

# 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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Production Status (As of 4 Nov 07)	
Forward Fuselage	6 - Assembly 4 - Mate/Final
Center Fuselage	11 - Assembly 4 - Mate/Final
Aft Fuselage	5 - Assembly 4 - Mate/Final
Wing	7 - Assembly 3 - Mate/Final
Fuselage Structure Mate (EMAS)	3 (BF-2, BG-1 & BF-3)
Subsystems - Mate/Tail Installation	1 (BF-1)

**BF-1** - The aircraft has moved from the EMAS to final assembly. Power-on activities began on 21 Oct 07 with a successful system checkout. The non-airworthy Lift Fan and F-135 main engine have arrived in support of interface test fit activities. Several challenges remain in achieving successful roll-out and first flight dates: Late part deliveries resulting in work-around plans, planning issues, safety of flight qualification anomalies impeding supplier deliverables, ... of 30 Oct 07, BF-1 percent completes for Wing, Forward and Mate are 86%, 94% and 14% respectively. BF-1's Mate and Final Assembly SPI and CPI cum performance is (SPI=.545 & CPI=.541 - September data). Mate cost efficiency (Earned Budget/Actuals) is running 68%, while behind schedule touch labor hours has grown to -31,228 (MS5). As of 4 Nov 07, BF-1's first flight date of 23 May 08 is projected to be -46 Mdays late (~ 2.2 months). Based on LM efficiencies and performance, i.e; presently ~ 20% complete at Mate, DCMA projects ~ 10% completion per month and estimates a Sep 08 first flight date.

Consequential to the SDD Mid Course Risk Reduction (MCRR) initiatives, PAN 07-D-0019, Execution of Estimate at Completion 6 (EAC6) and Incorporation of Master Schedule 6 (MS6) for the SDD Program has been released. MCRR activities, driven by recurring Program cost and schedule variances, included the deletion of two flight test aircraft (AF-5 & CF-4) as well as the restructuring and reduction of team staffing to achieve efficiency targets. The revised baseline (MS6) will be executed in conjunction with EAC6. Scheduled IMS baseline complete date is Feb 08, with the first CPR reflecting the new EAC6 changes expected in Spring 08. It is anticipated that the new baseline will more closely follow LM Aero's internal Shop Operating Plan (SOP); however, past performance has shown that LM Aero has had limited success in achieving target SOP dates.

EAC 6 actions began mid-August with start of GR&A formulation process. GR&A took two months longer than expected. Drivers were staffing reductions as well as AF-5 & CF-4 being dropped from SDD. As a staffing example, Systems/Software Quality (S/SQ) has been asked to take additional budget reductions and reduce travel budget. With the current budget, severe leaning of processes, bare minimum effort with suppliers has occurred. This poses increased risk of noncompliance to Lockheed company processes and standards. S/SQ provides valued insight into the software development processes and products within LMFW and their suppliers. Further budget reductions do not support assurance that delivered products have met contractual requirements prior to delivery.

The DCMA EVMS compliance review, conducted 20-31 Aug 07, found that Lockheed Martin Aeronautics Company (LM-Aero), Fort Worth, Texas, is not following, nor consistently applying, the American National Standard Electronic Industries Alliance Earned Value Management Systems (ANSI/EIA-748-A) guidelines during the execution of Department Programs. The findings of the review indicate that, under LM-Aero stewardship, the utility of the EVMS has declined to a level where it does not serve its intended purpose and the government is not obtaining useful program performance data to anticipate and mitigate program risks.

Key LM-Aero EVMS processes and procedures are below standard and do not provide the requisite definition and discipline to properly plan and control complex, multibillion dollar weapons systems acquisition programs. Documented findings indicate that a large percentage of LM-Aero Control Account Managers (CAM) are disconnected from basic LM-Aero EVMS functions and can not satisfactorily demonstrate that they understand EVM processes, procedures and tools to manage their work. These weaknesses adversely impact the validity of the data used in internal and external decision-making processes and are fully disclosed in this report. (Attached)

On 13 Aug 07, the Divisional ACO advised the contractor the estimating system is inadequate in part and has asked for a corrective action plan to ensure the cited deficiencies are resolved. LM Aero submitted the corrective action plan on 10 Sep 07 – actions are being reviewed at bi-weekly meetings that include DCMA, DCAA, and LM Aero representatives from all three sites.

The facilities leases for the plants at Fort Worth and Marietta have been extended to 30 Nov 07. DCMA has been advised the lease costs will be significantly increased –













#### 4.0 Production / Airframe

**Cost (WBS 3000)** – The JSF Production Operations current budget is insufficient to complete SDD and DCMA predicts an additional cost growth over the current estimate at completion (EAC). DCMA rationale for this cost growth is based on: Program cost performance is short of required performance needed to meet baseline EAC. The Cum Production Operations CPI is .937 (Sep 07). The To-Complete-Performance Index (TCPI) is 1.080. This gap of 0.143 is an indication of an unrealistic EAC. Tier 4 CPI and SPI cum performance emphasize the need for an additional using the formula  $(ACWP + ((Work\ Remaining) / (CPI * SPI)))$ . Additional significant threats & pressures and future changes are included in the DCMA IEAC such as: Partially unfunded requirements for Major and Minor Change Curves Interchangeability & Replaceability risk and Sustaining Change Challenge-LRIP

**Cost (WBS 1200)** – The DCMA IEAC for WBS 1200 is which is a -6.4% variance to LM Aero's BAC of DCMA's IEAC is a calculated EAC of as a potential cost growth of This potential cost growth includes cost pressures and threats within WBS 1200. The cumulative schedule variance percent is -0.8 and the cumulative cost variance percent is -4.4.

is a -3.0 VAC% from the BAC. The schedule variance for this month was favorable, but the cumulative schedule variance is still negative. The cumulative cost variance is still negative though it has improved. It is predicted that the total cost variance at completion should not exceed Numerous design changes and iterations have directly impacted cumulative cost and schedule variances.

**Schedule** – WBS 3100 performance to date has been degrading over the last seven months with WBS 3140 Wing build remaining on the critical path. WBS 3120 Forward Fuselage, WBS 3130 Center Fuselage and WBS 3180 Mate and Final Assembly are experiencing similar trends. Critical part shortages, complex work, engineering change traffic, QARs, late planning, and a host of other factors continue to impact the mechanics ability to earn budget in an efficient manner.

**AF-1:** Fwd/Wing delayed starts due to late planning and parts. Wing Cost Efficiency (Earned Budget/Actuals) is at 50% as of this report. LMA contract letter, dated 16 Oct 07, changed the delivery date for AF-1 Center delivery to 8 Jan 08. The change in schedule has reduced risk to delivery – DCMA rating is now Green. The Aft, VT, HT are all running ahead of their current internal SOP4 schedules.

**CF-1:** Late parts/hardware, planning, tooling rework, and EBOM/MBOM mismatch issues have delayed starts for Forward and Wing – Wing start pushed to Jan 08. Center fuselage is currently working in both J351 and J350 as nouncements their mitigation/recovery plan caused by the scrapped J355 Keel section.

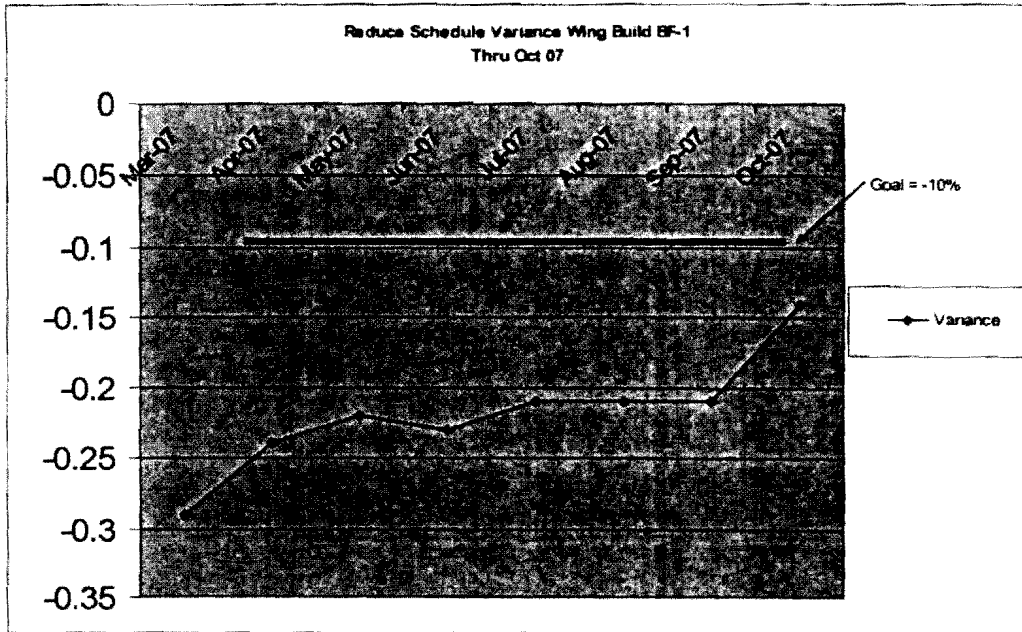
**Effective Acceptance Processes / Safety of Flight** – Safety of Flight verification was performed on the following items/aircraft:

- L/H and R/H Horizontal Tail EHAs/AA-1
- L/H and R/H Rudder EHAs/AA-1.
- L/H and R/H Vertical Tail Install / BF-1
- F-1 Fuel Tank / BF-1
- Flight Control Power SCOP / BF-1



**Successful Component Build –**

BF-1 Wing schedule variance percent (Planned vs. Actual Schedule) has improved to only a -14% variance to actual Schedule (MS05). BF-1 Wing has made positive strides toward its mid-December completion date. All fixed Wing skins have been permanently attached. Fuel and hydraulic tubes, PTMS ducting and wiring checkouts have been completed for installed systems. Performance is still below the DCMA goal of -10%; however, it's a considerable improvement over AA-1 Wing build variance of ~ -50%. Areas of concern continue to be: availability of critical parts, change management, and planning completion/quality.



DCMA LM Fort Worth will continue with the 6S Continuous Improvement Team: Wing Tool Storage and Retrieval. Currently there are several open actions being worked related to our audit findings in August.

**Track to First Flights –**

A/C	Component	% Scheduled	% Complete	Roll Out	DCMA Comments
BF-1	Fwd Wing Center Aft VT HT Mate		94% 86% 100% 100% 100% 14%	12/18/07	LTN parts and planning continue to plague Fwd/Wing. Wing has improved to its recovery plan, such labor hrs remain to complete by mid December 07. Mate Cum SPI & CPI (Sep data) are .545 and .541. while behind schedule hours has grown to - performance must improve in order to meet the 12/18/07 Rollout schedule.
AF-1	Fwd Wing Center Aft VT HT Mate	96.3% 73.9% 98% 100% 77% 65.3%	60% 26.2% 93% 50% 21.2% 9.3%	6/30/08	Overall: 12 week mitigation required to meet First Flight MS05 date according to LM (10-12-07 Deck Review), recovery plan in work. Fwd/Wing delayed starts due to late planning and parts. Wing Cost Efficiency (Earned Budget/Actuals) is at 50% to date (10-28-07 GAO spreadsheets).
CF-1	Fwd Wing Center Aft VT HT Mate	  54.7%  01/07/08 01/28/08 05/19/08	- - 22.7% - - -	05/19/08	Late parts hardware, planning, tooling rework, EBOM/MBOM mismatch issues have delayed starts for Fwd/Wing (10-25-07 MPR). Wing start pushed to Jan 08.

%Scheduled / % Completed data as of 28 Oct 07 'JSF Component/Aircraft Status Map' and weekly GAO status spreadsheets. Center information comes from DCMA P-35 weekly/monthly reports Nov 07/Oct 07. Wing Cost efficiency is (Earned Budget/Actuals), all values are touch labor hours. MPR is the LM Monthly Program Review





**Effective Quality Processes** – Process areas assessed this period:

- Forward Fuselage Assembly – Process Review completed by DCMA QA with no findings noted
- Forward Fuselage Assembly – Product Examination completed by DCMA QA with no discrepancies.
- Final Assembly (Moving Line) – Process Review completed by DCMA QA with findings in tool control and in F.O. control
- Final Assembly (Moving Line) – Product Examination completed by DCMA QA with no discrepancies noted

Process Review conducted in the Final Assembly area (BF-1) revealed an item was removed from a tool kit with nothing left in its place. In addition, the logbook for tracking items brought into the FOD critical area was not being controlled. Items were logged in days prior that were not annotated to indicate their removal from the area or their consumption. Debriefed Moving line Supervisor of findings. Supervisor assured increased diligence of all persons in area. DCMA QA will continue to monitor and influence effective C/A.

**Effective Improvement Processes / Predictive analysis of SDD cost, schedule and performance variance (Earned Value)** – EV is rated Red for WBS 3000 and Yellow for WBS 1200 based on the DCMA Independent Variance at Completions of -17.15% and -6.4% respectively.

The overall DCMA IEAC for JSF Production Operations is \_\_\_\_\_ which is a -17.15% variance to LM Aero's BAC. The cumulative performance to date is therefore rated Red. Cost Performance is not meeting the requirement to achieve the baseline EAC. The current Prod Ops F-35 To Complete Performance Index (TCPI) is 1.08 and has been growing over the past several months. This is an indication that the program may not be able to meet cost performance goals without significant changes in performance and/or budgets.

Numerous major component build operations are experiencing negative cost and schedule variance performance trends to the existing program schedule (MS05). Production Operations continues to be impacted by: critical part shortages, high change traffic, difficult/inefficient work (Out of Station/Out of Sequence, warping/drooping bulkheads, FS270 bulkhead mods, etc.), and late and/or constant rework of planning. DCMA expects Production Operation's cost (CPI) and schedule (SPI) indexes to continue to trend downward over the next several months lead by (WBS 3100) Production Build.

WBS 3100 performance to date has been degrading over the last six months with WBS 3140 wing build remaining on the critical path. WBS 3120 Forward Fuselage and WBS 3180 Mate and Final Assembly are experiencing similar trends. Critical part shortages, complex work, engineering change traffic, QARs, late planning, and a host of other factors continue to impact the mechanics ability to earn budget in an efficient manner.

Overall WBS 3700 (Production Engineering) and WBS 3900 (Material) performance to date have followed WBS 3100's trend. Areas such as: BTP growth/change, M.E. support, Planning,

Design Maturation, NC Programming, support, and Tooling manufacture have all exceeded original plans.

Integration

LM continues to put emphasis on: Advanced workable set up teams to review job packages prior to major assembly start, design and tooling changes to reduce metrology work (available for AF-3 and on), tiger teams to improve supplier parts deliveries, process improvement initiatives and increased manpower and outsourcing to reduce planning backlogs

## **5.0 Vehicle Systems**

**Verification of supplier design, manufacturing, quality and improvement processes for transition to production –**

Wing System SoF testing has completed 15 of 120 planned tests. Testing is on hold due to Flaperon failure. Currently waiting for the units return to service before testing commences. The Empennage System SoF testing has completed 45 of 93 planned tests.





Blk 1.0-1 SW baseline delivery is 15 Mar 08. Currently 2-3 months behind – driven by focus on 0.5.3-2 SW, lack of resources, and lab asset contention with Blk 0.5.3-2 effort. Staffing is 15% under the plan. Blk 1 HW development running lean but not impacting critical path. Recovery of Blk 0.5.3-2 schedule has repercussions on Blk 1.0-1. and LMA are discussing issues and brainstorming options. One alternative is combining Blk 1.0-1 with 1.0-2 delivery.

1435 Radar –

Radar System Delivery – The first Build 2 Radar System intended for delivery to Lockheed Martin Aeronautics was received on schedule on 22 Oct 07. This system is to be installed in the Mission Systems Integration Lab (MSIL) Sensor Integration Platform (SIP) in Fort Worth, Texas to continue integration of the F-35 Radar System.

LRIP: LRIP1 authorization was received on 24 Oct 07. LRIP2 fact-finding took place in Baltimore 22-26 October, with negotiations scheduled in Fort Worth 26-29 November.

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).









## 8.0 Earned Value

DCMA JSF – September 07 Data

Lockheed is now reporting to an Over Target Baseline of \_\_\_\_\_ reported in the Cost Performance Report (CPR). The September 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

Primary Trip Wires				Secondary Trip Wires				
System Indicator	Baseline Indicator	Cum BEI	SPI	Cum CPLI	CPI	CPL/TCPI 10%	Contract Mods 10%	Baseline Revs 5%
		0.90		0.90		5.3%		N/A

### Primary Trip Wires –

(a) System Indicator: See EV Report (System Surveillance Section)

(b) Baseline Indicators: A baseline assessment shows the contractors BAC and EAC to be optimistic. To complete the contract within the CBB, the contractor needs to be about 5.3 percent more efficient. The BAC has increased by 36% since the start up in Oct of 2001. The cost growth is likely to increase due to inherent engineering risks in the first versions of STOVL and CV aircraft.

### Secondary Trip Wires –

The Baseline Execution Index (BEI) metric is an Integrated Master Schedule (IMS) based metric that calculates the efficiency with which actual work has been accomplished for the SDD Program when measured against the baseline. The BEI provides insight into the realism of program cost, resource, and schedule estimates. An index of 1.0 indicates the program is being completed as planned.

- Baseline Execution Index (BEI): Cumulative Tasks from October 2001 thru October 2007: Cum BEI = 115,450 Completed Tasks/128,141 Planned Tasks = 0.90  
Monthly (October 2007) BEI = 800 Completed Tasks/1483 Planned Task = 0.54
- SPI= BCWP/BCWS= .985

The Critical Path Length Index (CPLI) indicates whether or not the program schedule can be completed on time. This is an Integrated Master Schedule (IMS) based metric that calculates the longest, continuous sequence of tasks through the SDD Program network schedule from contract start to contract completion. An index of 1.0 indicates the program will finish on-time.  $CPLI = (\text{Critical Path}_{\text{Baseline Duration}} + \text{Float Duration}) / \text{Critical Path}_{\text{Baseline Duration}}$

- CPLI =  $(2990 + (299)) / 2990 = .90$
- CPI = BCWP/ACWP = .982
- CPI/TCPI =  $0.982 / 1.034 = .947$
- Contracts Mods – (BAC now)/original BAC 10/01 = .359

The DCMA Risk Rating for EVMS at the total program level is rated yellow - using the agreed to parameter of VAC (-5.85%). Compare this to the Lockheed's EAC and one can see a difference of over 5%. Similarly, the  $TCPI_{\text{EAC}}$  is different when using the DCMA IEAC versus the contractor's EAC:

$$\begin{aligned} TCPI_{\text{DCMA IEAC}} &= 0.877 \\ TCPI_{\text{LM EAC}} &= 1.026 \end{aligned}$$

Cumulative to date SPI and CPI are at .984 and .981 compared to .985 and .982 in the previous month. Cumulative SV% and CV% are -1.60% and -1.98%, compared to -1.54% and -1.80% in previous month and are also rated green.

The DCMA EV Report is attached:

## 9.0 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