

Joint Strike Fighter – Lightning II Monthly Assessment Report

Prepared for the Joint Strike Fighter Program Office (JSFPO)

Prepared by DCMA Lockheed Martin Fort Worth

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Table of Contents

1.0 JSF Executive Summary	3
2.0 PBM Assessment Matrix	5
3.0	5
4.0	7
5.0 Production / Airframe – LMFW	9
6.0 Vehicle Systems.....	12
7.0 Mission Systems	13
8.0 Propulsion	16
9.0 Earned Value.....	18
10.0 Process Reviews	18
11.0 Appendix A.....	20

1.0 JSF Executive Summary

Aircraft AA-1 return to flight projections are for mid-August, although testing progress of the redesigned configuration of [redacted] may extend this date into September. Additionally, numerous Electrical Power System (EPS) issues need to be resolved prior to AA-1 flight, such as [redacted] as well as an [redacted] during return to flight testing. Other factors such as: Flight Clearance (Flight Test Update (FTU) #2); [redacted]

DCMA Earned Value Management Center plans to conduct an Earned Value Management Systems (EVMS) Compliance Review (CR) at Lockheed Martin Aeronautics, during the period of 20 through 31 Aug 07. The purpose is to evaluate ongoing compliance of LM Aero's EVMS against the American National Standards Institute/Electronics Industry Alliance (ANSI/EIA-748) Standard Guidelines.

LM Aero's EAC5 projects around [redacted] in estimated cost growth. DCMA's review of the [redacted] shows the following: As of the end of May, [redacted] contained an estimated [redacted] in potential costs (open threat & pressure items) and an estimate' [redacted] in potential savings (open initiative and capture items). In comparing EAC5's estimated cost growth of \$37.3M to the [redacted] estimated [redacted] in potential costs, EAC5 reflects 5% of the [redacted] estimated potential costs. There were several [redacted] entries, in the [redacted] for costs / line items and there were several status category downgrades between 4 Jun and 10 Jul (many cost items downgraded from threat/pressure to watch).

LM Aero Comment: As of 18 Jul 07, there are about [redacted] in pressures and threats, and [redacted] in watch items (for the entire program) in the database.

Watch items were not counted in the cost figures used during EAC5 formulation.

Note* DCMA has not allowed credit/ realization of savings which have not yet been fully realized by the LM Aero budgeting process. Past performance has not validated the magnitude of these projected savings being realized / captured.

LM Aero will be conducting a grass roots estimate, at the end of the year, for EAC 6.

As of 15 Jul 07: Aircraft assembly / Production flow follows. LM Aero with: 3 aircraft in Mate; 8 Forward Fuselages in work (3 in Mate); 5 Wings in work and 1 moved to Mate. [redacted] has 14 Center Fuselages in major assembly (3 in Mate). [redacted] has 5 Aft Fuselages in major assembly.

Teammate Furnished Equipment (TFE) – Late arrival of parts from teammates continues to influence out-of-station work, with a limited number of parts having the potential to push work deferral back to LMFW. These are items LM Aero owes to [redacted], and items from [redacted] owes to LM Aero. Late parts arrival would ultimately be completed at LMFW, and could impact the overall schedule. DCMA recommends consideration of Award Fee incentives for future

periods in this area to improve both the deliveries and the Harnesses & Interconnect processes, which are factors in driving schedule and cost inefficiencies.

Government Furnished Equipment (GFE) – Pending a firm VAVBN delivery schedule, to for BH-1 and CT-1, there may be schedule impacts for SDD units following BH-1. The consideration of a 10 to 12 week slip in the delivery of VAVBN's for BH-1 and CT-1 (Test mold for intake ducts and outer mold line), and the Vane Box configuration (considered as a "trade-space" to the delivery schedule) would pose challenges for the aircraft production sequence. Items for consideration follow:

A) Vane Box configuration is a significant factor to the overall assembly flow. would require a fully assembled structural The BH-1 unit would not require hydraulic lines or wire harnesses – however a retrofit would need to be coordinated with LMA. Likely result is schedule pressure to LMA final assembly/mate and check-out.

B) VAVBN for LRIP II is yet to be defined, however considered medium risk. has a 90-week template lead time, which makes it unlikely that NGC can support the Jig load for the first LRIP STOVL (BF-6) in Dec 08 (only 75 weeks away). Note- As of 12 Jul 08, NGC has been able work out the VAVBN issue with They have agreed to deliver the BH-1 VAVBN unit to NGC on 4 Oct 08 and the LRIP II units will deliver to NGC on or by the need dates currently on the Program Master Schedule.

5.0 Production / Airframe – LMFW

Technical Performance – Forward and Wing assembly are primarily being impacted by part shortages and late planning. Late Engineering continues to contribute to these part and planning issues. Overall remaining parts delivery forecast as of 25 Jun 07 for BF-1 (Forecast Start Chart Component Summary) is as follows: 1304 parts to go, 103 are critical, 575 do not support shop operating plan and 44 of those are critical. Production inefficiencies are primarily caused by the re-sequencing of assembly work which is driven by part shortages, work around plans, laser tracking of warped parts, and constant rework of planning.

Follow-on aircraft (Forward-Wing: BF4/AF1/AG1/AF2) are starting to experience large schedule variances (to budget) and poor cost efficiencies which is jeopardizing overall performance to Master Schedule 5.

According to LM, Planning currently supports shop floor need and anticipates staying ahead of the need for the rest of BF-1. LM is bringing in _____ in order to improve the ECD dates in SWBS 850. _____ staffing is up to eight people and will be up to twenty by 2 Jul 07.

Quality – Forward Fuselage Assembly (Risk – Moderate):

_____ A large percentage of these defects are attributed to workmanship issues. Although the amount of QAR's generated shows a decreasing trend for the past three weeks, and Lockheed has CAP's in place, this will likely continue to be a problem area until effective C/A can be fully implemented.

Wing Assembly (Risk – Moderate):

_____ is a top driver for defects in this area as well. Like the Forward Fuselage, the causes are largely attributable to workmanship issues. The amount of QAR's generated has remained fairly steady in this area in the past three weeks.

Mate and Delivery (Risk – Moderate) – _____

_____ are the main drivers in this area. Although workmanship is a concern, more defects are attributed to process deficiencies. The amount of QAR's generated is steadily increasing over the past three weeks partly a result of more ships sets being worked.

Quality Summarization for Assembly Processes – Changes in Engineering, EWI, and workmanship discipline are contributors to the amount and type of defects to date. Furthermore, schedule pressure, traveled work and supplier issues are likely contributors. Although these issues and the SDD phase environment warrant increased risk, it is felt that the contractor is consistently working to identify and correct these risk areas therefore the overall risk is considered Moderate. DCMA will continue to audit these and other processes, working with the contractor to mitigate any and all identified risk areas.

On 12 Jul 07, the F-35 I/R Board performed a Fit Check of the F2 Fuel Access Panel (P/N on BF:1.

Overall, the fit check was very successful and these tolerances should be acceptable for meeting I/R requirements.

The results of these gap and mismatch measurements are unknown at this time but are forthcoming. The results of this fit check will be discussed in detail at the next I/R Board meeting. These fit checks should prove to provide valuable information for making critical design and manufacturing decisions.

2BF-1

- **Forward Fuselage**
 - As of week ending 24 Jun 07, assembly touch labor hours variance to budget is (2116) hours. The fuselage is 88% complete and originally scheduled for completion in Apr 07 – continuing to work out of station tasks as parts arrive.
- **Wing**
 - As of week ending 24 Jun 07, assembly touch labor hours variance to budget is (13,558) hours. The current cost efficiency is 80.5% and is trending downward since early May 07 when it was 84%. Cost efficiency is defined by dividing earned budget by actuals spent.

2BF-2

- **Forward Fuselage**
 - As of week ending 24 Jun 07, assembly touch labor hours variance to budget is (2111) hours. The fuselage is 84% complete and originally scheduled for completion in Jul 07 – continuing to work out of station tasks as parts arrive.
- **Wing**
 - As of week ending 24 Jun 07, assembly touch labor hours variance to budget is (15,596) hours. The current cost efficiency is 68% and is trending downward since early Apr 07 when it was 80%.

2BG-1

- **Forward Fuselage**
 - As of week ending 24 Jun 07, assembly touch labor hours variance to budget is (74) hours. BG-1 moved early to mate on 18 Jun 07 – Forward is 94.14% complete
- **Wing**
 - As of week ending 24 Jun 07, assembly touch labor hours variance to budget is (7690) hours. The current cost efficiency is 82% and has been fairly steady since early Apr 07.

2BF-3

- **Forward Fuselage**
 - As of week ending 24 Jun 07, assembly touch labor hours variance to budget is (1878) hours – Forward is 60.01% complete.
- **Wing**
 - As of week ending 24 Jun 07, assembly touch labor hours variance to budget is (10660) hours. The current cost efficiency is 46% and has been consistently ranging between 45 and 50% since early Apr 07.

2BF-4

- **Forward Fuselage**

- As of week ending 24 Jun 07, assembly touch labor hours variance to budget is (3959) hours – Forward is 42.24% complete.

- **Wing**

- As of week ending 24 Jun 07, assembly touch labor hours variance to budget is (11973) hours. The current cost efficiency is 46% and has been consistently ranging between 45 and 50% since early Apr 07.

2AF-1

- **BTP Status**

- As of 10 June 2007, the total scheduled BTPs planned for release is 8135 BTPs, 7128 are already completed (87.62%), 233 are late to commit, 4254 were completed ahead, and 420 are forecast to be late to commit.

- **Forward Fuselage**

- As of week ending 24 Jun 07, assembly touch labor hours variance to budget is (4334) hours – Forward is 20.83% complete.

- **Wing**

- As of week ending 24 Jun 07, assembly touch labor hours variance to budget is (14943) hours. The current cost efficiency is 58% and has been decreasing since Jun 07.

2AG-1

- **BTP Status**

- **Forward Fuselage**

- 92.67% complete (139 complete/150 scheduled) BTPs Frozen to commit as of 27 Jun 07, 2 BTPs are late to commit, 122 BTPs were completed ahead, and 2 BTPs are forecasted to be late to commit
- 92.00% complete (138 complete/150 scheduled) BTPs Released as of 27 Jun 07
- There is 1 non-critical BTP projected to be late to need at freeze as of 24 Jun 07. There are no critical BTPs projected to be late to need at freeze as of 24 Jun 07.

- **Wing**

- 1 total BTPs projected LTN, with 0 critical projected LTN

- **Production Activity**

- **Forward Fuselage**

- As of week ending 24 Jun 07, assembly touch labor hours variance to budget is (5343) hours. Assembly should have started in Feb 07; however, component assembly has just started and is 0.04% complete.

- **Wing**

- As of week ending 24 Jun 07, assembly touch labor hours variance to budget is (6778) hours. No component assembly work has started although it was scheduled to begin May 07.

FORWARD FUSELAGE BUILD AS OF 28 JUN 07 (Flight Articles)							
SHIP	SCHEDULED START DATE (NOTE 1)	ACTUAL START DATE (NOTE 2)	CURRENT DAYS AHEAD OR BEHIND (NOTE 2)	CHANGE FROM LAST MONTH IN DAYS AHEAD OR BEHIND	PERCENT COMPLETE (NOTE 2)	CHANGE FROM LAST MONTH IN PERCENT COMPLETE	SCHEDULED COMPLETE
BF-1	13/Apr/06	8/May/06	@ Mate	@Mate	88.1%	2.6	18/Apr/07
BF-2	21/Aug/06	28/Jun/06	-19.0	-19.0	83.7%	9.5	6/Jul/07
BF-3	2/Nov/06	31/Aug/06	-33.5	0.0	59.8%	-0.1	3/Aug/07
BF-4	30/Nov/06	6/Nov/06	-68.4	-31.6	41.2%	7.3	17/Aug/07
AF-1	6/Jan/07	12/Dec/06	-72.8	-72.8	20.8%	3.9	26/Oct/07
AF-2	2/Apr/07		-35.0		0.2%		4/Jan/08

WING BUILD AS OF 28 JUN 07 (Flight Articles)							
BF-1	21/Jul/06	26/Jun/06	@ Mate	@ Mate	65.4%	2.7	24/Sep/07
BF-2	11/Sep/06	13/Jul/06	-83.2	13.4	47.8%	2.8	29/Oct/07
BF-3	20/Dec/06	2/Jan/07	-42.9	3.8	31.3%	5.4	18/Jan/08
BF-4	15/Feb/07	22/Feb/07	-64.2	8.8	14.7%	3.7	22/Feb/08
AF-1	29/Mar/07	6/Jun/07	-61.0	19.0	2.4%	2.2	21/Mar/08
AF-2	8/Jun/07						16/May/08

NOTE 1 Data for this column comes from MASTER SCHEDULE 5.

NOTE 2 Data for this column comes from weekly status sheet provided by LM Aero.

6.0 Vehicle Systems

Electro-Hydrostatic Actuation System – All FMET and functional Safety of Flight (SOF) procedures were updated for STOVL in Jan 07. Fifty One (51) functional SOF test procedures have been approved by LM.

AA-1 – [redacted] has since issued a Failure Analysis Report, met with Lockheed and issued a return to flight schedule which has subsequently been approved by Lockheed. A new ECP will be submitted to cover all AA-1 modifications in Jul 07. Current return to flight activities are as follows:

- Drawing, Build Process Work Instructions and OPS Sheet reviews continuing. Determination of “Kev Characteristics” in development during these reviews.
- [redacted]

[redacted] as well as completion of impasse status recovery.
Open system Problem Reports (PR's) allocated to STOVL and CV have increased to 134 in Jun 07. Open software (PR's) have increased to 17 during the same period. The PR generation to closure rate of have a difference of 229 PR's in Jun. PR closure is critical to SOF and first flight.

7.0 Mission Systems

[redacted] – BF-4 FF Block 0.5 rating changed to Yellow in this report due to information on 1420 not being available – this previously was rated Red.

OSS (1426) – Its first flight is BF-1. The software once expected to be available for IMR testing in April has slipped to July due to late necessary In addition, further slips may occur due to the need for a definition of a new baseline 0.5.6.1.

1438 HMD – has been cleared for AA-1 flight. Track to First Flight is rated Yellow until the first flight result.

The following SW Productivity table provides the required and an estimate of the actual block 0.1 and 0.5 software productivity for each of the major software teams. This table shows results of SW Productivity calculation that uses cumulative hours since the over target baseline (OTB).

The "NA" shows up for WBS 1425 SW Productivity calculations because no hours charged to activities considered in the SW Productivity calculation.

Green: > -5% Variance
Yellow: - 10 to -5% Variance
Red: < -10% Variance

Within the 1420 WBS' and considering only those hours since OTB, Block 0.1 is 93.5%, and Block 0.5 is 75.6% complete. Considering all hours since inception within 1420 WBS' (i.e.

142X), Block 0.1 is 96.4%, and Block 0.5 is 77.9% complete.

9.0 Earned Value

DCMA JSF – May 07 Data

Lockheed is now reporting to an Over Target Baseline of _____ reported in the Cost Performance Report (CPR). The May 2007 cost summary is as follows:

	BAC	LM EAC CPR	DCMA IEAC
Performance Measurement Baseline (PMB)			
Management Reserve (MR)			
Total:			

Table 1. Budget Baseline and EAC Summaries

The DCMA Risk Rating for EVMS at the total program level is rated yellow - using the agreed to parameter of VAC (-5.67%). Compare this to the Lockheed's EAC and one can see a difference of over 5%. Similarly, the $TCPI_{IEAC}$ is different when using the DCMA IEAC versus the contractor's EAC:

$$\frac{TCPI_{DCMA\ IEAC}}{TCPI_{LM\ EAC}} = \frac{0.888}{1.019}$$

Cumulative to date SPI and CPI are at .990 and .982 compared to .992 and .983 in the previous month. Cumulative SV% and CV% are -1.01% and -1.84%, compared to -0.76% and -1.68% in previous month and are also rated green.

10.0 Process Reviews

On 7 June 07, members of the F-35 Product Assurance (PA) Production Team, DCMA LM Fort Worth, performed a review of LM Aero's PD-60/AC-5484; F-35 Traveled Work Process.

Walking through the process flow diagram with LM and a product examination of an Internal Traveled Work package we found the process to be very detailed and logical in flow. There were no obvious lapses in its methodology nor were there any steps which we considered to be missing. The Lockheed employees we interviewed mentioned how a great deal of work had been put into the process to date and that it was working well for them.

A document trace through [redacted] and [redacted] of External F-35 Traveled Work Document:

[redacted] yielded positive results. We found that both the planning and visual aids were incorporated into Mate and Delivery (MAD) Center Fuselage J860 planning as required.

Observations – We were unable to observe a method or metric for measuring the effectiveness/efficiency of the process. It was also unclear if traveled loose parts are inventoried by the receiving IPT at handover and if the “loose parts” list is ever referenced again during subsequent operations. There was also an internal document link to [redacted] for processing major component moves and traveled work to Mate and Delivery from LM on-site IPTs which was found to be cancelled.

A request for the contractor to update [redacted] include the correct internal traveled work document number in order to close out the finding was made. A Lockheed Continuous Improvement (CI) 6S Team lead by [redacted] is currently addressing [redacted]. DCMA will make contact with the CI team and request [redacted] to be in the loop with the team’s improvements in order to assess/resolve the “loose parts” observation.

LM Aero Comment: LM will ensure the Aero-code link is updated, Provide additional definition on how they track ship loose parts, and explore establishing a traveled work process metric.

[redacted] Team is focused and is tracking to project schedule. Coordination across LM has been vast and intense. [redacted] Overall progress to date is positive and DCMA participation has been highly encouraged – no concerns at this time.

11.0 Appendix A

EV Assessment Criteria Rating Criteria is based on the DCMA VAC% and when possible should include MR in the DCMA IEAC

 - VAC% > -5%


Yellow - $-10\% < \text{VAC}\% < -5\%$

 - VAC% < -10%


N/R - Not Rated or Not Reported

Technical Performance Evaluation Assessment Criteria

Will the final SDD product satisfy all the major mission requirements?

 - All TPMs are on track and final production item is predicted to meet the contractual requirements.


Yellow - Some TPMs and/or requirements are currently off track and there is good probability that it will be on track by the end of SDD or it will have no mission impacts.

 - Product will not meet all requirements, which will result in mission impacts.


N/R – Not Rated or Not Reported

Track to First Flights Evaluation Assessment Criteria

Will the deliveries support the need dates for major events (e.g. ILR, IMR, Power On, First Flight)? Will the delivered product meet the expected quality and maturity?

 - All products (lab and first flight) deliveries are not in LM Aero's critical path for first flight and delivered product will be of the expected quality and maturity. If there are variances, they will be minor and will not require work-arounds.

Yellow - Product is expected to be delivered late; however, it is not known if it is in LM Aero critical path for first flight and/or delivered product will require workarounds or has traveled work.

 - Product will be late and is in the critical path for first flight or for the pending deliveries the product will not meet the expected quality and maturity and does not have any known work-arounds.

N/R – Not Rated or Not Reported