

OPEN ISSUES = 10/29 NEW ISSUE ADDED = 1

<u>DATE</u>	<u>ITEM</u>	<u>ISSUE</u>	<u>STATUS</u>
<b>Subsystem EMI Requirements</b>			
8/19/2003	28.	Allocation of EMI requirements to the subsystems.	Format has been generated for LAT EMI database. -12/1; Entries are being made for the Tracker and ACD subsystems. <b>-12/12; Input for the Tracker, Electronics, Mechanical Systems and Calorimeter subsystems have been entered.</b>
<b>e Ni PLATING OF Ti</b>			
8/19/2003	1.	Issue between SAI and LAT as to whether or not to use the four flexures as the ground connection between the instrument and the spacecraft. Can the 2.5 mohm requirement be met and keep the inductance low? Any other method would probably infringe upon the thermal impedance at the interface.	-LAT has suggested coating the flexures with electro less nickel which should keep the resistance well below the 2.5 mohm requirement. Still negotiating with SAI. -See item 2. -10/1 Fred Blanchette to contact SAI to discuss. -10/7; Based on e-mail, SAI does not meet the 2.5mohm requirement on connection between spacecraft and instrument. F. Blanchette to work with SAI to resolve issue. -10/15; Issue being worked between SLAC and SAI. -11/19; Issue being still worked between SLAC and SAI. <b>-12/1; LVDS analysis in progress between SLAC and SAI. These analysis results will determine the need for electro less nickel coating of the flexures.</b>
8/19/2003	2.	The implementation of titanium (Ti) with electro less nickel (e Ni); SAI claims there is a possible contamination issue, while SLAC expert says there isn't. SAI concerns were directed at the use of a commercial plating house.	-Telecon held between SAI and SLAC on 8/19. SAI to call F. Gross (GSFC) to find out if GSFC has any experience with e Ni plating of Ti. SLAC to research the possibility of corrosion under the plating and will prepare a test plan for some samples. SAI will review. -Dr. S. Harvey has written a proposal addressing SAI's concerns. Has been sent to SAI for review. - Telecon held between SAI and SLAC on 9/16. SAI to provide analysis to support contention that uncoated Ti will meet the 2.5 mohm requirement for EMI. Fred Blanchette to review the analysis. It was found that uncoated Ti will not meet the 2.5mohm requirement. Per D. Nelson, it is estimated to take 80mhours to test for compliance to the 2.5 mohm requirement. Direction and budget from project management will be needed before this test can begin. - Closure dependent on Item 1 - 10/7; L.Lee to determine status of SLAC's proposal for addressing SAI's concerns - 10/15; Direction given by Project Management start the testing to determine the feasibility of plating electroless nickel on titanium. <b>- 11/19; Plating tank being located to plate the test samples; test can not start until test samples has been plated.</b> -12/18; Preliminary test results have been provided and is being reviewed.
9/2/2003	17	Do the Ti standoff's for the calorimeter baseplate need e Ni plating?	-Yes. Same as item 2. - L.Lee to obtain history of application from Lockheed-Martin and Armalloy of Illinois(Plating shop). <b>-12/1; Still being worked</b>
<b>e Ni PLATING</b>			
9/2/2003	25	Does e Ni have spaceflight history?	-F. Blanchette to check. -Yes. Gathering data. - 9/25;Gathering data from Jim Green and Fred Gross. - 10/7; Waiting for responses from Jim Green and Fred Gross. - 11/19; Still waiting for response from Jim Green and Fred Gross. <b>-12/1; Work in progress</b>
<b>JOINTS</b>			
9/11/2003	28	Large hole in the Calorimeter enclosure to accommodate the AFEE-TEM cable.	-Investigate characteristics of the penetration. - F.Blanchette/L.Lee to review drawing to ascertain if there is an EMI issue or not. <b>-12/1; Issue being worked.</b>

## CONNECTORS

9/11/2003 27 CAL AFEE - TEM cable has no shields on the connectors. TEM connectors have no bulkhead seal. -Add info to the EMI database and investigate.  
- F.Blanchette/L.Lee to review drawing to ascertain if there is an EMI issue or not.  
**-12/1; Issue being worked.**

## HEATERS/RADIATORS

8/20/2003 11. No EMI testing of the heater/radiator arrangement is planned. Emissions from the heaters will not be measured. The converters supplying the power have a chopper frequency of 550 KHz. Cannot wait until instrument level testing to find there is a problem.. -To be worked.  
-D. Nelson doing bench testing with a heater supplied by Mechanical Systems. Additional testing to include tape over the heater will be performed.  
-LM did not cost this test in their Phase II proposal. There will be cost and schedule impacts to Radiator delivery.  
-Radiator is on a day for day slip until specification is released including resolution of this issue.  
-Additional test to be performed with conductive tape on heater. Status D. Nelson on test results. Per D. Horn there will be no test for the heater/radiator arrangement at this time pending results from heater bench testing.  
-D. Nelson to provide status of test using conductive tape and if not completed, what is the ECD?  
10/15; Test completed. F. Blanchette to review results to close this issue.  
**-12/1; Review in progress.**

9/2/2003 15 The radiators, at present, will not be on the instrument during EMI testing. For a truly valid test, the radiators must be mounted during instrument level EMI testing. - Mechanical Systems agrees that radiators should be installed for at the LAT level EMI test.  
- Test details will need to be coordinated with M. Lovellette.  
- I&T needs To assess impacts To current test flow and spacecraft regulated power needs To be available.  
- Systems Engineering needs To revise LAT test Plan.  
-Project approval needed to implement the addition of radiators to LAT level EMI test with the above listed impacts.  
-T. Lesiang to provide impacts 10/14 from I&T and NRL for implementing the addition of radiators to LAT level EMI test. 10/14; Report on impacts completed. Presentation of report at next engineering meeting.  
**11/3; Engineering meeting cancelled; report presentation rescheduled for another time.**

## TRACKER BIAS PLANE

12/1/2003 29. Does the Kapton sheets need to be grounded for ESD purposes? **12/1; Issue being investigated.**

## CLOSED ISSUES

8/19/2003 3. Electro less nickel on the calorimeter/grid structure; D. Nelson wants to use for grounding. M. Nordby says the design still relies on friction to carry the LAT loads. Friction testing has been done only on bare aluminum and alodined surfaces. Is there value added by plating with electro less nickel, instead of just an aluminum to aluminum contact? -To be discussed 9/2 at the Subsystem Engineering meeting.  
-Per D. Nelson presentation e Ni is orders of magnitude lower in  $\Omega/\text{in}^2$  than alodine.  
-Per M. Nordby presentation e Ni must be tested to establish friction allowables.  
-Per M. Campell presentation implementation of e Ni on the grid is a concern for the following:  
(1) Sequence of Grid plating, insert installation and higher level drilling operations.  
Impact: Update Grid Manufacturing plan and plan dued by early September to meet current schedule  
(2) Grid will require high emissivity outer walls.  
(3) Masked areas for bonding operations.  
Impact: Generate new revision grid drawing with e Ni note callout and masking details; drawing dued by mid-September to meet current schedule  
(4) Grid has 2000+ holes so masking/plugging holes is non-trivial.  
-Item reviewed and discussed 9/16; Fred Blanchette to review the quantitative impedance for electroless nickel coating the grid versus bare aluminum/alodined grid.  
**-CLOSED; 9/25 Electroless nickel plating will be used on the grid per L.Klaisner's**

8/19/2003	4.	There are gaps in the ACD BEA boxes; no gaskets or flanges (butt joints only). Investigate.	<p>-G. Shibley says they are not butt joints. Need to review box design.</p> <p>-Met with G. Shibley; all sides have 90° intersections except one. Will revisit when the channels are returned to GSFC. ACD will supply a set of signed off drawings for EMI database inputs as soon as they are ready.</p> <p>- Issue will be closed pending final review.</p> <p>- F. Blanchette to verify that ACD subsystem will implement EMI "fix" in flight hardware.</p> <p><b>CLOSED; 10/15, It is F. Blanchette 's recommendation to implement EMI "fix" on flight hardware.</b></p>
8/19/2003	5.	EMI shield is a butt joint design; therefore contact at the interfaces is questionable.	<p>-Discussed with M. Campell and D. Nelson. Various mitigations are under consideration.</p> <p>(1) Tonque and groove or EMI gasket</p> <ul style="list-style-type: none"> <li>- Difficult to implement on grid near S/C interface &amp; other Grid shear bosses.</li> <li>- Can be done for some skirt to skirt joints and some areas of the X-Lat plate to EMI skirt away from heat pipe exits</li> </ul> <p><u>Impacts:</u></p> <ul style="list-style-type: none"> <li>- Redraw 12 skirt drawings (90 manhours) and drawings are needed late September.</li> <li>- Grid drawing will include redesign &amp; analysis of shear bosses (80-120 manhours)</li> <li>- X-LAT plate is awaiting final definition</li> </ul> <p>(2) Radiator Mount Bracket &amp; Heat Pipe Patch panels could be conductively bonded to each other &amp; the grid (no planned removals after grid assembly)</p> <p>- Fred Blanchette to review the effectiveness of these mitigations and to make recommendation for project management impletation. Meeting set up for 10/9 at GFSC between L. Klaisner, Marc Campell and F. Blanchette.</p> <p><b>CLOSED; 10/14, Agreement with Mechanical Systems to use EMI gasket and groove on EMI skirt.</b></p>
8/19/2003	6.	Cross LAT plate is a butt joint design also; same reasoning.	<p>-Discussed with M. Campell and D. Nelson. Various mitigations are under consideration.</p> <p><b>-CLOSED; See item 7.</b></p>
8/19/2003	7.	Cross LAT plate is three pieces; one piece would be better. Would remove two long joints in the plate and provide better shielding effectiveness.	<p>-Discussed with M.Campell and D. Nelson. Under consideration.</p> <p><u>Issues:</u></p> <ol style="list-style-type: none"> <li>(1) Alignment of X-LAT fasteners to E-box inserts for direct bolting of X-LAT plates</li> <li>(2) LM tooling impacts &amp; VCHP alignment</li> <li>(3) Tolerance of butt joint is an issue at EMI skirts</li> <li>(4) LM cost &amp; producibility</li> </ol> <p>-Discussed with LM; they have no issue with a single plate. Mechanical Systems to look at the tolerance stack up.</p> <p>-Project direction needed for Mechanical Systems to perform tolerance stackup analysis and project management direction will be needed for Cross LAT plate design selection</p> <p><b>-CLOSED; Per F. Blanchette it is recommended that the Cross LAT plate be one piece for EMI considerations.</b></p>
8/19/2003	8.	Flex cables on tracker are not shielded and connectors are not sealed; do not need to seal connectors if cable is not shielded. 50 micron aluminum face sheet will cover the four sides of the tower; any greater thickness would impact the science. Corners will be sealed with conductive tape. Look into the use of conductive tape on boxes for spaceflight.	<p>-F. Gross (GSFC) will investigate.</p> <p>-NRL expert says there is no data to say that adhesive will last ten years.</p> <p>F. Gross supplied vendor and part number info for three acceptable tapes.</p> <p>Will set up interchange between NRL expert and F. Gross.</p> <p>- Fred Blanchette to set up the interchange meeting between NRL and F. Gross.</p> <p>-F. Blanchette to verify flight history of tape with GSFC(F. Gross); Per F. Blanchette it is recommended that "Avoid use of conductive tape if practical within budget and schedule constraints. If necessary used the three acceptable tapes from F. Gross's e-mail on same subject" The three acceptable tapes will listed at next EMI list update.</p> <p><b>CLOSE; 10/17, GSFC approved the use of Chomerics CCJ-36-201 Tape for EMI. The other three EMI tapes approved for use on the project are Lamart 892-L Aluminum Foil Tape with acrylic adhesive, Lamart Corp. Clifton, N.J. Permacel P-111 Aluminum Foil Tape with acrylic adhesive, Permacel Corp. New Brunswick, N.J. Arclad AR- 8003 Copper Foil Tape with acrylic adhesive, Adhesives Research, Inc. Glen Rock, PA</b></p>

8/19/2003	9.	4 in <sup>2</sup> vent holes are being designed into the EMI shield. Are these holes really needed for venting? Ruins the integrity of the shield. Applying a band aid to this scenario is not recommended.	-Discussed with M. Campell and D. Nelson. Need to have someone take a look at the necessity of these vent holes. -Mechanical Systems to review this item. These vent holes is one option but the other option is to vent through the CAL baseplate crenulations, past TRK and out between ACD to Grid gap. Both options have a cost; the vent holes option are straight forward but a 550 khz filtered vent must be designed, developed and tested (120 manhours) in additional to the two needed EMI skirt drawings ( 20 manhours). The EMI skirt drawings are needed by late September to support current schedule. The other option is venting through a convoluted path past TRK & CAL cables. Test will be required since the vent analysis is not robust. -Project direction needed to determine if additional venting analysis is adequate; if not then project direction will be needed for a test to be performed. <b>-CLOSED 9/30 pending approval of specific venting device design provided by M. Campell.</b>
8/19/2003	10.	Are the bands on the connector back shells flight qualified? On Terra had an issue with the bands during vibration testing. Check.	-T. Perry (GSFC) and N. Vermani (NRL) will investigate. -Explained band-it issue to T. Perry; response will have to wait until 9/15 when T. King, connector expert, returns to work from surgery. -Status on 9/16. -10/7; Waiting status from T. Perry and T. King. <b>-CLOSED; Approved for flight</b>
8/20/2003	12.	The present design for mounting the radiators calls for the insertion of G10 spacers between the radiators and instrument structure to provide thermal isolation. From the EMI perspective it would be much more beneficial to the instrument for the radiators to be tied electrically (very low resistance) to the LAT structure such that they become part of the LAT ground plane.	-Discussed with M. Campell and D. Nelson. Under consideration. -Thermal needs direction to provide an analysis of the proposed foil wrap (to provide the low impedance ground connection) over the spacers. - F. Blanchette to provide foil thickness and width on 10/7. <b>- CLOSED 10/7; Per F. Blanchette, Foil thickness on G10 spacers shall be 2 mils minimum and width wide enough to provide satisfactory connection between radiators and Instrument structure.</b>
8/21/2003	13.	The tracker will use copper tape to seal all the "cracks" in the towers. The Calorimeter also has gaps in their panel joints but say that the use of copper tape is not an option as the adhesive deteriorates in space, and the tape will come loose in a few years. Should adhesive backed conductive copper tape be allowed on the LAT? Similar to item 8.	-F. Gross (GSFC) will investigate. See item 8 status. -This issue will be closed pending closure of Issue No.8 <b>CLOSED per response to Issue No. 8</b>
9/2/2003	14	Not all LAT connectors are e Ni. Should they be? Some are gold at present.	-Either e Ni or gold are acceptable; no issue. <b>-CLOSED.</b>
9/2/2003	16	Heat pipes do not have a low impedance connection to ground. Does the silver impregnated bonding material provide this low impedance path?	-The contact area is 12 in <sup>2</sup> each. Need vendor volume resistivity data from G. Lam. - Per G. Lam for CV2646, the resistivity is .004 ohms-cm. - L. Lee to complete calculation 10/14 for review by F. Blanchette. <b>CLOSED; Calculation reviewed by F. Blanchette shows that the silver impregnated bonding material does provide a low impedance path.</b>
9/2/2003	18	For grounding purposes it would be preferred to have the calorimeter boxes e Ni plated.	-Per D. Nelson presentation e Ni is orders of magnitude lower in $\Omega/IN^2$ than alodine. <b>-CLOSED 9/25 per L. Klaisner's direction</b>
9/2/2003	19	Do the heaters need to be shielded?	-Per J. Wang the design is to shield the heaters <b>- CLOSED.</b>
9/2/2003	20	Both ends of the tracker cables have connectors that are not terminated in a 360° shield.	-This should be a moot issue as the flex cables do not have any shielding. Hence, shielding the connector backshells would provide little value added. <b>-CLOSE.</b>
9/2/2003	21	Review board level designs for EMI compliance.	-The board designs can be reviewed for compliance with general EMI board design rules. However, if the issue is whether or not additional filtering is required (for CS and CE), this should be determined through analysis by the board designer. - See Issue No. 22 <b>-CLOSED</b>
9/2/2003	22	Calorimeter board may be noisy; there were indicators in the EMI test data.	-Review the design and determine whether or not filters are required. -Calorimeter contends the noise source is the TEM power supply. - Separate meeting to be setup by Fred Blanchette/Leonard Lee discuss issue in detail. <b>- CLOSED</b>

9/2/2003	23	Heat pipes penetrate the X LAT plate and EMI skirt. How are these penetrations going to be sealed?	<p>-Options are under consideration.</p> <p>- Separate meeting to be setup by Fred Blanchette/Leonard Lee to review options in detail.</p> <p><b>- CLOSED 10/7; F. Blanchette recommends that the heat pipe penetrations between the X LAT plate and EMI skirt be sealed. Details can be reviewed.</b></p>
9/2/2003	26	Plate the ACD BEA boxes with e Ni for grounding.	<p>-Per M. Nordby presentation recommend anodizing the grid perimeter and BEA inside surfaces for thermal purposes. J. Wang to review.</p> <p>-G. Shible will review and discuss with Nordby/Wang.</p> <p>- J.Goodman to provide impact for not anodizing the grid perimeter and BEA inside surfaces for thermal considerations. Need emissivity comparison between Anodized Al and electroless nickel plated Al surfaces.</p> <p><b>CLOSED; The BEA is currently only cooled by conduction and run the risk of overheating if the electro nickel plating is not applied to the inside of the BEA and grid perimeter.. The emissivity of Anodized Al and electroless nickel plated Al surfaces is 0.8 and 0.07 respectively.</b></p>
9/2/2003	24	Is there a minimum internal edge radius requirement for e Ni plating?	<p>-Yes. However, for e Ni plating, the surfaces that must be plated are flat. Therefore, this should not be an issue.</p> <p>- Approval should be given to proceed</p> <p><b>- CLOSED 9/25</b></p>