

# Joint Strike Fighter – Lightning II Monthly Assessment Report

Prepared for the Joint Strike Fighter Program Office  
Prepared by DCMA Lockheed Martin Fort Worth



21 July 2008

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## JSF Executive Summary

Flight Test – AA-1 has accomplished 44 flights as 17 Jul 08. BF-1 has flown 8 flights, accumulating ~7.6 flight hours as of 18 Jul 08.

Production Status (As of 13 July 08)	
Forward Fuselage	8 – Assembly 7 – Mate/Final
Center Fuselage	11 – Assembly/On-Dock (2ea. LRIP 1) 7 – Mate/Final
Aft Fuselage	5 – Assembly/On-Dock 6 – Mate/Final
Wing	10 – Assembly 5 – Mate/Final
Fuselage Structure Mate (EMAS)	5 – (AF-1, AF-2, AF-3, AG-1 & BF-4)
Final Assembly/Sub-Systems/Systems Test/Labs	3 – (BF-2, BF-3, & BG-1)
Field Ops/ITF	2 – (AA-1 & BF-1)

Progress to MS6.1 – BF-2: As of 29 Jun 08, DCMA estimates that BF-2 has approximately 37,595 hours of Forward/Wing/Mate build work remaining. If it moves to the flight line in this condition, it will have an approximate 43% variance to its planned schedule and will be 6% less mature than what BF-1 was when it moved to the flight line. As of this report, BF-2 is projected to move to the flightline the first week of August, behind its scheduled 27 Jun 08 date. As of 13 Jul 08, IMS shows ~2.6 months late to first flight of 13 Jan 09.

As of 13 Jul 08, BF-4 (Initial MS aircraft) has ~2.6 months of negative float to its first flight date of 24 Mar 09. AF-1 has ~1.9 month's negative float to its flight date. The current average negative float to first flight for the remaining eleven flight articles is ~1.8 months. with static articles averaging ~1.5 months behind their completion dates.

Overall Production Operation cost and schedule performance trends have been trending negative for the last several months (May SPI=.911, CPI=.896), with Mate and Final Assembly having consistent trouble performing to cost and schedule requirements. Flight line Operations, System Checkout, and Instrumentation negative performances are contributing to Mate and Final Assembly's declining performance.

Performance continues to be impacted by: persistent critical part shortages, high change traffic, difficult/inefficient work (out-of-station/out-of-sequence work, part and tool locating via metrology, integration of flight test instrumentation, etc.), late and/or constant rework of planning and tooling issues/availability. Additionally, exacerbates contractors' production build effectivity. performance is hindered by items such as: Manufacturing Resource Planning (MRP) systems that are not linked and do not convey requirements, complex change process, as well as labor intensive/manual post delivery and RPO requirements. shortages are routinely hundreds of parts.

Software – As of 26 Jun 08, the last 6 months of Software (SW) development effort Cost, Schedule, and Technical performance have increasingly trended downward – driven primarily by

the extended Block 1 Integration & Test (I&T) effort requiring extensive fixes. The development effort includes Block 1 Operational Flight Program (OFP), Block 2 OFP, Advance Program (AP) OFP, Modeling & Simulation (M&S), Mission Data Tools (MDT), and I&T Support SW. Block 1 D (the original, base-lined final block 1 delivery) in the System Integration Lab (SIL) has generated multiple SW Change Requests (SCRs) which have pushed out the Block 1 Delivery. Block 1E and Block 1F were added into the development, and now have planned deliveries in Oct '08 and Mar '09 respectively. The delay has pushed cost and schedule for the remaining Block 1 SW effort. The delay of the Block 1 SW effort intern has impacted the Block 2 and AP SW development efforts. DCMA predicts that software will deliver late to the most recent plan by approximately 11 months,

### **Report Scope**

The Joint Strike Fighter – Lighting II Monthly Assessment Report (MAR) is intended to meet customer outcomes identified in the Memorandum of Agreement (MOA) with the JSF Program Office (JSFPO). The objective is for the contractor to deliver products on schedule.

The customer outcomes as described in the overarching MOA between DCMA and the JSF Program Office are as follows:

- |                                      |                                    |
|--------------------------------------|------------------------------------|
| A. Effective Design Processes        | D. Effective Acceptance Processes  |
| B. Effective Manufacturing Processes | E. Effective Improvement Processes |
| C. Effective Quality Processes       | F. Supply Chain Management         |

The JSF MAR is intended to highlight issues by exception in areas where DCMA indicates risk, and is not intended to duplicate program information readily available. This report has an abbreviated format that assumes the reader has access to past JSF MARs.

## JSF Outcomes and Performance Commitments

Outcomes, performance commitments, and the associated ratings are shown below. Interdisciplinary teaming between Business and Technical Product Assurance (PA) personnel is used to ensure customer outcomes are ascertained, risks to outcomes are identified and assessed.

DCMA Outcome	Performance Commitment	Rating Criteria	Rating
Improve Build-to-Package (BTP) Quality	18% of BTPs approved (no error) on first review	<17% = Red Up to but not including 18% = Yellow 18% or > = Green	
Successful Component Build	<10% variance of planned builds vs. actual schedule	> -15% = Red -10% to -15% = Yellow < -10% = Green	
Non-Conformance Reduction	10% reduction in MRB discrepancies per year	>10% Above Goal = Red Within 10% of Goal = Yellow < Goal = Green	
Safety of Flight (SoF)	First pass rate >75% for acceptance of SoF items	<69% = Red 70-75% = Yellow >76% = Green	
Effective Management of Formal Risks	Risk mitigation activities and waterfalls do not exceed 60 days off track	<90% = Red 90% to 99% = Yellow 100% = Green	
Successful System Checkout Procedures (SCOPs)	Scheduled completion is greater than 90%	<80% = Red ≤ 89% to ≥ 80% = Yellow ≥ 90% = Green	
Improved Software Productivity	Block 0.5 Software Productivity Cost Performance Variance (SPCPV) for WBS 1420 Airborne Software is improved at least 30% from Block 0.1 SPCPV	Block 0.5 SPCPV improved <10% of Block 0.1 = Red Block 0.5 SPCPV improved at least 10% but <30% of Block 0.1 SPCPV = Yellow Block 0.5 SPCPV improved at least 30% from Block 0.1 SPCPV = Green	
Predictive analysis of SDD cost, schedule and performance variance	Resource requirements are aligned in support of funding and budget allocations(s)  Resource requirements are aligned in support of funding and budget allocations(s), IEAC data and projections predict actual performance within 10% of actuals	>10% Variance = Red 5% to 10% Variance = Yellow <5% Variance = Green	Y

Delegated field assessments of supplier design, manufacturing, quality and improvement effectiveness	Each delegated supplier has quality ratings >96%	<87% = Red 87% to 95% = Yellow ≥ 96% = Green	Y
Successful completion of assist audits	Process contractor / PCO requests for domestic / international assist audits within 2 business days 85% of the time	<75% = Red 75% to 84% = Yellow >84% = Green	
Successful contract closeouts	Accomplish 94% contract closeout action within FAR mandated timeframes	<85% = Red 85% to 93% = Yellow >93% = Green	
Ensure "At Risk" funds, likely to require replacement, do not cancel	90% of canceling funds de-obligated / billed	<80% = Red 80% to 89% = Yellow >89% = Green	





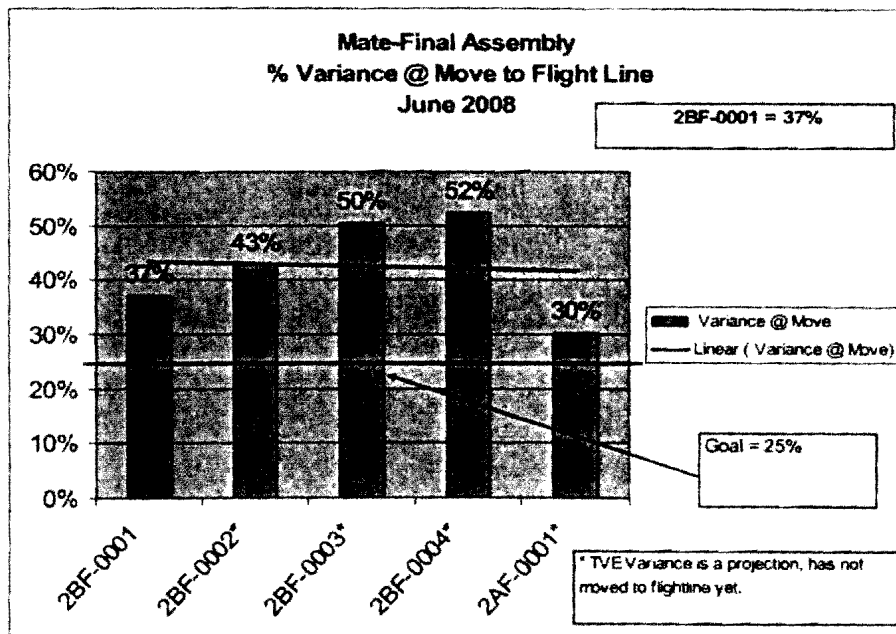
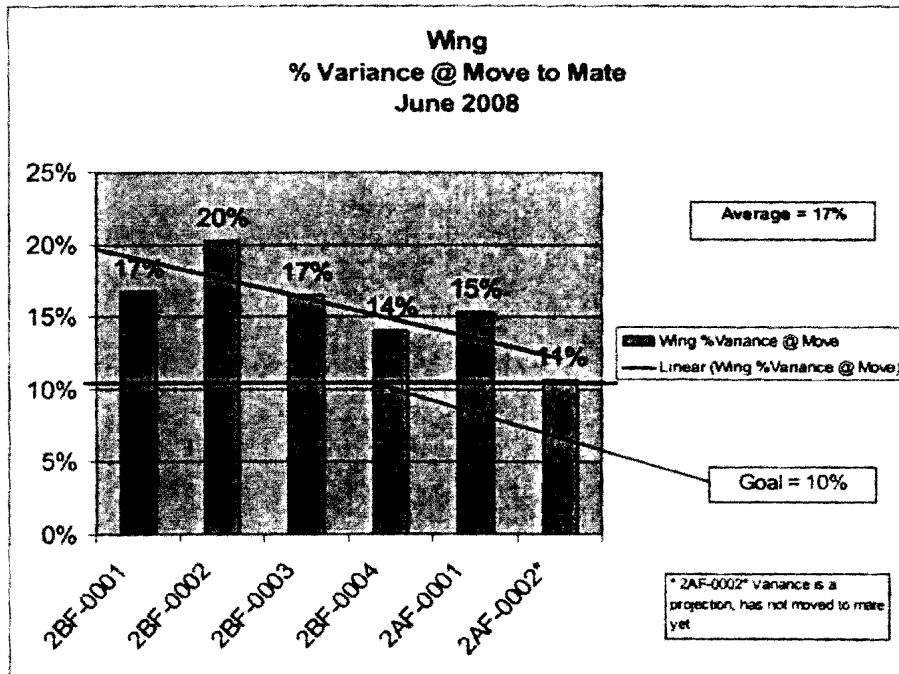


### **Successful Component Build**

Performance Commitment is rated Red this period with a current overall Wing average touch labor variance to schedule of -17%.

LM continues to put emphasis on several cost/schedule savings initiatives.

The charts below show that the Wing is steadily reducing its variance at move to Mate. This is important since history has shown that Mate performance has been significantly affected by the condition (maturity) of the Wing at delivery. We are currently not seeing a great deal of improvement in Mate and Final Assembly's performance even though the Wings are beginning to arrive more complete. It may take some time for Mate and Final Assembly to come down its learning curve, resolve the same types of issues the Wing and Forward experienced, and begin to show positive cost and schedule performances. *Per Lockheed Martin.*



## Processes Assessed

DCMA LM Fort Worth Electrical Fabrication Shop Joint Process Review update: Currently there are 5 (of 21) findings which remain open. These findings will remain open until the review team can analyze and accept the contractor's responses. Dependent on how rapidly we receive

satisfactory responses, we anticipate that we will conduct a verification walk through of the findings that require validation in late July or early August.

**First Flight Metrics** – The metrics target a percent improvement by key variant over baseline aircraft (AA-1) first flight date as planned. AA-1 was approximately 4 months (~80 Mdays) behind schedule to final Program first flight date.

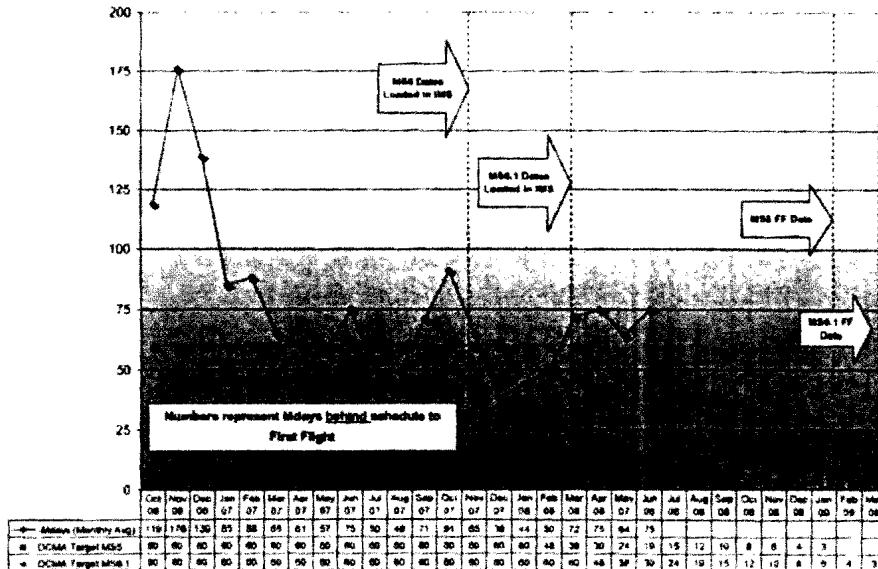
Data is retrieved after weekly IMS calculations are performed. An end-of-month average for metrics is utilized. (*Note: Mdays are displayed as positive values, but represent behind schedule status*). MS6.1 shifted all first flight dates (except BF-1) to the right an average of ~5 months compared to MS5 as of week ending 9 Mar 08. Metric targets have been adjusted to MS6.1 dates.

The metric for BF-4 date targets a 50% improvement in achieving first flight, and incorporates a 20% reduction in Mdays beginning 12 months prior to first flight date per the Master Schedule. Target goal is 0 Total Float by first flight date (month).

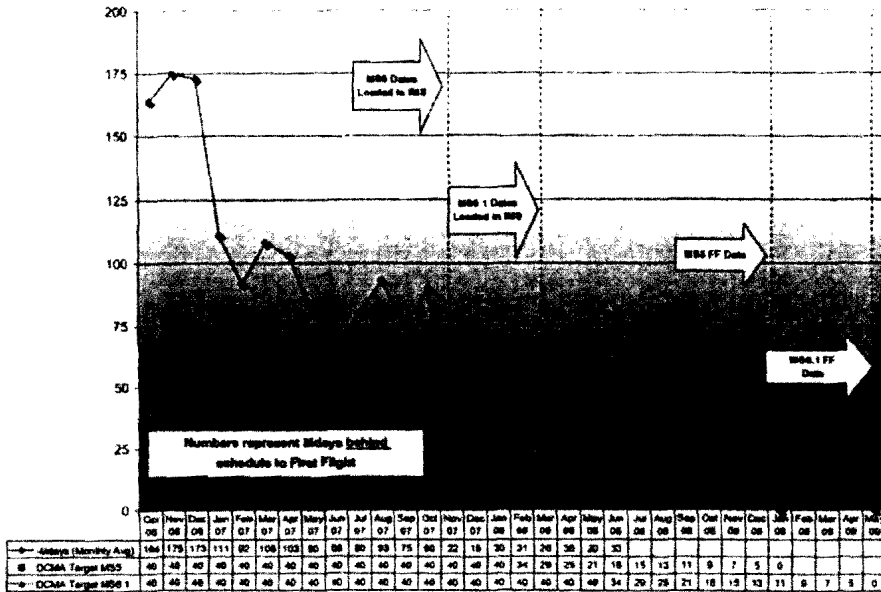
Metrics for remaining key aircraft:

- AF-1 targets a 50% improvement with a 15% reduction / month
- CF-1 targets a 35% improvement with a 20% reduction / month
- CF-3 targets a 50% improvement with a 20% reduction / month

BF-4 First Flight (24 March 09 - MS6.1) Total Slack Trend  
MS5 dates in IMS 4 Nov 07 / MS6.1 dates in IMS 9 Mar 08



AF-1 First Flight (14 May 09 - MS6.1) Total Slack Trend  
 MS6 dates in IMS 4 Nov 07 / MS6.1 dates in IMS 9 Mar 06



## Effective Management of Formal Risk

### Mission Systems

#### 1434 CNI

UVPA Control Loop testing issues -

UVPA is failing in the laboratory environment, but not failing in the Acceptance Test Procedures/Process (ATP). The determination is that the Control Loop is not working as required, and the control loop processes (algorithms) and circuitry is not currently accessible due to lack of access to the designer of the subsystem. The problem being that modifications to the circuitry and algorithms for the control loop would require reverse engineering to be able to understand the control algorithm completely enough to modify it.

Processor Memory Allocation for Block 3.0 GPPV CSC1 currently exceeds the requirement. Memory for Block GPP V 3.0 is currently estimated to be at 113% of the memory requirement.

Array Antenna Assembly (AAA) and Antenna Interface Unit (AIU) Qualification Issues – The AAA units have been in qualification vibration testing for 16 months with numerous failures and redesigns. There are also significant concerns about the AIU design in regards to vibration testing because of the AAA issues to date. Currently the AIU is failing and has less than 25% of predicted life during random vibration testing. Causes of failures are to be determined. The AAA High Cycle Fatigue is experiencing multiple failures and is estimated to be 43-58% complete.

### 1435 RADAR

Technical risk is still rated Yellow due to tracking three medium risk items. Two of the medium risk items deal with SoF testing and delays associated with BFE hardware – the testing is seven weeks behind schedule.

#### Active Current Risk Table

Risk Number (IPT)	Risk Name	Description	Current Risk Level	Mitigation Plan Status	Planned Completion Date
RDR-021R1	SoF Test in BFFE Racks	LM cables: BFE cables have suspected shielding problem; working with vendor to resolve; Interface resistance issue is closed	Moderate	Active: Delayed	8/1/08
RDR-047	Qual Test Failure Rework	EMI SoF is currently 7 weeks behind due to test anomalies, BFE and H/W issues. Opportunities being explored/implemented for SoF schedule recovery.	Moderate	Active: Delayed	10/01/08
RDR-050	CPSW Capability/Integration	Risk statement: Block 1 CPSW capability/Integration. Several SPARs were resolved; planning based on a 7/08 Block 1 Formal release.	Moderate	Active: On Track	7/18

### 1436 EW/ CM

Flare 1 encountered an initiator failure during the March '08 Testing. Findings from the preliminary root cause investigation identified a squib modification or new squib development to be the most effective corrective action.

A mid-August '08 static test of the completed modified Flare assembly at Kugite is anticipated. BAE's current plan indicates the Flare 1 will Return-to-Green near the end of November '08 with the Flare IRFT 2A-2 testing. Flare builds for the FT-2 B&C have been rescheduled to late July/August due to the rescheduling of these flight tests. The Flare CDR is now projected for early '09. EQT will be rescheduled once a final design and successful test of Flare 1 has been achieved.

Aperture Multi-Path issues – successfully delivered 15 CIM units (including 2 Lab units) during May '08. While no evidence of unacceptable characteristics have been identified over the specified bandwidth, are evaluating the existence of possible Droop and Suck-out conditions just outside the required bandwidth. No follow-up information has been received.

task is 1 July.

the completion of this

### Technical Performance

Software related SARS (31 as of 1 Jun 08) are requiring unplanned resources to correct.

DCMA Prediction – SCRs addressing SARS will be closed for Block 1 prior to May '09. Block 2 will have SW related SARS that will drive cost and schedule as in Block 1 – Risk Rating is High.

### 1439 Common Components

Technical performance risk is Yellow. There are two technical issues on watch list that DCMA considers significant; and Transceiver crosstalk.

### EW rack performance issue:

- unable to demonstrate EW rack design supports
- Issue presents EW qualification test risk
- Possibility of MIL-STD-461 failure: RE102 and RS103

### Transceiver crosstalk performance issue:

- Switch Safety of Flight (SoF) Testing
  - Observed active link status and subsequent ITW (Invalid Transmission Words) errors on unconnected ports/channels
  - Although link activation was observed, no error-free (i.e.: “valid”) messages were observed on unconnected ports which could cause severe system impact
- Testing at confirmed active links on unconnected ports on vendors, designs and no “valid” data message transmissions
- Testing at confirmed crosstalk of active ports on to unconnected ports

### 1525 25 MM Gun Systems

Overall Technical performance is rated Yellow. This rating is due to failures, Gun System Control Unit (GSCU) environmental failure, STOVL/CV engineering testing and qualification and STOVL/CV Gun Pod delivery delay.

### Successful System Checkout Procedures (SCOPs)

System Check Out Procedures Completion Progress – BF-1 first flight occurred on 11 Jun 08. A total of 3 SCOPs remain to be completed for BF-1. These remaining SCOP tests are related to STOVL mode operational checks and weapon bay electrical checks. The STOVL operational checks will be delayed until a redesigned engine is made available by the end of the year and STOVL flight limitations are lifted. DCMA's current data shows that 119 SCOP tests have been completed prior to BF-1 first flight. This equates to 98% of the total planned testing was complete per Master Schedule 5 (MS5) as of June 08.

DCMA is currently updating data for the BF-2, BF-3, BF-4 and AF-1 test articles and realigning to Master Schedule 6.1. Estimated completion is Aug 08.

has responsibility for SCOP development of their systems included in the Empennage (AFT, Horizontal Tail and Vertical Tail assemblies) for the F-35 variants. DCMA is tracking the progress for SCOP preparation, sign off and release. Current formal document release rate for STOVL is 100%, CTOL is 92% and CV is 21%.

As for the testing performance of Empennage assemblies, Seven (7) SCOPs were scheduled for completion in the May/June timeframe but none were completed. All build schedules are currently off track.

### **Improved Software Productivity**

**DCMA [WBS 1422 – External Communications Domain]**  
DCMA will be watching for the LINK 16 implementation decision. DCMA is currently trying to comprehensively characterize and validate the reasons for SLOC growth in WBS 1424. DCMA is monitoring the rework trend and mitigation action.

**DCMA –[WBS 1424 – Mission Domain]**  
DCMA previously reported a miscalculation in the rework algorithm and received a letter of appreciation from the POC. DCMA has also noted that the planned rework threshold has shown a dramatic change each month and will be looking into this more closely. DCMA plans to attend a SCS Accounting review/audit with NG SQA in early July 2008

**DCMA [WBS 1428 - Fire Control NAV & Stores]**  
**(Responsibility for NAV functionality relocated to WBS 1428 from Own Ship Sensor WBS 1426)**  
DCMA is currently looking into rework tracking at the SPM level. DCMA also conducted an independent assessment of the S/W Process Evaluation process to determine the maturity of this function. The organization was subsequently determined to be thorough and effective in the regular performance of the SPE process with only very minor notations.

**DCMA**  
**Integrated Core Processor (ICP)**  
DCMA will perform process audits on Product Validation and Integrated Project Management with results to be reported next month.

### **Processes Assessed**

DCMA-LMFW participated as observers in contractor Software Product Evaluations (SPE's). The objective was to observe the contractor SPE process in action and to facilitate generation of process review questions for the SPE Process Review that DCMA-LMFW is currently involved in. DCMA has developed an initial set of interview questions and will be giving them to the contractor next week. DCMA-LMFW has also completed the product examination portion of this process review utilizing contractor source data.

## Delegated Field Assessments

Performance Commitment (PC) – Each delegated supplier has quality ratings greater than 96%. This PC tracks supplier quality ratings using Lockheed Martin's rating system. The suppliers that are tracked meet one or more of the following criteria:

- a. Safety of Flight
- b. Critical Safety Item
- c. Known Issues
- d. Critical Path
- e. Single Source

### Supplier Ratings

continues to be the driver for the overall poor quality rating. Fifty-eight connectors, from the same lot of parts and affecting all three dash numbers, are the drivers for low quality rating. The dimension required to control the locking teeth thickness was omitted on the drawing. All 58 connectors have been through the system and the quality rating should continue to increase. The DCMA representative at is working with his counterpart to insure corrective actions are in place to prevent this error from occurring again. We also continue to work with Lockheed PQA to insure a good root cause analysis was accomplished and that they are obtaining good corrective actions from their supplier.

## Predictive Analysis of SDD Cost, Schedule and Performance Variance

Lockheed Martin is now reporting to an Over Target Baseline of reported in the Cost Performance Report (CPR). The May 2008 SDD cost summary is as follows:

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

Budget Baseline and EAC Summaries

Contract Data	KT 1	KT 2	KT 3
Contract #	N00019-02-C-3002	N00019-06-C-0291	N00019-07-C-0097
Name	JSF SDD	LRIP 1	LRIP 2
Contract Type	Cost Plus Award Fee	Cost Plus Award Fee	Cost Plus Award Fee
Obligated Amount	19,822,649,195.54	\$197,248,033.28	\$1,142,363,786.00
ULO	\$720,371,283.78	\$142,262,193.27	\$1,103,701,848.00
Performance Start/End	Oct 2001/Apr 2012	May 2007/Feb 2010	Apr 2010/Feb 2011
ACQ Stage	SDD	LRIP	LRIP



Primary Trip Wires				Secondary Trip Wires				
System Indicator	Baseline Indicator	Cum BEI	SPI	Cum CPLI	CPI	CPI/TCPI 10%	Contract Mods 10%	Baseline Revs 5%
	(b) Yellow					10.9%		N/A

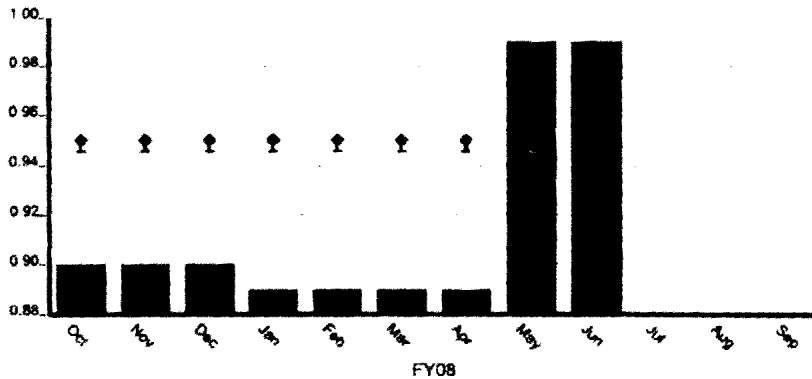
**Primary Trip Wires –**

(a) System Indicator: Please see EV section of report.

(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 10.9 percent more efficient. The BAC has increased by 31% 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. As of month-end May 2008, MS-6.1 baseline dates have been incorporated into the IMS.

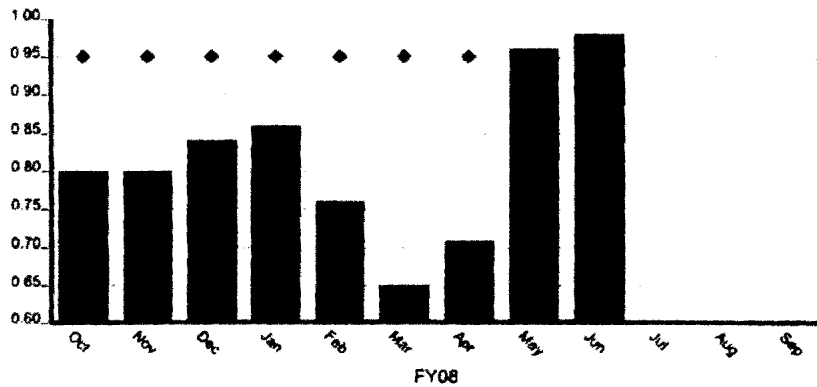


Date	Status	Actual	Target
FY08	■	8.24	8.55
Oct	■	0.90	0.95
Nov	■	0.90	0.95
Dec	■	0.90	0.95
Jan	■	0.89	0.95
Feb	■	0.89	0.95
Mar	■	0.89	0.95
Apr	■	0.89	0.95
May	●	0.99	0.95
Jun	●	0.99	0.95

**Program Baseline Execution Index**

- Baseline Execution Index (BEI): Cumulative Tasks from October 2001 thru June 2008:  
Cum BEI = 127,374 Completed Tasks/128,213 Planned Tasks = 0.99
- Monthly (June 2008) BEI = 1109 Completed Tasks/1797 Planned Tasks = 0.62 (Previous month BEI = 727 Completed Tasks/919 Planned Tasks = 0.79)
- SPI= BCWP/BCWS=  $\approx$  -0.968

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 utilizes the critical path methodology definition being: the longest, continuous sequence of tasks through the network schedule with the least amount of float from contract start to contract completion. After contract start, the critical path is always measured from "time now" until contract completion. An index of 1.0 indicates the program will finish on-time.  $CPLI = (\text{Critical Path}_{\text{Baseline}} \text{ Duration} + \text{Float Duration}) / \text{Critical Path}_{\text{Baseline}} \text{ Duration}$ . The Total Program Critical Path currently shows a projected completion of 21 Nov 2014, approximately one month beyond the latest OTS period of performance.



Date	Status	Actual	Target
FY08	■	7.36	8.55
Oct	■	0.80	0.95
Nov	■	0.80	0.95
Dec	■	0.84	0.95
Jan	■	0.86	0.95
Feb	■	0.76	0.95
Mar	■	0.65	0.95
Apr	■	0.71	0.95
May	●	0.96	0.95
Jun	●	0.98	0.95

Program Critical Path Length Index

- $CPLI = (1573 + (24))/1573 = 0.98$  (Time Now = 29 Jun 08)
- $CPI = BCWP/ACWP = .968$
- $CPI/TCPI = 0.968/1.086 = .891$
- Contracts Mods - (BAC now)/original BAC 10/01 = 1.313

The DCMA Risk Rating for EVMS at the total program level is rated Yellow - using the agreed to parameter of VAC (-6.83%). Compare this to the LM's EAC and one can see a difference of over 6%. Similarly, the  $TCPI_{EAC}$  is different when using the DCMA IEAC versus the contractor's EAC:

$$\begin{aligned} TCPI_{DCMA\ IEAC} &= 0.848 \\ TCPI_{LM\ EAC} &= 1.086 \end{aligned}$$

Cumulative to date SPI and CPI are at .968 and .968 compared to .971 and .970 in the previous month. Cumulative SV% and CV% are -3.24% and -3.33%, compared to -2.93% and -3.11% in previous month and are also rated green.

### **Earned Value**

LMA Earned Value Management System – Level III CAR – As of 9 Jul 08, LM has completed 82% of the work related to CAP within 59% of the scheduled time to complete the CAP milestones. Among the milestones that have been completed are: Evaluation and definition of roles and responsibilities and update documentation, creation of Model to assist in ID of Span of Control and appropriate assignments, development of compliant work authorization process and associated system description update, development of compliant EV cost schedule integration practices and Baseline Change Control Processes and associated documentation updates, development of compliant Variance Analyses Process and Tracking Mechanism, and enhancement of Subcontract Management principles and associated documentation updates.

## 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