Mechanical Systems
December 2003 Status

Marc Campell, Subsystem Manager
Accomplishments

• Accomplishments during January
  – Successful Grid MRR in December
  – Tapemation given the “OK to Proceed” with the initial final machining operations on Flight Grid #1
    • Minor revisions to EMI shields, contractual paperwork in place, Tapemation has started programming
  – Tapemation given “OK to Proceed on rough machining billet #2
  – Technical evaluation of Tapemation cost proposal completed – processing of the P.O. change notice is in work (second grid and additional shields & shear plates)
  – Clear cutting of the MECH drawing tree is complete
    • Replanting is in progress to align with latest I&T integration plan
Accomplishments (Cont.)

- **LM Accomplishments during January**
  - Successful Radiator MRR in December
  - Variable Conductance Heat Pipe (VCHP) fabrication has begun
  - Radiator Thermal Vacuum test planning kickoff meeting held
  - GLAST requested LM submit revised cost and schedule to align PCMS with the current forecasted delivery dates
  - LM has submitted their preliminary package including Basis of Estimate for the to go effort
  - BOE’s have been reviewed and approved the MECH & IPO
## 3 Month Milestones Jan - Mar

<table>
<thead>
<tr>
<th>Milestone Description</th>
<th>Original Date</th>
<th>Current Date</th>
<th>Major Reqmnts to Achieve Milestone</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid Box detailed stress analysis (Combined with below)</td>
<td>08/03/03</td>
<td>01/19/04</td>
<td>Final analysis report approved &amp; released.</td>
<td>Analysis complete.</td>
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<td>Draft report out 1/19/04</td>
<td>Draft report out 1/19/04</td>
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<tr>
<td>Deliver 1 x 4 Grid to I&amp;T</td>
<td>09/03/03</td>
<td>Mar 04</td>
<td>Complete 1x4 testing - static load test.</td>
<td>Complete</td>
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<td>Modify Top Flange &amp; cable chaseways</td>
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<td>Drill TRK interface after test.</td>
<td>Pending resolution of TKR-Grid interface</td>
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<td>Compare 1x4 &amp; 4x4 models to determine if 1x4 can be reworked</td>
<td>design mods</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>in progress</td>
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<tr>
<td>X-LAT Plate MRR</td>
<td>Feb 04</td>
<td></td>
<td>Release of X-LAT Plate IDD</td>
<td>Draft out for review ECD 1/30/04</td>
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<td></td>
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<td></td>
<td>Release of X-LAT spec</td>
<td>Draft due 1/30/04</td>
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<td>LM complete design</td>
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<td></td>
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<td></td>
<td>LM complete analysis</td>
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<tr>
<td>Start Grid #1 production</td>
<td>11/15/03</td>
<td>01/23/04</td>
<td>Restricted OK can be given with release of the stress report</td>
<td>Programming started</td>
</tr>
<tr>
<td>Receive Grid #1, EMI skirts, details</td>
<td>03/30/04</td>
<td>05/20/04</td>
<td>Close MRR action items</td>
<td>Revised Grid plating requirements to pull in date</td>
</tr>
<tr>
<td>Start rough machining of billet #2 (Qual unit)</td>
<td>02/02/04</td>
<td>02/02/04</td>
<td>Provide Tapemation OK to rough machine</td>
<td>OK given 1/22/04</td>
</tr>
<tr>
<td>Grid #2 MRR &amp; start machining</td>
<td>03/01/04</td>
<td>03/22/04</td>
<td>Sufficient progress on Grid #1</td>
<td></td>
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<tr>
<td>Grid Heat Pipe bond process Qual</td>
<td>02/24/04</td>
<td>03/05/04</td>
<td>manpower priorities</td>
<td></td>
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<tr>
<td>Radiator Integration Demo</td>
<td>02/19/04</td>
<td>03/15/04</td>
<td>manpower priorities</td>
<td></td>
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<tr>
<td>Grid Assembly MGSE Design</td>
<td>02/04/04</td>
<td>03/15/04</td>
<td>define TRK interface requirements release Top Assy dwgs</td>
<td>in work, need TRK IDD</td>
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<td>in work drafts available</td>
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<tr>
<td>Milestone Description</td>
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<td>Major Reqmnts to Achieve Milestone</td>
<td>Notes</td>
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<tr>
<td>Fab, assy &amp; test TCS prototype</td>
<td>01/30/04</td>
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<td>ELEC responsibility</td>
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<tr>
<td>Finalize TCS design &amp; drawings</td>
<td>03/15/04</td>
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<td>ELEC responsibility</td>
</tr>
<tr>
<td>Order TCS electronics components</td>
<td>01/30/04</td>
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<td></td>
<td>ELEC responsibility</td>
</tr>
<tr>
<td>Design Heater Control Box</td>
<td>03/01/04</td>
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<td></td>
<td>ELEC responsibility</td>
</tr>
<tr>
<td>Order TCS flight hardware</td>
<td>12/19/03</td>
<td>02/06/04</td>
<td>Update of LAT instrumentation plan</td>
<td>Spreadsheet updated</td>
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<tr>
<td>Heaters, thermostats &amp; thermistors</td>
<td></td>
<td></td>
<td>Determine qual+ flight+spares qty for each component</td>
<td>Gunther?</td>
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<td>Get parts approved on EEE parts list</td>
<td>Complete</td>
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Drawing Release Plan

• 39 of 56 (69%) drawings released
  – These are all drawings required for the Grid Box machining at Tapemation

• Remaining hardware is needed for MECH assembly operations in May
  – Feb 5 planned
  – Mar 8 planned
  – Apr 4 planned
Issues & Concerns

• When will we be ready to cut Grid chips – current est. 2/2/04
  – Provisional “OK to Fab” given, but need to close MRR actions
  – Waiting to get on machine
• Grid to I&T delivery date – schedule continues to compress.
• Grid Box Assy Static Load test will be performed on Grid #2 after start of I&T on flight unit. This increases risk.
• Grid thermal control components & Downspout Heat Pipe to Grid thermal joint are not verified until LAT T/Vac test. Difficult to access these components at this level (remove Radiators & ACD).
• ELEC & MECH schedules are not tied for TCS design & fab in PCMS
• X-LAT plate & Radiator delivery schedule due to late starts.
• Details of how, where & who for Grid Box Assembly work needs to be coordinated with I&T
• 1 x 4 Grid delivery date to I&T.
  – Need to implement modified Grid – TRK interface
  – Meeting planned to examined the best way to verify flight interfaces and support beam test
Open Flight Design Issues

• Grid-TRK interface - define Grid datum & TRK interface
  – Working group in progress
  – Evaluating if TRK interface can be put into Grid by Grid Vendor
  – Impacts MECH Assy fixture design

• Define GBA Static Load test requirements & plans
  – Prelim plan presented at Peer Review
  – Working group meetings with Spectrum and GSFC started
  – Interface loads being developed

• Baseline is no thermal cycle test for Grid Box Assy prior to I&T
  – Need to develop risk assessment & trade study.
  – Submit waiver (8 vs. 12 thermal cycles) if required

• Coordination of MECH assembly plans and LAT I&T integration plans.
  – LAT assembly plans shows Downspout Heat pipes coming off.
  – DSHP to Grid thermal joint not verified until LAT T/Vac
Open Flight Design Issues (cont)

• Radiator integration sequence
  – Study complete – shows that current design works, but may not be practical. Looking at 2 work arounds

• Radiator VCHP Helium leak rate may impact ACD PMT’s
  – How to evaluate this? LM can substitute another inert gas, but it impacts ground performance (not on-orbit). LM given the “OK to Fab” the VCHP’s up to the charging operation.
  – ACD He sensitivity may be decreased?

• RFA’s closure
  – RFA’s addressed at Grid and Radiator MRR’s – no show stoppers
  – working with Pat Hascall
Open Flight Design Issues (cont)

- TCS – location of Grid heaters, thermostats, RTD’s and associated wiring needs to be finalized (top assembly drawing)
  - Layouts started
- TCS validation vs. LM modified Radiator Thermal Vacuum & Balance plans
  - What are TCS test requirements? Is this a TCS Qual test?
- U shaped X-LAT heat pipes can be deleted
  - Updated thermal analysis shows that failure of X-LAT Heat Pipe can be tolerated (within ATP limits)
  - Close issue with GSFC and proceed
## MECH Qualification Program

<table>
<thead>
<tr>
<th>Qual Test</th>
<th>Status</th>
<th>ECD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-Top Flange Heat Pipe bond process qual</td>
<td>Parts in fab</td>
<td>Apr 04</td>
</tr>
<tr>
<td>Grid Box Assy Static Load test</td>
<td>Planning in work. Perform on Grid #2</td>
<td>Aug 04</td>
</tr>
<tr>
<td>Grid Box Assy Thermal Cycle test</td>
<td>Plan to delete test</td>
<td></td>
</tr>
<tr>
<td>X-LAT Plate Thermal Vac test</td>
<td>at LMMS</td>
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</tr>
<tr>
<td>Radiator Variable Conductance Heat Pipe new extrusion</td>
<td>1st article tests planned</td>
<td></td>
</tr>
<tr>
<td>Radiator Acoustic</td>
<td>at LMMS</td>
<td></td>
</tr>
<tr>
<td>Radiator Thermal Vacuum</td>
<td>at LMMS</td>
<td></td>
</tr>
<tr>
<td>TCS-Radiator Thermal Balance</td>
<td>Scope is changing. Need to define requirements</td>
<td></td>
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</tbody>
</table>
CUM Schedule

- Budgeted Cost Work Scheduled $6.846M
- Budgeted Cost Work performed $6.614M
- Schedule Variance $231K

- $184K Flight thermistors not received in Dec
- $36K for late EM testing
Program Threats

• Top threats to maintaining schedule
  – Grid delivery from Tapemation
  – Highly compressed, success oriented schedule
  – Better coordination with ELEC on TCS fab and wiring
  – Closure of open items for Grid manufacturing
  – LM X-LAT & Radiator delivery dates

• Top threats to staying within cost
  – Interdependencies on ELEC for TCS
  – TCS costs
    • Prototype may require PDU, SIU & GASU boards
Actions Required to Stay On Schedule

- Replan TCS design & development activities including prototype
- Replan Heater Control Box design, fab, assembly, test (including Qual)
- Compress MECH assembly plans again
  - Some tasks may be performed after delivery to I&T
- Release X-LAT spec & IDD