

# Joint Strike Fighter – Lightning II Monthly Assessment Report

Prepared for the Joint Strike Fighter Program Office (JSFPO)  
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N00019-02-C-3002



15 August 2007

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## 1.0 JSF Executive Summary

Lockheed Martin Aeronautics Company announced earlier this month that they had over billed the Government by \$266M on the JSF SDD Program. LM Aero discovered this over billing during an internal audit, and stated they will reimburse the government for the principal amount and interest charges. The government has temporarily suspended direct billing activity, and is currently in the process of verifying Lockheed Martin Aeronautics' method of calculating the interest and principal for the amount over billed.

Return to flight testing for AA-1 will most likely occur in September. As of this reporting period, the design solution, delivery, and SOF qualification of the Inverter Converter Controller (ICC) and subsequent VSIF testing could potentially be the pacing item for return to flight. Additional threats to return to flight are: delivery of -9 configuration Electronic Units (EU's), Power Distribution Center (PDC) delivery, installation, and regression testing, along with FTU 2.3 load and regression testing. Flight clearance approval must occur as well. The independent review team has concurred with using -9 EU's for return to flight, with a retrofit to -10 EU's occurring at a later date. Although the -9 EU configuring places a 33K' ceiling on flight activities, several valuable tests can still be accomplished, and are desired prior to the planned Edwards deployment in November for airstart and Power and Thermal Management Systems (PTMS) testing.

Production Status (As of 5 Aug 07)	
Forward Fuselage	5 – Assembly 3 – Mate
Center Fuselage	12 – Assembly 3 – Mate
AFT Fuselage	4 – Assembly 3 – Mate
Wing	5 – Assembly 1 – Mate
Mate & Delivery (EMAS)	3 (BF-1, BF-2 & BG-1)

**BF-1** – Lack of parts to support Major Mate activities and the potential for additional work around plans may impact October power on event. Wing completion remains critical – recovery plan progression is slower than originally anticipated. Current goal as of July ASMR is to get out of EMAS by ~20 Oct 07 – this is dependent on ITF engineering releases and subsequent Wing systems installations. Other activities hampering BF-1 completion are; FS270 bulkhead modification kits to support completion of Center to Forward Mate, Chine Fairings to support completion of 556 Mate joint, CS&E deliveries needed for HT and VT assembly and installation, and Main Landing Gear skins (in-house make) for completion of Center to Wing Mate. As of 12 Aug 07, current threat to the 23 May 08 first flight date is estimated at -51 Mdays due to dependency of BG-1 testing – mitigation efforts to remove this threat are underway.

## 2.0 PBM Assessment Matrix

WBS	Description	EV	Tech Perf	BF-1 FF	AA-1 BLK 0.1	AF-1 FF	AF-3 FF	BF-4 BLK 0.5	CF-1 FF	CF-3 BLK 1.0
ALL	F-35 Program	YEL	YEL	YEL	N/R	N/R	N/R	N/R	N/R	N/R
1200	Airframe	YEL	YEL	YEL	N/R	YEL	YEL	N/R	YEL	N/R
1300	Vehicle Systems	YEL	YEL	YEL	N/R	N/R	N/R	N/R	N/R	N/R
1400	Mission Systems	YEL	YEL	N/R	YEL	N/R	N/R	YEL	N/R	YEL
3000	Production Ops		YEL	YEL	N/R	N/R	N/R	N/R	N/R	N/R

**STOVL –**

BF-3: Remains physically in J320a; but is also working hours against J310. Final installation of remaining systems is still in progress. The mislocated keel on BF-3 has been thoroughly evaluated, with LMA, for impacts. The aft portions of the Keel Assembly will be trimmed to within Wing-Mate tolerance levels and the Weapons Bay Doors will be trimmed PMM to accommodate the RGA/Hinge placement (which will remain per-drawing). Additional kits are being developed and will be delivered to LMA for use if further adjustments to other systems become necessary. s targeting 23 Aug for their In-Place delivery (DD1149) to LM.

BF-3 Teammate Furnished Equipment (TFE): decreased (by 1) their forecast of deferred items; now forecasting 26 items of TFE (~197 hrs of work) to be deferred back to LMA along with 7 other items (~0.20 hrs of work) that are being deferred due to the disruption impact of those 26 shortages. , a single pair of ECUs) they are responsible for procuring/installing for ~4 hrs of work to LM.

BF-4: In J330b. Most of the ~3,187 hrs behind schedule in J320 for BF-4 are due to late wind load bracketry which is holding up wire harness installation. Most bracketry is expected to deliver by end of Aug 07, is projecting to complete assembly by 3<sup>rd</sup> week of Sep 07; including work on the 270 Bulkhead and lower keel (if necessary).

BH-1: Loaded J354 only; however it is short critical frames w/latest ECD into 2<sup>nd</sup> week of September.

BH-5: Not Loaded; scheduled to load 24 Aug 07.

The 270-Bulkhead delivery for BH-1/BF-5 will be 2 months late at best. has stated they can bring the current ECD of 23 Dec 07 to the left by 4 weeks at the most – this is still 2 months past jig need date – and this timeline assumes zero non-conformance impacts and zero issues just to shave those 4 weeks; in addition, there are only 2 pieces of raw material

available for the fabrication of these parts. Program Master Schedule shows J355 starting on 19 Sep 07, which is too far out to predict impacts with any fidelity, especially given the issues with CV units in J355.

Teammate Furnished Equipment (TFE): LMA Teammate Furnished non-support items continue to impact PMC assembly flow. BF-4: ... forecasting a decrease by 1 item/~2 hrs of work; now 30 items/~201 hrs of deferred work; along with 3 items/~15.5 hrs of travel work. CCB authorized travel, remains at 11 items/~30 hrs of work. Late COAX continues to threaten to increase this total by 200+ hrs of work.

#### **CTOL –**

AF-1: AF-1 is in J330-ADS working the lower skin hole drilling. Wind Load bracket delivery is improving; however late TFE and critical fuel tubes continue impacting systems installation. Master Schedule margin decreased again by 1.5 days, and is now 12.6 days behind master schedule.

AF-3: In J345-ADS working upper skin hole drilling. There is pressure to work the late delivery/installation of the Gun Trough Blast Port Assembly, as well as processing the In-Flight Refueling Receptacle (IFRR) Vent Change Request before there is an impact to assembly operations.

CTOL Gun Port Access Panel: This item is extremely difficult to manufacture. received 5 “no-bids” from potential suppliers, rejecting the design as too complex to manufacture. ... planning on working with suppliers to build a pool of 3<sup>rd</sup>-tier suppliers willing to hot-form the part; a detailed time-line to work this issue has not been established. Final engineering BTPs are on-hold, impacting AF-2, AF-3, and AJ-1. The blast port assembly PO has been placed for AF-2 and is still reporting an ECD of 24 Jan 08 (Master Schedule ship date is 21 Jan 08).

Inlet Lips: 2 inlet lip sections for AJ-1 – are 6 months past need date – have been scrapped, and 3 other sections have non-conformance tags against them; highlighting the difficulty in producing these parts.

Fuel Floors: AF-4 and AF-5 fuel floors are reporting 6-weeks late to MND. Both are held for engineering dash-number roll.

A critical frame for J354 (first duct cost center) is reporting 1 month late delivery

#### **CV –**

CF-1: In cost centers J356 (aft duct) and J355 (270 Bulkhead/F1 tank mate to Fwd intake ducts). CF-1 is jig-locked out of the J351 cost center, and will not be able to move forward until the tank assembly in J355 completes. Tank Assembly (J355) – this cost center has moved into the critical path. The L/H Keel was scrapped, and delivery will now be over 17 weeks (4 months) late to MND with a new ECD of mid-September or early-September at best. The FS 302 frame is also driving this cost center with a mid-September ECD. NGC is working a detailed recovery plan;

however, the current ECD does not support delivery. CF-1 Fuel Floors have been delivered (except for the F1/J355 fuel floor). Remaining CV Fuel Floors are all late-to-need.

CF-3: Only 1 duct (R/H) loaded into the J354a (STOVL/CV) positions: however this unit is also showing impacts to J355

CG-1: Both forward ducts are in the J354c/353c positions

CF-2: Both units loaded late into the J354b/353b (CTOL/CV) positions

CG-1 thru CF-3: All reporting Keels/Drag Brace/Bulkheads approximately 6 to 8 weeks late to need dates – CG-1's drag brace was scrapped.



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**5.0 Production / Airframe – LMFW**

Technical Performance – Overall, Forward, Wing and Mate assembly performance to MS05 schedule is degrading. For example, as of 26 July 07, jig load dates have been missed in the Forward Fuselage for AF-3, AJ-1, CF-1, CG-1 as well as AG-1, AF-2, and AF-3 in the Wing. Performance is being impacted by: Critical part shortages, high change traffic, difficult work (fuel floors, chine fairings, MLG boring, warping/drooping bulkheads, etc.), and late and/or constant rework of planning. LM now projects that BF-2 and all follow on Wings will move to mate 2-4 weeks later than originally planned. Current Wing touch labor assembly performance to budget for BF-1 is around 15k hours above original estimates.

LM is currently working to an internal Shop Operating Plan (SOP) which they believe will bring them back into MS05 requirements. LM recently held an offsite to assess their current schedule position, engineering, tools, and planning availability. From this offsite they have identified four key focus areas: increasing staffing, creating workable work packages for the mechanics, establishing and deploying a rigorous production tempo and improving management and support team efficiency. In addition, planning and manufacturing engineers' resources are being added to improve support to the shop floor.

Quality – Flight Ops / Delivery (Risk – High): AA-1, DCMA requested that a Customer Concern (ICA # 69008) be initiated to address shortcomings with regard to both the quality of work instruction for the M/L/G replacement / Ops checks (SCOP's), and the associated adherence discipline for actual work performed. During M/L/G replacement, some protective shipping wrapping was not removed and was noted during DCMA SOF inspection (Ref: QAR # CE64429). Contractor initiated REA # MM30608 to their Supplier to request a contrasting color of wrap be used in the future.

Quality Summarization – Changes in Engineering, Electronic Work Instructions (EWI), and workmanship discipline are continuing to contribute to the amount and type of defects to date. The concern initiated in the flight arena seems to have been taken very seriously by the contractor and they are being proactive to mitigate the additional risks that have been exposed. Contractor Program Management is involved ensuring adequate corrective action. DCMA will continue to closely monitor these areas and assist the contractor in mitigating all risk areas.

Safety of Flight – Implementation of DCMA SOF requirements into contractors EWI is progressing very well to date.

With an estimated 82% of all SDD variant original design development BTP's completed (BF-1 = 99%, AF-1 = 90%, and CF-1 = 48%), BTP efforts are winding down. The Late to Commit (LTC) for BF-1 as of Jul 07 is 34, AF-1 is 190, and CF-1 is 616. The LTC indicates that Engineering is unable to release BTPs as scheduled, but have improved. Based on DCMA trend analysis, we found the following: BF-1 BTP behind schedule had reduced from 6.15 % in Jan 07 to 3.3% in Jul 07; AF-1 BTP behind schedule had reduced from 3.5 % in Jan 07 to 2.3% in Jul 07; CF-1 BTP behind schedule had reduced from 20% in Jan 07 to 15.7% in Jul 07

**Forward Fuselage, Wing and Mate Schedule as of 28 Jul 07**

## **6.0 Vehicle Systems**

Supplier Schedule – A total of 20 components remain to be delivered which are required for BF-1 initial power-on scheduled for 22 Oct 07. Of those, 16 components are deemed critical for execution.

Tactical Navigation System – Supplier has concluded the Lightning Performance test.

Electro-Hydrostatic Actuation System – Electronic Unit (EU) rework (-9) is in progress and future deliveries are planned in support of continuing AA-1 flight test schedule, which will resume with altitude limitations until final configuration EUs (-10) are available. Redesign testing at simulated altitude conditions yielding high confidence is planned path forward. Overall impact to cost and schedule regarding these activities are yet to be determined.

received contract change to the environment and duty cycle requirements for the EHA in Mar 07. Proposed design changes, based on results from AA-1 flight test data, were to

STOVL requirements and designs have been frozen in preparation for STOVL Safety of Flight (SOF) certification testing.

The program plan is under pressure to meet LM remaining needs for:

- Software FQT completion by Sep 07
- B-1 system (Wing and Empennage) SOF completion by Dec 07
- System SOF completion by Dec 07
- Flaperon SOF completion by Dec 07

The above schedule is dependent on a timely solution of CTOL system PRs that have been pushed to STOVL. The number of EHA and EU CTOL PRs will not have a great impact/risk on the STOVL schedule.

A STOVL EHA SOF unit passed an ATP in March and is ready to start SOF qualification testing. The EHA Flaperon STOVL SOF test procedure was submitted and LM gave conditional approval with comments for the impulse and vibration testing. The SOF impulse test started in April and was successfully completed in May. The SOF vibration testing started in July. A motor failed during SOF vibration testing and is still under investigation. The SOF test procedure for tests conducted after impulse testing is completed was submitted to LM in March and is awaiting approval.

EHAS Software Development – All 20 PRs have been fully defined in Ver. 7.0.3 and is scheduled for release 7 Aug 07. TTR for Ver. 7.0.3 is scheduled for 14 Sept 07 with FQT completed by 28 Sept 07. STOVL system SOF is tentatively schedule for completion in Dec 07. An additional build, Ver 7.0.4, will be required to address flight critical issues. To date, four (4) known issues will be include within the contents of the build 7.0.4 with an additional nine (9) issues that may be included in the future.

Power Thermal Management System – Item 1 (2WTV00001-0002, PAO/Fuel/Hydraulic Oil Heat Exchanger) has completed 10% of the pressure cycle on all circuits and an additional 10% pressure cycle will be applied to the fuel circuit. SoF vibration testing is scheduled late July 07.

Item 221 (2CTV00221-003, Heat Exchanger, Air to Hot PAO) Qualification failure is still under investigation. Additional vibration testing is schedule with follow on detailed design to address failure to be completed by 31 Oct 07 with hardware delivery scheduled for Mar 08. Qualification testing will be rerun after new hardware is available. Delivered BF-1 unit will need to be replaced.

Item 121(2CTV00121-0004, PTMS Controller) is not compliant to the EMI requirements RE102 and RS103. Extensive upgrades have been incorporated into the BF-1 development unit which is currently undergoing EMI and Power Quality testing.

During vibration testing of the PTMS Controller,

A new -3 configuration will be employed for BF-1 and on. The CDR for the -3 flow sensor was conducted on 11 Jul 07. Flow sensor delivery for BF-1 is scheduled for 20 Aug 07.

## 7.0 Mission Systems

1434 CNI – EAC/BAC increased by \$14.279M from proposals in response to new work: 1) \$11.4 M on the System Security Information Assurance (SSIA) revisions to address additional requirements and 2) \$2.8M on the Blk 0.5 Integrated Support System (ISS) upgrade to Blk 1.0 configuration.

In reference to is controlling costs ahead of schedule. is behind primarily with Blk 1 infrastructure delays. This is putting pressure on the Blk 1.0-1 delivery.

1437 ICP – Contractor's IMS data prior to Jan 07 received poor ratings due to the fact it did not show proper schedule logic, it had missing links (no predecessors and successors),

Thus DCMA rates their IMS system as Red working on a new IMS to resolve the aforementioned concerns and integrate with the EV data. It is to be released sometime early 3QFY07 originally projected released in 1QFY06. DCMA has proceeded to review schedule slippages on the deliverable IMS (to Aero). IMS for month end Jun 07, show 2 tasks that are late with 4 that are forecasted to be late.

### Safety of Flight (SOF) Test Status –

- 23 Jul 07 started setting up a perform Acoustic Noise testing for the Block 0.5 Forward and Aft ICPs and the 0.1+ Forward ICP. After resolving several setup problems, they officially started and successfully completed the Acoustic Noise Test for the Block 0.5 Aft ICP. During the ten cycles of post SIT testing of the Aft ICP, several problems were encountered in the Forward ICP (an FC Test failure and a SP Domain test failure) that will need to be investigated prior to the start of the Acoustic Noise testing for the Forward ICP.
- Two out of three TFRRs (Test Flight Resolution Reports) were submitted to Aero for approval. 1. Block 0.1+ EMI SOF RE102 outages. 2. Block 0.1+ EMI CS115 1394 failure. 3. Block 0.1+ 1553 SIT failure is being held here at Lockheed test group for more information.
- LM STAR has some short falls for GP and GPIO testing. There is an LM21 event addressing these issues.

- Possible schedule low risk on GP domain due to development – this should not affect aircraft flight schedule
- DS module – Software issue pushing delivery out to Oct/Nov 07. proposed plan of recovery has not yet been agreed to Also, This may affect the TR1 Flight (Block 1) for 2008.

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).

**SW Development Lifecycle Productivity Table:**

WBS 1425 SW Productivity calculations are not shown 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 94.2%, and Block 0.5 is 77.4% complete. Considering all hours since inception within 1420 WBS' (i.e. 142X), Block 0.1 is 96.8%, and Block 0.5 is 79.5% complete.







## 9.0 Earned Value

DCMA JSF – June 07 Data

Lockheed is now reporting to an Over Target Baseline of \_\_\_\_\_ reported in the Cost Performance Report (CPR). The June 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	SPI	CPI	CPI/TCPI 10%	Contract Mods 10%	Baseline Revs 5%
Y						

Primary Trip Wires:

(a) System Indicator: The yellow rating is based on the findings described in this report on Systemic Surveillance.

(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 12 per cent more efficient. The BAC has increased by 36% since the start up in 2001. The cost growth is likely to increase due to inherent engineering risks in the first versions of STOVL and CV aircraft

Several of threats and pressure items in previous month have been downgraded to watch items. We have requested justification and are awaiting the final disposition.

Secondary Trip Wires:

SPI= BCWP/BCWS=

CPI= BCWP/ACWP=

CPI/TCPI= 0.983/0.895=1.098

Contracts Mods – (BAC now)/original BAC 10/01=

The DCMA Risk Rating for EVMS at the total program level is rated yellow - using the agreed to parameter of VAC (-5.29%). Compare this to the Lockheed's EAC and one can see a difference of over 5%.

Similarly, the  $TCPI_{EAC}$  is different when using the DCMA IEAC versus the contractor's EAC:

$$\begin{aligned} TCPI_{DCMA\ IEAC} &= 0.895 \\ TCPI_{LM\ EAC} &= 1.016 \end{aligned}$$

Cumulative to date SPI and CPI are at .988 and .983 compared to .990 and .982 in the previous month. Cumulative SV% and CV% are -1.21% and -1.71%, compared to -1.01% and -1.84% in previous month and are also rated green. Key DCMA IEAC drivers come from Production Engineering and Production Operations, Vehicle Systems, Airframe, and Mission Systems. In Production Operations and Production Engineering, the main drivers are: Unfunded requirements for Minor and Major Change Curves, I & R effort, loss of Commonality, engineering changes and tooling growth. In Missions Systems, key drivers include: associated with change curve B implementation at risk (added scope and performance), additional Radar testing, and ICP work. For Vehicle Systems, the main drivers are: additional effort for SW effort to support AA-1 flight test SPAR burn down, on Airframe, the main drivers are: late release of engineering changes and greater than planned effort for STOVL and CTOL BTPs. In Missions Systems, key drivers include: associated with change curve B implementation added scope and performance), additional Radar testing, and

Update: DCMA gave LM Aeronautics Business Management 30 days from 18 Sep 06 to address an apparent lack of EAC updates with an action plan. The trend charts of both EAC and BAC provided as part of the JSF CPR indicated that there had been no cost growth on this program – when, in fact, Cost growth enough, in point of fact, that EAC4 incorporates a number of program changes in order to bring the anticipated cost of the program down. That represented a violation of the EV Criteria that

requires regular updates of the EAC when significant changes occur. Lockheed has provided that plan – called \_\_\_\_\_ and DCMA is in the process of reviewing the response. Enough time has passed to test the maturity of the \_\_\_\_\_ database and we are beginning an assessment review based on the agreements made back in December. In support of our review, \_\_\_\_\_ was indicated a failure of \_\_\_\_\_ to include appropriate estimates for engineering and other configuration changes. These estimates should have been included in the \_\_\_\_\_ database and were not apparently found. This issue with \_\_\_\_\_ will become part of our review of the effectiveness of the \_\_\_\_\_ the JSF program. Please see the System Surveillance section for more information. The DCMA EV Center will be coming to LM Aeronautics for an EV Compliance Review. It is currently planned to occur during 20-31 Aug 07.

The complete EV Report and subsequent System Surveillance information is attached:

## **10.0 Process Reviews**

Members of the Product Assurance Design and Integration Team, DCMA LM Fort Worth, conducted a review of the JSF Risk Management List – SEI-019. Analysis determined that WBS 1422, External Communications, which has 82.5% of work to be performed, was the candidate for the review. The contractor was found to be following their procedure as written and there were no major or minor findings with the process.

Product Assurance team members conducted a review of the BTP Engineering Checking process as described in PM-4052, Sections, 11-2.7, 11-3.2 and 11-3.4. The goal of the process is to ensure BTP discrepancies are captured and corrected prior to the approval process within the BTP release life cycle. No major or minor findings were discovered during the review.

## 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

**Green** - VAC% > -5%

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

**Red** - 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?

**Green** - 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.

**Red** - 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?

**Green** - 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.

**Red** - 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