to reliability projection curves with these fixes. The SDD program is currently adding reliability improvement tasks that are expected to help the F–35B propulsion system as well as adding margin to the F–35A/C system. Reliability-driven design improvements are paid for by the Government through the SDD contract at no additional cost (management reserve). The Government extracts financial consideration on fixed price incentive production contracts for parts not meeting specification. Unit cost is not projected to be affected due to planned reliability improvements.

Mr. TURNER. Both GAO and DOT&E highlighted that the program made adjustments to its test plans over the past year—including the deferral and/or elimination of test points, and the restructuring of an operational evaluation planned for Block 2B capabilities. a. What events required the program to adjust its test program over the past year? What are the implications to completing the test program going forward? Do you still project that the development flight testing will be completed in 2017 and in time to support IOT&E? b. As mentioned earlier, the program deferred an operational evaluation of the Block 2B capabilities, can you explain to the subcommittee the rationale for deferring this test and the implications, if any, to the Marine Corps as they plan to declare IOC later this year?

General BOGDAN. a) The Block 2B Operational Utility Evaluation (OUE) was canceled in favor of focused, limited assessments due to limited test assets. This action has afforded the time needed to build a plan for a successful Initial Operational Test and Evaluation (IOT&E) for Block 3F.

The Integrated Test Force (ITF) focused priority effort on Mission System (MS) testing throughout 2014 in order to meet timelines. The MS effort focused on completing Block 2B test points by prioritizing test points that fed critical-path analysis reports and certification. The result was deferral of a small portion of Block 3F Flight Science (FS) testing, which currently being performed.

The reduction of flight test points originally planned is part of the normal, ongoing process to manage the development program. The test plans are routinely revisited to add, change or delete test points, based on the results of previous tests and the needs of the certifying agencies. In this case, test points were reduced last year based upon what was required to verify requirements and certify the system in accordance with Service technical authorities' (Naval Air Systems Command and Life Cycle Management Center) standards, specifications and best practices. All test point reductions were vetted through the independent technical authorities for their concurrence prior to making any adjustments.

Current projections show the completion of Developmental Test (DT) flight test in the summer of 2017. The delivery of mature software, on schedule, remains the #1 risk in flight test.

b) The F–35 Program was not going to have ample Operational Test (OT) test jest in the 2014–15 timeframe. The decision, in conjunction with Director, Operational Test & Evaluation (DOT&E), was to prioritize our DT MS testing. Incorporating OT jets and pilots (including USMC aircrew) in DT is mitigating the impact to the Marine Corps, and is not on the critical path to Marine Corps Initial Operational Capability (IOC) declaration. The Block 2B capabilities will continue to be bolstered in upcoming software releases.

Mr. TURNER. In his statement, Mr. Sullivan describes positive trends in aircraft manufacturing, but he also identifies challenges, including supplier quality problems and late part deliveries, that the program faces as it plans to significantly increase production rates over the next five years. a. Do you agree with GAO's assessment of manufacturing progress and challenges? b. What risks or challenges that you think are the most critical as production rates increase and what steps to do you think are necessary to help mitigate these concerns?

General BOGDAN. A. JPO agrees with the GAO assessment that production progress is trending in the right direction and that challenges with supplier performance exist. The JPO remains committed to taking the necessary steps to closely monitor and mitigate impacts to production as rates increase in the coming years.

B. The three most significant challenges facing production are Supplier Performance, Outer Mold Line/Seam Validation, and Rate Readiness to meet peak production.

- Poor supplier performance leads to costly out of station work in assembly operations, schedule delays, and opportunities for poor quality. To alleviate this, Contractor teams are working closely with suppliers to reduce lead and span times, optimize parts inventory and availability, and reduce repair turnaround time and long term resolution to quality issues (root cause and preventative action).
- Outer Mold Line/Seam Validation is critical to aircraft performance. Low observable capability requires tight tolerances, which pose a challenge to manufacturing. With this in mind, improvements in metrology, design tolerance alleviation, and producibility/process improvements are being implemented to yield better performance in meeting manufacturing needs and reduce assembly span times.
- Significant production rate increases are expected through full rate production. Ensuring stability throughout fabrication and assembly is critical to meeting production ramp rates. Key enablers include:
  - Continuing the pace of reductions in scrap, rework, and repair, which has seen a 75 percent improvement since 2011;
  - Incorporating variation management improvements as basic tool sets for quality engineers; and
  - Rigorous and continual use of rate readiness risk management as part of incremental Production Readiness Review assessments

Mr. TURNER. Ever since the first projection of a trillion-dollar lifecycle cost came out, we've seen arguments about how much the F–35 would actually cost to operate. We now have real-world experience with more than 100 aircraft. Understanding that we are still not in regular operations, what are you seeing as the actual cost per flight hour for each of the variants?

General BOGDAN. The actual Cost per Flight Hour (CPFH) to date for each variant has been below the projected amount for that timeframe (FY13–14). The current CPFH projections for the steady state period (2035 to 2046) are $34.20K (BY12$) for the USAF F–35A, $38.14K (BY12$) for the USMC F–35B/C, and $36.76K (BY12$) for the USN F–35C. We expect further reductions in CPFH as we introduce more aircraft to the fleet and continue to realize reliability maturation and rate price improvements. We are on track to be below the steady state CPFH denoted in the Office of the Secretary of Defense, Acquisition, Technology, and Logistics (OSD/AT&L) Acquisition Decision Memorandum (ADM) targets of $35.2K (BY12$) for the USAF F–35A, $38.4K (BY12$) for the USMC F–35B/C, and $36.3K (BY12$) for the USN F–35C.

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## QUESTIONS SUBMITTED BY MS. DUCKWORTH

Ms. DUCKWORTH. Section 701 of the Agile Acquisition to Retain Technological Edge Act (H.R. 1597) proposes that your office consider increases in cost and schedule delays related to your office's activities. A joint study conducted last year by the Under Secretary of Acquisition, Technology, and Logistics and DOT&E found that testing was the least common reason for delay and that "all programs that had problems in test conduct also had at least one other reason that contributed to delay." As with cost, the vast majority of schedule delays were caused by fixing problems that must be addressed before the program could move forward. How do you think this proposal might positively or negatively impact your office's activities?

Dr. GILMORE. Although DOT&E does indeed take cost and schedule considerations into account when determining what testing is needed and feasible, this proposed provision will have effects that undermine realistic operational testing of weapon systems. The House report on this proposed provision states: "The committee remains concerned that some of the unforeseen increases in cost and schedule in major defense acquisition programs are a result of requirements changes or other matters that arise during operational test and evaluation (OT&E)." As noted in the question, there is no evidence that operational testing has had this effect; therefore, the proposed provision is based on a false premise that belies arguments made by some that the proposal is benign in its intent. The proposal's actual effects will also not be benign because of the perverse incentives program managers face within the Department's current acquisition system. As noted by GAO, "Postponing difficult tests or limiting open communication about test results can help a program avoid unwanted scrutiny because tests against criteria can reveal shortfalls, which may call into questions whether a program should proceed as planned." (GAO, Best Practices: A more Constructive Test Approach is Key to Better Weapons System Outcomes, GAO/NSIAD–00–199.) Thus, the proposed provision will strengthen and magnify program managers' incentives, irrespective of the merits of DOT&E's arguments, to plan and program for little, if any, realistic operational testing, and then to claim inflated costs and dire consequences if the testing that DOT&E argues is needed to evaluate performance is conducted. The need to counter this longstanding perverse incentive is a key reason Congress established DOT&E in the mid-1980s. Congress established the office and mandated its focus on assuring testing under realistic combat conditions, with independent reporting to the Secretary and the Congress, because of well-documented concerns with unexpected, poor performance of expensive weapon systems. The poor performance was unexpected because testing was not conducted under realistic combat conditions, and inaccurate reports of the results of the inadequate testing that was done were provided to the Congress and the Defense Department's senior leadership. Unfortunately, these concerns remain just as valid today as they were during the mid-1980s because the incentives for unrealistic testing and inaccurate reporting remain strong.

In a recent appearance at the Center for Strategic and International Studies, Senator John McCain stated "Many of our military's challenges today are the result of years of mistakes and wasted resources. According to one recent study, the Defense Department spent $46 billion between 2001 and 2011 on at least a dozen programs that never became operational." A number of these failed programs, including Comanche, Crusader, Future Combat Systems, Armed Reconnaissance Helicopter, and the Presidential Helicopter never entered operational testing, notwithstanding the expenditure of billions of dollars on their development. Other programs, including the Expeditionary Fighting Vehicle and the Early Infantry Brigade Combat Team Combat Systems, did undergo operational tests, with very negative results. Clearly, delays and cost increases caused by operational testing played no role at all in the noteworthy failures these programs suffered. Rather, poorly defined and unachievable requirements, inaccurate, if not misleading assessments of technology readiness and technical feasibility, as well as poor and misleading estimates of program costs and schedules were all causal. These problems, and the perverse incentives that create them, should be the focus of a serious acquisition reform effort.

Ms. DUCKWORTH. To the extent possible, please detail the timeline for achieving a deployable and fully operational ALIS system and what the associated testing and performance benchmarks are along that timeline. Additionally, please detail what constitutes "acceptable" performance in terms of the system identifying false-positives. That is, what is the acceptable rate for the system returning false-positives? Ex. Is 0% a realistic expectation? Lastly, please detail what the associated maintenance costs have been, to date, due to the false positives and how much of that cost will be decreasing as well what the costs have been in terms of increased manpower hours for both uniformed personnel as well as contractor support. Going forward, what do you expect those cost to be in terms of increased manpower hours for both uniformed personnel as well as contractor support on the ALIS system?

General BOGDAN. A deployable version of ALIS (Standard Operating Unit Version 2–SOUv2) is part of ALIS version 2.0.1 being fielded this summer to support to the U.S. Marine Corps Initial Operational Capability (IOC). A SOUv2 deployable system was fielded to Flight Test (FT) on May 3, 2015, to undergo a series of tests, including a formal Logistics Test and Evaluation process that will test all aspects of the Sortie Generation Process. ALIS version 2.0.2 is currently in work to support the U.S. Air Force IOC in Aug 2016. ALIS version 3.0 releases are planned to complete the ALIS capabilities required within the development program by October 2017. Each release will have an increasingly comprehensive testing regimen throughout the development process, including configuration item testing, integration testing, functional testing, information assurance testing, and deployment to flight test. User-defined performance standards and system level performance benchmarks are evaluated during integration and functional testing in the lab, as well as during flight test.

The F–35 performance requirement for false-positives (false alarms) is 50 flight hours between false alarms. In comparison to other platforms, this performance is 2 to 25 times more stringent, e.g., 1.8 hours for P–8 Poseidon and 23 hours for F–18 E/F Super Hornet. A zero-percent false-positive is not a realistic expectation. However, the ultimate goal from the improvements in off-board prognostics health monitoring and ALIS software is to achieve negligible false positives by the end of 3rd Quarter 2017.

An initial study on the impact of the current, "less than required" false-positive ratio was performed in January 2015 and showed a minimal increase in overall manpower needed to maintain war-time sortie generation rate and availability. Specifically, the findings were that for a squadron of 10 aircraft requiring 77 maintainers, one additional maintainer would be needed due to the current false-positive ratio. A follow-on study is being performed to refine the impact analysis accounting for other maintainability factors (e.g., average repair time), and will include associated costs. Results are expected in summer 2015.

The JPO stands ready to brief the committee members or their staffs on the full ALIS development and fielding plan.

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## QUESTIONS SUBMITTED BY MR. VEASEY

Mr. VEASEY. The area of sustainment for the F–35 program is critical as it moves forward both with the services and the partner nations. Last December, the F–35 Joint Program Office assigned F–35 Regional Maintenance, Repair, Overhaul and Upgrade (MRO&U) capability for airframes and engines for the European Region. Italy will provide the F–35 initial airframe MRO&U capability, and Turkey will provided the initial engine heavy maintenance capability. I understand the JPO is now preparing to launch requests for information for the European component MRO&U Hub.

Q1. Can you please elaborate on the component repair strategy, including a timeline for additional decisions?

Q2. Is the JPO employing a comprehensive sustainment approach where the approximate 750 components are supported at a single F35 partner nation MRO&U facility?

Q3. The UK will purchase the largest number of F–35s in Europe, and the U.S. Air Force has announced it will base two operational squadrons of F–35 at the Royal Air Force Lakenheath facility.

Q4. What plan does the JPO have to utilize this significant footprint in the UK when it considers MRO&U sites?

Q5. Do you intend to put component facilities in the UK to support this already significant F–35 investment?

General BOGDAN. The JPO's component repair strategy is to establish repair capabilities for all repairable components which have been identified as Core, consistent with Title 10 U.S. Code Section 2464, in the U.S. Military Service Depots (MSDs). As the international participants and U.S. Service fleets expand overseas, the need for repair capabilities outside the U.S. also increases. The JPO is currently analyzing current and expected capacity in the MSDs (much of the repair capabilities will be stood up in the CONUS MSDs over the next 5–7 years) as well as the expected component repair demands. This analysis will result in recommendations of components that could have repair capabilities OCONUS to support international participant demand and compete for above/non-core workload.

Of the approximately 750 components, the JPO is currently analyzing the top ~35 that show the highest repair demands based on forecast modeling and fleet data. When this analysis is concluded, the JPO will brief a draft plan for the assignment process of the ~35 components to senior DOD leadership not later than late May 2015. The JPO plans to release the initial Requests for Information (RFIs) in December 2015 to assess Partners' interest in component repair assignments. Over the next two years, the JPO will continue to assess repairable components to determine feasibility for overseas repair assignments.

No single partner would be responsible for repairing all 750 components, and many components will never have the repair demands to necessitate standing up repair capabilities other than that in the CONUS MSDs. The JPO envisions a single repair source per region per component, with no duplication of repair capabilities within Europe.

The JPO anticipates the UK will respond to the component RFIs. Those responses will be considered, along with any other nations' responses, to determine the best value repair location. All recommendations for assignment will be based on the "best value" assessment which includes: past performance, technical capability, capacity, and cost. The final determinations will be made by senior DOD leadership and will invariably be shaped by strategic and political considerations.

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