Mechanical Systems
March 2004 Status

Marc Campell, Subsystem Manager
Accomplishments

• Accomplishments during April
  – Tapemation has completed 80% of final machining operations on Flight Grid #1
  – Tapemation has completed the rough machining and heat treatment of billet #2
  – Released 10 drawings per plan
    • Including Rev 03 of Grid drawing
  – Approved Lockheed’s revised cost and schedule proposal
    • align PCMS with the current forecasted delivery dates
  – Passed Variable Conductance Heat Pipe qualification Burst test
  – Kicked off Radiation Thermal Vacuum test planning meetings (March)
<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>Deliver 1 x 4 Grid to I&amp;T</td>
<td>09/03/03</td>
<td>Apr 04</td>
<td>Release of X-LAT Plate IDD released</td>
<td>Complete</td>
</tr>
<tr>
<td>X-LAT Plate MRR</td>
<td></td>
<td>5/27/04</td>
<td>Release of X-LAT spec released</td>
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<td></td>
<td></td>
<td></td>
<td>LM complete design in work 50% complete</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>LM complete analysis in work 80% complete</td>
<td></td>
</tr>
<tr>
<td>Receive Grid #1, EMI skirts, details</td>
<td>03/30/04</td>
<td>08/04/04</td>
<td>Close MRR action items</td>
<td>Revised Grid plating requirements to pull in date</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stop changing the design</td>
<td>TRK mods &amp; wing mods for Radiator installation proposed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>resolve grid plating issues</td>
<td>vendor quote received</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BFA and Grid available</td>
<td>early May window</td>
</tr>
<tr>
<td>Grid #1-BFA match drilling</td>
<td>01/27/04</td>
<td>05/08/04</td>
<td>BFA and Grid available</td>
<td>Final May window</td>
</tr>
<tr>
<td>Grid #2 OK to proceed</td>
<td>03/01/04</td>
<td>05/29/04</td>
<td>Sufficient progress on Grid #1</td>
<td></td>
</tr>
<tr>
<td>Grid #2 start machining</td>
<td>03/01/04</td>
<td>05/29/04</td>
<td>Sufficient progress on Grid #1</td>
<td></td>
</tr>
<tr>
<td>Grid Heat Pipe bond process Qual</td>
<td>02/24/04</td>
<td>05/28/04</td>
<td>manpower priorities</td>
<td></td>
</tr>
<tr>
<td>Radiator Integration Demo</td>
<td>02/19/04</td>
<td>06/15/04</td>
<td>Receive parts</td>
<td>ECD 5/15</td>
</tr>
<tr>
<td>Grid Assembly MGSE Design</td>
<td>02/04/04</td>
<td></td>
<td>release Top Assy dwgs</td>
<td>in work - drafts available</td>
</tr>
<tr>
<td>Order TCS electronics components</td>
<td>01/30/04</td>
<td></td>
<td>activity started</td>
<td></td>
</tr>
<tr>
<td>Order TCS flight hardware</td>
<td>12/19/03</td>
<td></td>
<td>Update of LAT instrumentation plan</td>
<td>Spreadsheet updated</td>
</tr>
<tr>
<td>Heaters, thermostats &amp; thermistors</td>
<td></td>
<td></td>
<td>Get LM RTD’s, thermistors &amp; heaters approved &amp; on EEE parts list</td>
<td>all approved</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Grid heaters</td>
<td>working w/ vendor; ECD 4/30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Grid thermostats</td>
<td>on order, due 5/04</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MECH thermistors</td>
<td>received</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other Subsystem thermistors</td>
<td>ELEC - PO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LM procured TCS components</td>
<td>LAT level?</td>
</tr>
</tbody>
</table>


Drawing Release Plan

- 53 of 59 (90%) drawings released
- Remaining hardware is needed for MECH assembly operations in May
  - April – 10 released (9 planned)
  - May – 2 planned
  - June – 4 planned
- ~6 new parts (shims, misc. details) required for Grid Box & I&T assembly operations will be added to plan next month
- Known drawing revisions
  - April - 1 planned (Grid)
  - May – 2 planned (X-LAT & Radiator IDD’s)
Concerns

• Tapemation Grid #1 delivery schedule
  – Difficult to press vendor as we keep making design changes
• Grid to I&T delivery date – schedule continues to compress.
• Coordination of MECH assembly plans and LAT I&T integration plans.
  – Late delivery of Grid to SLAC drives whether work will be performed prior to or after delivery to I&T
• Tapemation Grid #2 delivery schedule
  – Start of Grid #2 on hold until we complete Grid #1 machining
• 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).
• X-LAT plate & Radiator delivery schedule have no float remaining due to late starts and manufacturing has just begun
Open Flight Design Issues

- Grid-TRK interface definition **RE-OPENED**
  - Bushings into grid are back
- Best assembly level to match drill ACD to Grid.
  - Grid to Base Frame Assy (BFA) now, or
  - ACD to LAT after ACD delivery to I&T
- X-LAT ground cooling heat transfer media **CLOSED**
  - Inert liquid selected (safe for electronics)
  - Final design of cooling pipes in work
- TCS – location of Grid heaters, thermostats, RTD’s and associated wiring needs to be finalized (top assembly drawing)
  - Grid thermostats are rated to 30V & 2A for 200,000 cycles
  - Planned operation at 35V & 1A
  - Vendor has some test data at 35V up to 2000 cycles
    - Nick Vermani to review test data
    - Only qualified thermostat available with 3 deg on-off differential (power concern)
- Define GBA Static Load test requirements & plans
  - Interface loads developed
  - Detailed load cases & STE being developed
  - Plan to hire Mechanical Engineer for this task
Open Flight Design Issues (cont)

• New request for 200 node thermal math model for launch vehicle thermal analysis
  – Need requirements from LV

• TCS validation vs. LM modified Radiator Thermal Vacuum & Balance plans
  – What are TCS test requirements?
  – TCS risk assessment and Qual test plan requested by GSFC

• Radiator integration sequence
  – Grid modified to allow installation using pure translation
  – Wet joint trials underway. Disassembly a concern

• Radiator level EMI test was deleted
  – Engineering test at this level under investigation by LM

• RFA’s closure
  – working with Pat Hascall
  – X-LAT RFA’s to close by MRR
### 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>May 04</td>
</tr>
<tr>
<td>Grid Box Assy Static Load test</td>
<td>Planning in work. Perform on Grid #2</td>
<td>Feb 05</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>
<td>Nov 04</td>
</tr>
<tr>
<td>Radiator Variable Conductance Heat Pipe new extrusion</td>
<td>1st article tests planned</td>
<td>Apr 04</td>
</tr>
<tr>
<td>Radiator Acoustic</td>
<td>at LMMS</td>
<td>Nov 04</td>
</tr>
<tr>
<td>Radiator Thermal Vacuum</td>
<td>at LMMS</td>
<td>Mar 05</td>
</tr>
<tr>
<td>TCS-Radiator Thermal Balance</td>
<td>Scope is changing. Need to define requirements</td>
<td>Mar 05</td>
</tr>
</tbody>
</table>
CUM Schedule

- CUM Schedule Variance  -$225K
  - $184K Flight thermistors just received in April. Variance will correct next month.
  - $24K for late EM testing
Program Threats

• Top threats to maintaining schedule
  – Grid delivery from Tapemation
  – Grid design & fabrication are occurring concurrently
  – Highly compressed, success oriented schedule
  – LM X-LAT & Radiator delivery have no float and manufacturing has just begun
  – Grid Box will be pathfinder for Flight hardware operations in B33

• Top threats to staying within cost
  – Staying on schedule
  – Interdependencies with DAQ for fab, assy & test of TCS