Second Report to Congress on F-35 Concurrency Costs: House Report 112-331, Conference Report to Accompany H.R. 2055

Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics

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Background

This report responds to language on pages 584-585 of House Report 112-331, the Conference Report to accompany H.R. 2055, the Department of Defense Appropriations Act, 2012, which states:

> "The conferees recognize that, for a variety of reasons, the Joint Strike Fighter program is burdened with what could be the highest level of concurrency ever seen in an acquisition program. Therefore, the conferees direct the Secretary of Defense to provide a semi-annual report to the congressional defense committees that shows the actual concurrency costs for the Joint Strike Fighter program. The report showing these actual concurrency costs shall be made available to the Director, Cost Assessment and Program Evaluation for the purposes of cost estimating and to develop lessons learned from allowing programmatic concurrency, so this cost can be considered when decisions are made regarding allowing such a high degree of concurrency in future programs."

Introduction

This is the second semi-annual report submitted as requested by House Report 112-331. The first report was submitted in September 2012. Future reports will track F-35 concurrency costs through the remainder of the development program.

Concurrency is defined as the overlap in the development and production phases of the acquisition program. Concurrency introduces the risk that aircraft built in early production lots will require modification due to discoveries made during qualification, flight and ground tests, or as a result of engineering analysis. An example of concurrency in the F-35 program is the redesign of the Fuselage Station 496 Bulkhead due to cracking discovered during structural tests. Incorporation of concurrency changes adds cost due to recurring engineering efforts, production break-in, and retrofit of existing aircraft. Nonrecurring engineering costs associated with concurrency changes are not included; those costs are part of the System Development and Demonstration (SDD) program costs. Planned and scheduled block upgrades to each aircraft are handled separately and are not considered concurrency costs. Concurrency costs will phase out with the completion of SDD.

For any given production lot, there are three types of concurrency changes: (1) changes discovered prior to beginning of the production of the lot; (2) changes discovered during the production of the given lot; and (3) changes discovered after delivery of the last aircraft in the given lot.

F-35 concurrency changes are funded under procurement appropriations *Aircraft Procurement, Navy* and *Aircraft Procurement, Air Force*, Budget Activity (BA) 01, in which combat aircraft are procured, and BA 05, in which in-service aircraft are modified. The BA in

which these changes are funded is dependent on the timing of a change in relation to a specific production lot. Types 1 and 2 concurrency changes are funded in BA 01 and type 3 changes are funded in BA 05.

Cost Model

The concurrency cost estimates reported in September 2012 were based upon parametric estimating techniques. As referenced in that report, in the summer of 2012, the F-35 Joint Program Office (JPO) and Lockheed Martin (LM) created a joint JPO-LM Concurrency Management Team. One of the team's tasks was to identify the key drivers of concurrency costs in order to develop a discrete, bottoms-up cost estimate and work collaboratively to mitigate expected concurrency impacts. The resultant new cost model reflects a detailed engineering approach informed by the remaining F-35 qualification, flight test, and ground test events. It accounts for technical issues affecting air vehicle performance, mission systems required for combat operations, and aircraft structures. These technical issues can be broken into two categories:

- **Known Issues:** A technical issue that has been discovered and deemed deficient to the contract specification

- **Forecasted Issues:** An issue that might occur in the future based on historical data of other programs

The cost estimate for known issues is developed from the actual costs of implementing approved changes. The number and cost of forecasted issues is estimated based on test data from the analogous F-16, F-15, F-22 and F/A-18E/F programs. The estimate includes costs for retrofit kits for those aircraft delivered before the concurrency change was introduced to the production line. The use of this new methodology provides a higher fidelity cost estimate compared to that detailed in the September 2012 report and provides greater insight into the changes and concurrency costs the Government may incur.

While not all forecasted issues may occur, some issues that were not forecasted are likely to arise during test. As changes become known, the discrete costs accrue and become a funding liability to the program. The funding outlays (or actuals) for changes incorporated during production account for only a portion of the overall concurrency cost to the program. Retrofits represent the predominate portion of concurrency costs, and initial activities only began in January 2012. The current concurrency liabilities, rather than actual outlays for incorporated changes, more accurately describe the impact of concurrency to the F-35 program and are provided in the next section of the report.

Current Concurrency Cost Estimate

In the Figure on page 5, *U.S. Government F-35 Concurrency Cost by LRIP lot,* the September 2012 and May 2013 estimates are shown side-by-side for Low Rate Initial Production (LRIP) lots one through ten. The number of aircraft in each LRIP lot is based upon the FY 2013 budget submission and reflects U.S. aircraft only. All values are in FY 2012 dollars. The figure

is a composite of two graphs. The vertical bar graph depicts total concurrency cost per LRIP lot, while the line graph depicts average projected concurrency cost per aircraft for each LRIP lot.

The total estimated U.S. Government concurrency cost for each LRIP lot is depicted with the values on the left y-axis. The purple portion of each vertical bar shows the cost estimate of known issues for those lots on contract at the time of estimate completion (LRIP 5 was not on contract in September 2012, so there is no purple portion shown). The gray portion shows the forecasted concurrency change costs through the end of development.

The orange and green lines show the September 2012 and May 2013 estimates, respectively, of average projected concurrency cost per aircraft for each LRIP lot, as shown on the right y-axis. The average cost per aircraft is determined by dividing the total concurrency cost of the LRIP lot by the quantity of aircraft in each LRIP lot (found on the x-axis label). For example, in the May 2013 estimate (green line) LRIP 2 has a projected average concurrency cost per aircraft of approximately $17 million ($200 million/12 aircraft). LRIP 4 has a lower estimated cost per aircraft of $15 million. The total concurrency cost for that lot is $440 million because an increased number (30) of aircraft are affected.

Conclusion

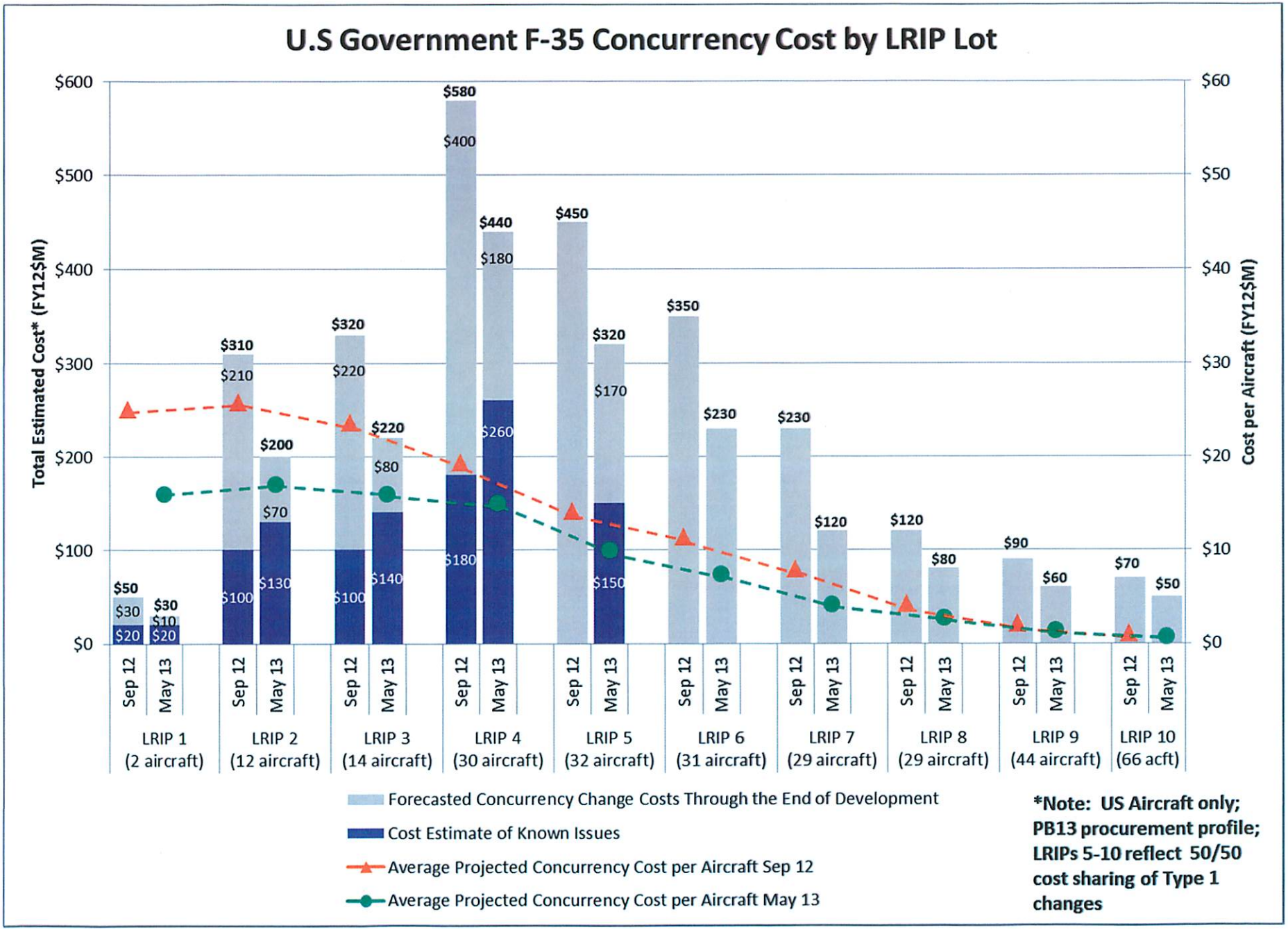
In addition to providing a more accurate and robust concurrency cost estimate, the F-35 program has taken measures to improve management of concurrency risk and minimize the costs of delivering warfighting capability to the Services. These measures focus on reducing the time required to implement changes into the production line so that fewer aircraft need post-production retrofits.

Lockheed Martin, in response to a specific LRIP 6 contract incentive, worked with the JPO to implement a joint concurrency management system. The system records meaningful information on the status and progression of discovered technical issues and change requests. It includes monthly delivery of metrics to demonstrate change process improvement over the remainder of the program and tracks all change requests in both production incorporation and retrofit modification. The joint JPO-LM Concurrency Management Team meets monthly to review these metrics and consider additional improvements to the concurrency management system. The team conducted Lean Six Sigma events, such as Rapid Improvement Events and Value Stream Mapping, to reduce the span time to resolve a technical issue and incorporate the fix into the aircraft.

Other contracting actions are also in place to reduce Government concurrency costs. In the F-35 LRIP 4 and 5 contracts, Lockheed Martin is required to submit a fixed-price-incentive-firm-target proposal with zero target profit for each future concurrency change to the aircraft. The LRIP 5 contract also includes language that implements 50/50 cost sharing for all changes discovered prior to beginning of the production of the lot. This concurrency cost sharing is intended to motivate Lockheed Martin to put concurrency changes into production as quickly as possible in order to avoid cost sharing and will continue to be implemented in future LRIP contracts. As part of establishing the LRIP 6 negotiation position, approximately 80 known

technical issues will be concurrency changes that the contractor will share in the cost to implement.

Over time, the cost of known issues will replace the estimated cost of forecast issues. To date, costs for known issues equal roughly 60 percent of the total forecasted estimate across the five LRIP lots (May 13 estimate). These estimates will be reviewed and updated on a semiannual basis to reflect adjustments as a result of retiring, realizing, or adding changes as the program progresses. Subsequent reports to the congressional defense committees will capture these updates. This report was coordinated with the Director, Cost Assessment and Program Evaluation, in order to derive lessons learned regarding concurrency and the corresponding cost implications that can be applied to future acquisition programs.


U.S Government F-35 Concurrency Cost by LRIP Lot
Total Estimated Cost* (FY12$M)
Cost per Aircraft (FY12$M)
$600
$500
$400
$300
$200
$100
$0
$60
$50
$40
$30
$20
$10
$0
$50
$30
$20
$30
$10
$20
$310
$210
$100
$200
$70
$130
$320
$220
$100
$220
$80
$140
$580
$400
$180
$440
$180
$260
$450
$320
$170
$150
$350
$230
$230
$120
$120
$80
$90
$60
$70
$50
Sep 12
May 13
LRIP 1 (2 aircraft)
LRIP 2 (12 aircraft)
LRIP 3 (14 aircraft)
LRIP 4 (30 aircraft)
LRIP 5 (32 aircraft)
LRIP 6 (31 aircraft)
LRIP 7 (29 aircraft)
LRIP 8 (29 aircraft)
LRIP 9 (44 aircraft)
LRIP 10 (66 acft)
Forecasted Concurrency Change Costs Through the End of Development
Cost Estimate of Known Issues
Average Projected Concurrency Cost per Aircraft Sep 12
Average Projected Concurrency Cost per Aircraft May 13
*Note: US Aircraft only; PB13 procurement profile; LRIPs 5-10 reflect 50/50 cost sharing of Type 1 changes