

GLAST Tracker

*LAT Monthly
Technical Review
September 2003*

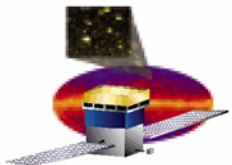
**Monthly Technical / Cost / Schedule Review
GLAST LAT Tracker
September 2003**

September 24, 2003

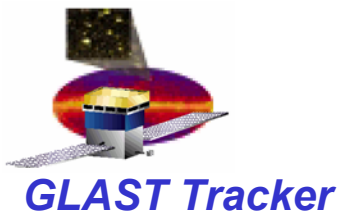
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University of California at Santa Cruz



- ❑ Last Month's Accomplishments
- ❑ Summary of issues & concerns
- ❑ Action Item status
- ❑ Status of Subsystem's Parts List & qualification program
- ❑ Key Milestones for next 3 months
- ❑ Cost and Schedule status



September Accomplishments

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❑ **ASIC procurement**

- 123 GTFE wafers and 20 GTRC wafers in hand (100% of flight needs).
- The last wafer was probe tested last week.
- Wafer lapping, dicing, and inspection is in progress and well advanced.
- All radiation testing was completed successfully!
- However, the GTRC fabrication may need to be redone...

❑ **MCM Front-End Electronics**

- Between DDI, Teledyne, and SLAC we have greatly improved the pitch-adapter flex-circuit attachment, with good alignment, smooth radius, no cracking of traces. However, the trimming fixture still needs some improvement, as the trimming is a bit ragged along the back edge.
- We visited Teledyne to review their proposal and agreed on a way to proceed. SLAC is preparing a contract for the preproduction.
- The 50 preproduction MCM PWBs were received yesterday from DDI.
- The 50 preproduction flex-circuit pitch adapters were received in August from Parlex.
- All SMT parts are in hand and received by Teledyne.
- Issues with Omnetics connector qualification appear to be resolved after a visit to the factory (skin contamination and understanding of traceability).
- MCM/ASIC qualification test plan, MCM test system, burn-in system are in progress.

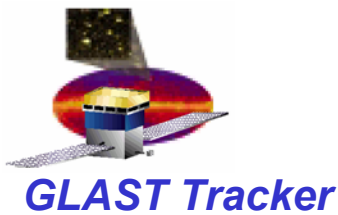
- ❑ **Flex-circuit cables**
 - Grid interface issues were extensively worked and resolved.
 - Final cable length, with all bends specified, was settled.
 - Final mechanical layout in progress.
 - Electrical layout will then be updated and completed.
 - Flex Cable Assembly SOW in release cycle.
 - Connectors were procured for the test jig.
- ❑ **Mini-Tracker Tower (Tracker personnel assisting I&T)**
 - I&T receiving tests were completed at SLAC.
 - Integration with the CAL and Grid was done twice by I&T, and Tracker cable length and fit issues were worked.
 - The GTRC TOT processing was found to have a bug that causes occasional event reading timeouts.



□ Sidewalls

- All issues with ply and panel thickness are completely understood.
- All notes and information needed for drawings were extensively reviewed between Swales, COI, Hytec, Plyform, INFN and SLAC and are complete. The drawings will be ready for release by September 30 or earlier, including drawings for all test coupons.
- Prepreg material is at COI ready for sidewall fabrication. Prepreg was shipped to Plyform September 24. We will have panels and all coupon tests from both vendors.
- Coupons cut from the original panels (see right) have more than enough tensile strength, even with 2 plies missing in the layup.
- New coupons were made at Plyform. Thickness and void density are now well within specifications.
- Techniques for K13D material testing at Plyform (unidirectional coupons) are being understood with help from COI.





September Accomplishments

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❑ **Bottom tray static testing**

- The plan for lower face sheet repair on the bottom tray SN001 was written, reviewed, and approved. The tray has been repaired.
- Flexure static test plan and analysis were completed, and the pre-test review is scheduled for September 30.

❑ **Tray panel fabrication**

- Final release of the mid-tray closeout drawings for flight production was completed.
- Mid-tray closeout machining is in progress.
- Bias circuit drawings are released and going out for bids.
- Finalization of assembly drawings and documentation of resolution of PRR actions are in progress.

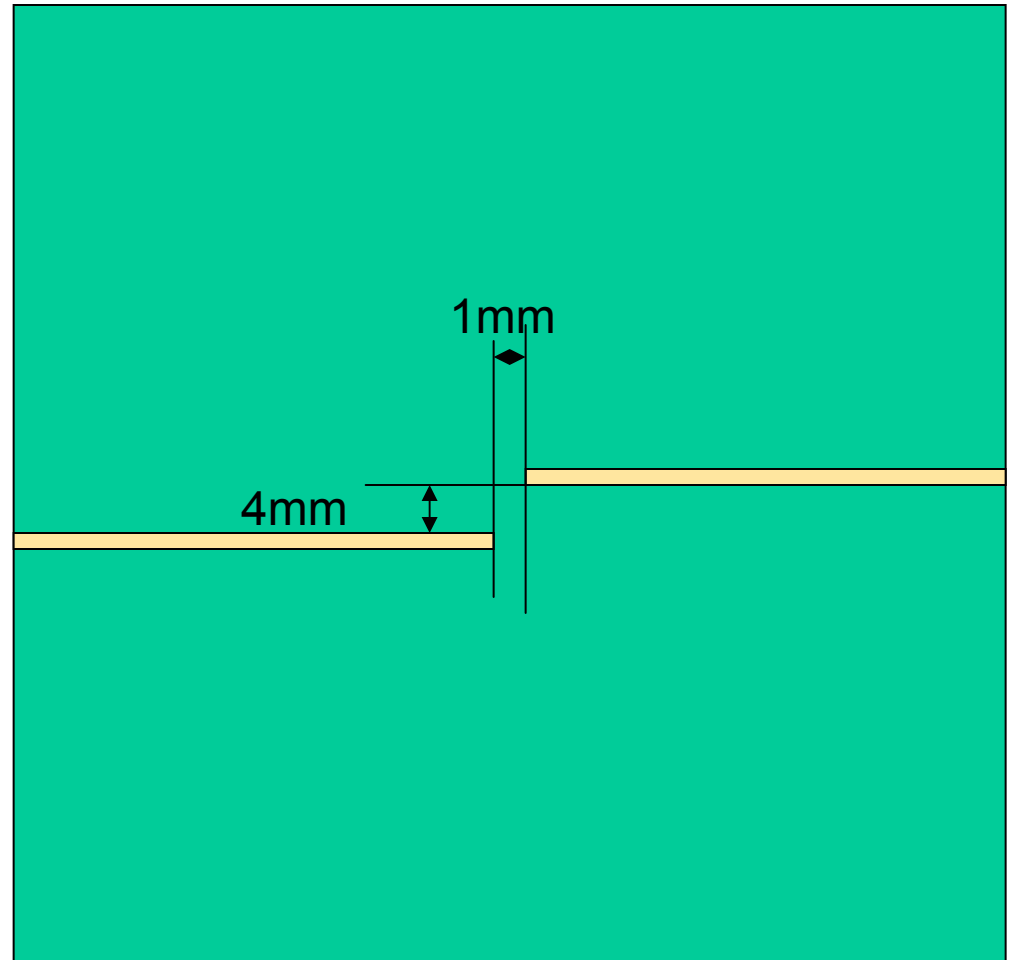
❑ **Collaboration Meeting**

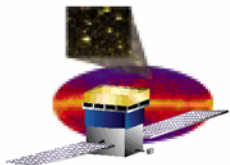
- Used up a week of time for many of us.
- Fruitful discussions with Italian colleagues and visits to G&A, Alenia Spazio, and INFN Pisa.

❑ **New Tracker engineering hire at SLAC: David Rich**

□ Thick Tungsten foils

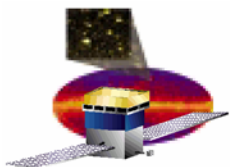
- Hytec completed an analysis of the effect on tray stiffness of splitting the foils.
 - Only a 1.1% drop in the fundamental frequency.
 - Margins of safety in the panel and the tungsten are more than adequate.
- INFN has proposed a method to cut the foils that has no impact on their tooling or assembly procedures and is low cost.
- Kerf would be about 0.2 mm.





❑ **Difficulties in starting the MCM assembly line**

- The critical path in getting Tracker flight production started.
- All parts needed to get started are in hand, except for connectors, which were delayed by issues found at GSFC.
- PWB preproduction now looks excellent, and we now achieve excellent results with machining the radius.
- One remaining process issue: flex-circuit trimming. It appears that the board needs to be held more rigidly in place relative to the cutter.
- The high Teledyne flight production quote was driven by their concerns over materials that we deliver to them. We agreed to a contract for the preproduction and to review flight production costs afterwards.
- The 16-week preproduction estimate from Teledyne was viewed by them as worst case, in the event of major problems. They agree that it can go much faster, and they are willing to work 2 shifts.



□ GTRC Issues

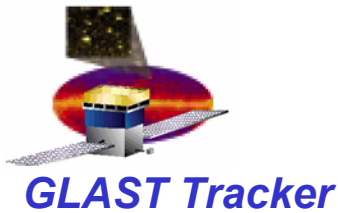
- TOT bug. Most likely the TOT cannot be used with the present chips. The problem and the fix are well understood, but remaking the chips is a major schedule and manpower problem.
- Extra clock delay in data transmission from one GTRC to the next.
 - RC delays (?) result in the chip capturing the data 1 clock later than intended when operating at 20 MHz (and above).
 - This may not be a problem in itself (note that the mini-tower functions at 20 MHz), but there is a zone of instability at lower frequencies (around 18 MHz).
 - The transmission operates as intended at low frequency (about 16 MHz and below).
 - Detailed understanding of the cause is in progress, as of yesterday.

□ EM Environmental Tests

- Delayed into November/December by the need to redo the sidewall panels.
- Significant planning and preparation are still needed, especially for T/V.

□ Design changes and production improvements needed with respect to the EM

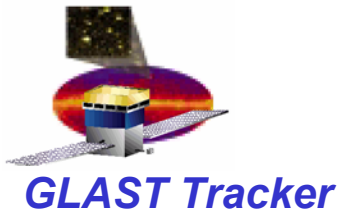
- Plan to make a new “mini-tracker” with 4 x,y planes from the first few trays produced, using preproduction MCMs.
- Plan vibration and thermal/vacuum testing of the first trays assembled with preproduction MCMs.



Issues/Concerns

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- ❑ **MCM attachment and wire-bond encapsulation.**
 - Procedures and tooling are developed but still being proved at G&A. This appears to work well at this point, as long as we achieve good results on the pitch-adapter attachment at Teledyne.
 - Verification of this interface in thermal vacuum will have to await assembly of the first trays, using preproduction MCMs.
- ❑ **K13D Sidewalls**
 - We and our Italian colleagues are confident that Plyform will deliver panels meeting specifications this time. Nevertheless, the project has decided to back this up with a parallel EM production at COI. Hence this risk is well covered.
- ❑ **Late delivery of MCMs and Flex-Circuits to Electronics and I&T**
 - Assemble 36 MCMs (without right-angle interconnects) at a quick-turn vendor (9 are already in progress; 3 completed and were debugged/reworked by the Tracker group).
 - Initial tests using burn-in cables; in assembly.



EEE Parts List and Qualification Plan

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❑ **ASICs**

- Wafer probing, lapping, dicing, wafer inspection all approved and nearly completed.
- Qualification plan (MCM level) is in the works, based on recommendations by N. Virmani.

❑ **PWB**

- Spec, drawing, and procurement approved.
- 50 preproduction boards received (second iteration). They and coupons need to be evaluated to release the remaining production.

❑ **Pitch-adapter flex**

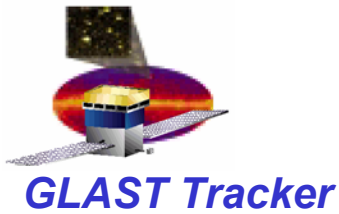
- Need PCB approval of the final drawings and specifications.
- Preproduction articles are in hand.

❑ **Nano connectors**

- GSFC found issues with the 2nd preproduction lot.
- One issue (traceability) was only a misunderstanding. The contamination issue was resolved in a visit to the vendor.

❑ **Micro-D connectors**

- Approved. Qualification testing to be done at GSFC.



EEE Parts List and Qualification Plan

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❑ SMT Parts

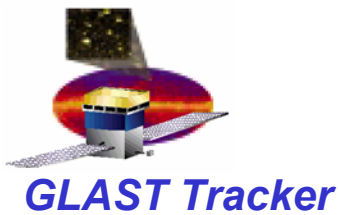
- All are approved and at least partial quantities of all of them are in hand.
- Agreed upon flight-lot qualification tests are in progress on the polyswitches.

❑ Bias-circuit flex

- No new design changes since the last prototype, except labeling details.
- Need PCB approval of the drawings and specifications.

❑ Flex-Circuit cables

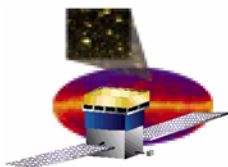
- Spec is approved.
- Some work remains on the layout and drawings.
- The SOW is out for signatures and release.



Tracker Near-Term Milestones

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Milestone Description	Original Date	Current Date	Major Reqmnts to Achieve Milestone	Notes
Static Test Bottom Tray	07/25/03	10/31/03	Completed on schedule for 1 of the 2 trays, to the static equivalent of the random vbe levels. To complete the program: Repair of bottom damaged face sheet. Analysis. Review of detailed plan.	Face sheet repair in progress. Review of flexure test plan 9/30/03. Final static test will occur when new sidewalls are ready.
Vibration and T/V Test of EM Tower	08/01/03	12/20/03	Fabricate conforming sidewalls: Fabricate and test coupons from existing prepreg. Procure new prepreg. Review drawings and specs. Make and test coupons from existing material.	Prepreg has been procured. Drawings are updated. Work on sidewalls is starting. Vibration test in November, T/V in December.
Delivery of mini-tower to I&T	08/22/03	08/22/03	Completed	
AV: Delv of TKR EM to SLAC I&T/MGSE	08/22/03	01/02/04	Complete vibration and T/V testing. Ship to SLAC.	
Tracker replan progress review	09/05/03	09/26/03	Teledyne contract, delivery dates for MCMs	Replan in progress using proposed build schedule installing ladders onto trays before MCMs. Review with Lowell 9/26/03.
Deliver 36 MCMs and 8 flex cables to electronics	09/15/03	09/15/03	We have provided the MCM and burn-in cable parts to the electronics group. We are helping them with testing and debugging, but it is their schedule now to complete these parts.	We are assisting elec group to build MCMs without right-angle-interconnect, using parts in hand. Plus we will use burn-in cables that are in hand.
Composite tray panels assembled for tower A	09/30/03	12/16/03	Bias circuits, tungsten foils, bottom tray closeouts. Drawing review & release. Closure of PRR action items	Machining of closeouts began. Still need some items and drawings signed off for assembly.
Start flex-circuit cable production	09/30/03	10/20/03	Complete design. PRR	Work still in progress to close issues on Grid/TEM interface. Then the detail layout must be updated.
Start flight sidewall production	10/15/03	01/05/04	Successful completion of EM sidewalls and coupon tests. Completion of EM T/V testing. Order material in advance.	
Start the MCM preproduction run	09/30/03	10/10/03	<i>Teledyne proposal received 8/15/03.</i> Resolution of MCM assembly issues. Remake PWBs. Manufacture pitch adapters. MCM pre-production review. Set up burn-in station at SLAC.	Contract with Teledyne for the preproduction is nearly in place. Last technical issues still being resolved.



Near Term Schedule Summary

September	October	November	December	January	February	March	April	May
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EM Completion	Sidewall Fabrication		Vibration Testing	T/V Testing
	Static Test			

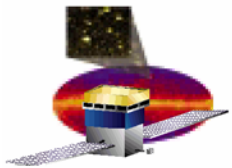
MCMs	Production Preparations	Preproduction Run	Burn In	1st Production Run
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Tray Panels	Machine Closeouts; Bias Circuits, etc	Assemble Panels for Tower A and Test
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Flex Cables	Complete Design and PRR	Manufacture and Test First Flight Cables
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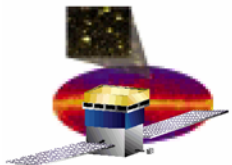
Tower A	Assemble Ladders on Trays	MCMs on Trays	Test Trays & Assemble Tower A	Tower A Testing and Shipping
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New GTRC	Update Design and Verify	Wafer Fabrication	Test & Dice	System and Radiation Testing
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Schedule Variance Report

- ❑ Schedule variance: -\$74k for July
 - ❑ **Scheduled MCM production start did not happen accounting of the majority of the negative variance.**
- ❑ Schedule variance: -\$608k total accumulated
 - ❑ **Delays in starting MCM production**
 - ❑ **Delays in starting flex-circuit production**



Cost Variance Report

- ❑ Cost variance: -\$94K for June
 - **-\$9.6k each month for electronics test engineer**
 - **-\$24k flight tower design and fabrication effort**
 - **-\$49k in additional electronics overruns**
 - **-\$6k for Ames shake test last fiscal year**
 - **-\$5.4k misc small variances in labor**
- ❑ Cost variance total: **-\$347K**