Mechanical Systems
August 2003 GSFC Status

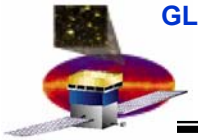
Marc Campell, Subsystem Manager

Accomplishments

- **Accomplishments during September**
  - Grid Box Structural Design Peer Review held
  - X-LAT – E-box interface design review held
  - Successfully completed 1 x 4 testing
  - Completed CAL-Grid interface detailed design
  - Completed X-LAT thermal interface detailed design (pending analysis & test verifications)
  - Tapemation given OK to rough machine billet #1 (internal reviews & meetings with Tapemation held)

Issues & Concerns

- Many open items to be resolved prior to the start of detailed machining of the grid (design, analysis, TRK, EMI, S/C…)
- Inadequate manpower – Mech. Engr., LM support & TCS support
- EMI requirements implementation
- Resolution of X-LAT – E-Box interface including completion of analyses and testing
- X-LAT plate & Radiator delivery schedule



Open Flight Design Issues

ISSUE	CLOSURE
1. Finalize CAL-Grid interface design	Analysis,design finalization, GSFC approval
2. Finalize X-LAT to E-box design	Analysis,design finalization, testing, GSFC approval
3. Close the loop on Grid-ELEC interface (grounding & EMI)	Meeting req'd for consistent implementation across LAT
4. Delete Radiator level EMI test requirement?	Deleted from LM spec. Need to resolve EM testing with ELEC
5. Mechanically install Radiators for LAT EMI test?	EMI test plan out for review
6. Grid-TRK interface define Grid datums & TRK tooling interface	Investigating use of existing TRK drill fixture
7. Define GBA Static Load test requirements & plans	Rob Black has been assigned as responsible engineer for this test
8. S/C Flexures for GBA static load test?	Working w/ analyst & GSFC
9. GBA Thermal cycle vs Thermal Vacuum test approval	What paper needs to be submitted
10. RFA on adding a U heat pipe to X-LAT plate in case of XLHP failure	LM has submitted impacts, awaiting direction
11. Other RFA's closure	
12. Examine removing X-LAT plates from GBA static load and thermal cycle tests to break schedule dependency	LM to submit cost of X-LAT simulator
13. How to handle ITAR hardware in B/33	Working with SLAC legal & I&T

Mech Sys Parts List

- All mechanical parts are approved by SLAC & GSFC

	Inorganic	Polymer & Composite	Lubricant	Process	Total
Mechanical	78	26	4	11	119

  - Expect ~5 miscellaneous fasteners to be added to this list

- 9 EEE parts for Thermal Control System are not yet approved
  - 1 thermistor submitted, approved and ordered
  - 3 Thermal Switches (2 Grid, Radiator) awaiting set point definition
  - 4 Heaters (2 Grid, Radiator reservoir and anti-freeze) awaiting final sizing
  - 1 RTD (for Radiator)

3 Month Milestones

Milestone Description	Original Date	Current Date	Major Reqmnts to Achieve Milestone	Notes
Grid Box detailed stress analysis (Combined with below)	08/03/03	09/30/03	Final approved analysis report memo released.	*Analysis complete. Approval pending 9/23/03 review. Final report due 9/30/03*
Grid Box Design Review	08/01/03	09/23/03	Complete stress analysis. Incorporate design mods as required.	*Complete*
			CAL-Grid interface closure.	*Design review held 9/23*
			GSFC complete drawing package review.	*GSFC review complete.*
Cal-Grid RFA closure meeting	08/03/03	09/23/03	Complete conceptual drawings of shear fittings and grid.	Completed-detail dwgs in work.
			Develop approved LAT test plan and LAT Analysis Plan.	Complete
			Obtain concurrence and required analyses from NRL.	*Complete*
			Complete stress analysis showing positive margins.	*Complete*
			Complete concepts for cable tray installation and I & T activities.	*Design concepts completed.*
			Obtain GSFC concurrence on interface design.	
X-LAT I/F RFA closure meeting Will be split into 2 meetings; A design review on 9/25/03 and final review that includes thermal analysis and EM test results.	08/03/03	11/10/03	Develop shim budget and shim plan for E-boxes	*Complete*
			Complete and document stress analysis on heat pipes and heat pipe bonded joint	*Complete*
			Complete and document thermal distortion and ascent loads senitivity analysis and complete component thermal test on interface joint.	*Complete*
			Develop test concept for thermal performance of E-box stack.	*Complete*
			Document preliminary system level thermal analysis to show positive margins.	*ECD 11/3/2003*
			Obtain GSFC concurrence on interface design.	*Tentative meeting date 11/10/03*

3 Month Milestones (cont)

Milestone Description	Original Date	Current Date	Major Reqmnts to Achieve Milestone	Notes
Deliver 1 x 4 Grid to I&T	09/03/03	10/24/03	Complete 1x4 testing - static load test.	*Complete less report.*
			Drill TRK interface after test.	*Awaiting TRK vibe drill fixture which will be modified to drill the 1 x 4.Available date of fixture is TBD*
Grid MRR	09/12/03	10/15/03	Award 4X4 Grid contract.	*Contract awarded 7/29*
			Close open items list (14 items)	*ECD 10/15/2003*
			Grid Box Design Review complete	Complete 10/23/03
Grid Billets Available	09/12/03	09/16/03	Ultrasonic inspection	*Billet # 1 inspected (no flaws) & delivered to Tapemation. Billet #2 being remade due to out of flatness at mill ECD 10/31/03*
Rough machine grid billets #1	10/03/03	09/25/03	SLAC OK to proceed.	*internal readiness meeting held. Ready to give OK pending closure of A/I's ECD 9/25/03*
Radiator MRR	09/03/03	11/03/03	Spec & IDD complete and released to LM.	*Spec release ECD 10/1/03*
			LM complete Radiator TCS & mechanical designs.	*LM finalizing design w/ VCHP overtemp thermostat for redundant power*
			Close related CDR RFA's.	*CDR RFA's closure in work.*
			EEE parts list approved.	*LM parts need to be submitted for approval*
			Radiator stress analyses complete.	*Radiator stress analysis completed but needs independent review. Kickoff meeting sched. 9/25/03*

Schedule Variances

4.1.8.5 Thermal Control System

- **Cum SV = -$353K late start due to unavailability of key personnel across subsystem lines**
  - **Design, fab, assemble and test control system prototype**
  - **Analyze TCS performance**
  - **Detail drawings & spec for hardware**
- **Recovery plan**
  - **Plan is not in place**
  - **Requirements for prototype are needed**
  - **Jack Goodman hired as LAT thermal engineer to lead this effort**

Schedule Variances (cont.)

4.1.8.7 Grid EM program

- Cum SV = -$169K = -$132 Labor and -$37 Mat'l
- -$37 Material is EM hardware procurements
  - Cantilever Beam, CAL-Grid interface test, Grid HP process tests

EM TASK	SV x $000	COMMENT
Grid Top Flange HP processes	19	Deferring until Fall 03
CAL tab coupon tests	2	Planned work complete,
1 Bay Grid test*	18	Test definition is TBR
Cantilever Beam test*	50	Test deleted. To be folded into 1 x 4 test
1 x 4 Grid test	5	Write test report
X-LAT Plate prototype design, fixtures & fab*	73	LM will perform. Tasks will be deleted after LM Phase II is approved
EMI skirt mock-up	4	Will complete in Aug
Total	169	

4.1.8.7 Grid EM program

- Recovery Plan
  - EM tasks marked * ($141K) will be re-planned along with incorporation of LM Phase II efforts

Schedule Variances (cont.)

4.1.8.8 Flight Fab, Assy & Test

- **Cum SV = -$292K late start of Assembly preparations**
  - **Grid Tasks -$100K**
  - **Grid Mat'l & fixtures -$70K**
  - **X-LAT Tasks -$122K (will to remove from plan)**
- **Recovery plan**
  - **Rebaseline plan is in work**
  - **Grid MGSE next up for Designers after Grid Box designs are released**

Cost Variances

4.1.8.3 Mechanical System Dev

- **Cum CV = -$238k**
  - **Will continue until CAL-Grid and X-LAT – E-box interfaces are finalized**
  - **Additional resources for this will be captured in rebaseline plan.**

Lockheed-Martin cost breakdown by WBS was not available

- **Cum CV = +$557K**
  - **LM did not spend according to plan last month**
- **Recovery plan**
  - **LM manufacturing effort full turn on after MRR 11/03**

4.1.8.7 Engineering Modeling

- **Cum CV = -$107K = -$68K Labor and -$40K Material**
  - **Most of CV is for ongoing EM tests related to Cal-Grid and X-LAT interfaces**
- **Recovery plan**
  - **Additional resources for this will be captured in rebaseline plan.**

Program Threats

- Top 5 threats to maintaining schedule
  - Inadequate manpower
  - Closure of open items for Grid manufacturing
  - Resolution of X-LAT – E-Box interface
  - EM tests and flight designs are being performed in parallel – increases impact of any EM test failure
  - LM does not get their requested information in a timely manner
- Top 6 threats to staying within cost
  - As CDR design and fabrication plans solidify, we may find that fabrication costs exceed what was budgeted (which was based on preliminary/conceptual designs)
  - Grid Box Assy Test program may exceed what was budgeted due to scope increase
  - TCS prototype costs (may require PDU, SIU & GASU boards)
  - CAL-Grid interface design taking longer than budgeted
  - EM program taking longer than budgeted
  - LM cost for X-LAT work larger than budgeted