

GLAST Calorimeter

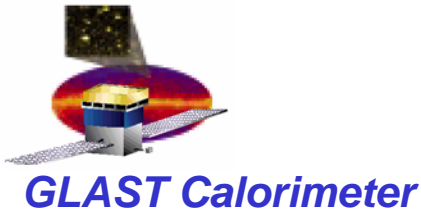
*Monthly Cost /
Schedule / Mission
Jan 2004*

Monthly Cost/Schedule/Mission Review

GLAST LAT Calorimeter Jan 28, 2004

**W. Neil Johnson
Naval Research Lab**





Outline

*Monthly Cost /
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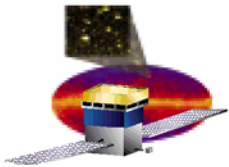
Technical Status:

- ☐ Last Month's Accomplishments
- ☐ Near-term Milestones & Status towards them for next 3 months
- ☐ Drawing Release Plan and Status
- ☐ Summary of issues & concerns
- ☐ Status/Closure of action items
- ☐ Open Design/Engineering model/manufacturing issues and closure plan for them
- ☐ Documentation and qualification program

Cost & Schedule

- ☐ Variances
- ☐ Actions required to retain zero schedule variance





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Significant Accomplishments January 2004

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□ CDEs

■ Csl Crystals

- To date Kalmar has delivered ~750 fully tested crystals to NRL. They have received ~1050 (out of 1950) from Amcrys-H.

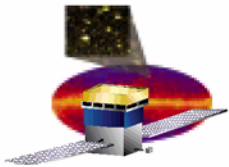
■ PIN Photodiode Assembly (PDA)

- ~3150 (of 4800) Dual PIN Photodiodes (corrected flight process) have been received from Hamamatsu
- ~ 850 flight PDAs have been manufactured, tested and delivered to Swales.

■ CDE Assembly Process

- ~340 CDEs have been bonded at Swales
- Of these, 25 have been wrapped and capped. (12 are qualification units).
- Completion of the CDEs has been limited by availability of end caps from LLR Ecole Polytechnique. (50 have been delivered, 300 more are due by end of January).
- The planned production 60 CDE per week is apparently an easily obtained goal.





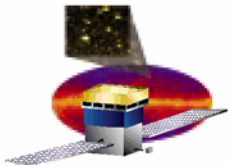
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Significant Accomplishments January 2004 (2)

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- ❑ **Composite Structure Manufacture – LLR Ecole Polytechnique**
 - **Composite structure manufacture began Jan 15th at LLR. NRL participated, reviewed processes and documentation.**
 - During layup of structure, a flaw was noticed in several of the prepreg plies
 - Paper backing lifted causing semi-curing in some areas.
 - NCRs created and manufacture continued.
 - Completed structure looks good, passed metrology.
 - Experts suggest that the structure is probably OK but verifying it would be difficult.
 - Strength testing scheduled for 1st week of Feb.
 - **Investigation / Mitigation**
 - All existing composite layup kits have been re-inspected. One additional kit indicated problem – it has been set aside. Both kits associated w/ one roll of prepreg. This problem is being investigated w/ HEXCEL in Utah. More material will be ordered.
 - NRL plans to assemble PEM from this structure (for training) but will set it aside for potential delivery as 18th module (spare). Alternatively, a 19th structure will be fabed.





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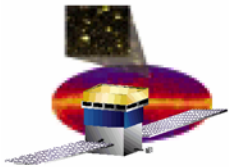
Significant Accomplishments January 2004 (3)

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❑ Structure Machined Parts – NRL

- Late start in machining (drawing approval and release) has been mitigated by \$\$\$. All parts complete by Feb 16th using 2 – 3 shifts in shop.
- Late discovery of error in close-out plate required modified design – need serpentine EMI “o-ring” groove to avoid helicoil holes.
- First article inspection of base plate and top frame are complete. All copies have been rough cut.
- All closeout plates (40 X, 40 Y) are complete.
- Side panels are being manufactured in France. Delivery scheduled for next month.





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Significant Accomplishments January 2004 (4)

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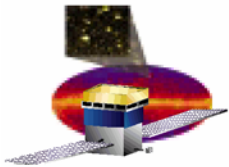
❑ AFEE Electronics

▪ Radiation Testing

- Laser probing of ASICs, ADCs, and DACs at NRL was used to help identify SEU and SEFI sensitivities.
- Heavy ion testing at BNL for MAX145, MAX5121, GCFE9A and GCRC5 investigated LET thresholds for SEU and SEFI. No SEFI detected.
 - MAX5121 is SEU sensitive – value change and/or reset. Cross section is small and not a problem for CAL use.
 - GCFE9A SEU-resistant registers are more sensitive to SEU than expected but the observed upset rate is still very small and not a problem for flight.
- There are no outstanding SEL, SEU, or SEFI issues for CAL. Flight lot ASIC tests will occur in Feb. Remaining TID testing will occur in Feb. (Prelim TID on GCFE occurred in Dec '03 and showed no problems.)

- Prototype of flight AFEE boards (X & Y) have been received, assembled and are currently in test.
- 7 GCFE test stations have been fabricated and are ready for flight part functional tests.





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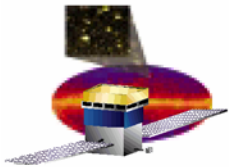
Significant Accomplishments January 2004 (5)

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❑ AFEE Electronics (cont)

- 2 GCRC test stations have been assembled for functional testing of flight ASICs
- **Lot T36T ASICs delayed at ASAT – Non-accomplishment**
 - 9 GLAST ASIC die (CAL, ACD, T&DF) of Lot T36T were shipped to ASAT in November.
 - ASAT reported that all had been packaged and shipped from Hong Kong before the end of the year. 2 ASICs (GCRC5, GAFE7) arrived.
 - Evidently the other 7 ASIC die were actually held up in Hong Kong behind a rush order from a big customer.
 - They will be shipped by mid February. GCFE9A will be at NRL on Feb 9. **This is the CAL critical path for delivery of FMA and this date is 8 weeks behind schedule.**
 - Qual testing of ASICs at GSFC will require priority to meet schedules for assembly of AFEE boards.





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Significant Accomplishments

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❑ EM CAL Module

- EM CAL has returned to NRL after successful beam test at GSI in Germany.
- EM now supporting Flight test script development.

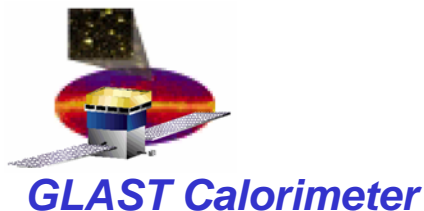
❑ Mini-EM (2 active layers with full electronics)

- Assembly and test completed.
- Shipped to SLAC on Jan 8.

❑ I&T Facilities

- Assembly of dedicated CAL clean room in the NCST I&T building is complete. Contract for improved humidity control is in development.
- Refurbishment of ESD clean rooms in SSD is complete.



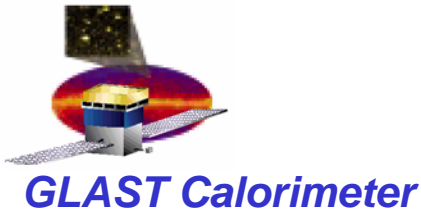


CAL Near Term Milestones

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Activity ID	WBS	Activity description	Early Start	Early Finish	Current Finish	Comments
5C57000050	4.1.5.5.7	Fab PDA Lot 1 (600)	2-Dec-04	7-Jan-04		Done
5C61500030	4.1.5.6.1.5	Aluminum Parts Manufacture	3-Nov-03	6-Feb-04	16-Feb-04	Base, top frame, closeouts
5C62300000	4.1.5.6.2.3.1	IN: Receive FMA Mechanical Struct		9-Feb-04	20-Feb-04	delay in strength test schedule
5C62300030	4.1.5.6.2.3.1	CDE Inspection	10-Feb-04		17-Feb-04	FMA CDE
5C62300040	4.1.5.6.2.3.1	CDE - Mech Struct Integration	25-Feb-04		9-Mar-04	Begin FMA PEM assembly
5C76000224	4.1.5.7.6.1	Package ASIC Lot T36T	30-Oct-03	17-Dec-03	8-Jan-04	Come and gone w/o ASICs - still slipping.
5C76000228	4.1.5.7.6.1	IA: GCFE9A, GCRC5 for Screen/Qual		17-Dec-03		
5C76000460	4.1.5.7.6.1	100% functional test GCFE/GCRC	17-Dec-04	23-Dec-04	20-Jan-04	Test equipment is ready
5C76000480	4.1.5.7.6.1	10% RC Post Burn In Func test (-30C,25C,85C)	15-Jan-04	29-Jan-04		Thermal forcing hood setup needed.
5C76001000	4.1.5.7.6.2	AFEE PCB manufacturing	15-Jan-04	5-Feb-04	19-Feb-04	Finish check of 1st prototype this week.
5C76001050	4.1.5.7.6.3	Board Assembly (vendor)	9-Mar-04		7-May-04	
5C77300120	4.1.5.7.7.3	ND: (5) EM2 TEM/PS for AFEE board ass'y & test		15-Jan-04		Delay is not a problem
5C77300130	4.1.5.7.7.3	ND: (5) CAL Test Stations for AFEE ass'y & test		15-Jan-04		Delay is not a problem



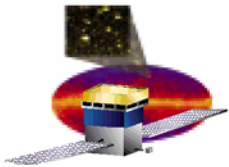


Plans for February

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- ❑ Continue flight production of PDA, CDE
- ❑ Complete qualification testing of DPD and CDE
- ❑ Complete remaining radiation testing on all plastic encapsulated parts.
- ❑ Complete functional testing of flight ASICs. Start qualification program at GSFC.
- ❑ Complete testing of prototype AFEE cards, release flight AFEE PCB to manufacture and establish board assembly contract.
- ❑ Complete manufacture of structure aluminum parts.
- ❑ Begin 1st PEM assembly

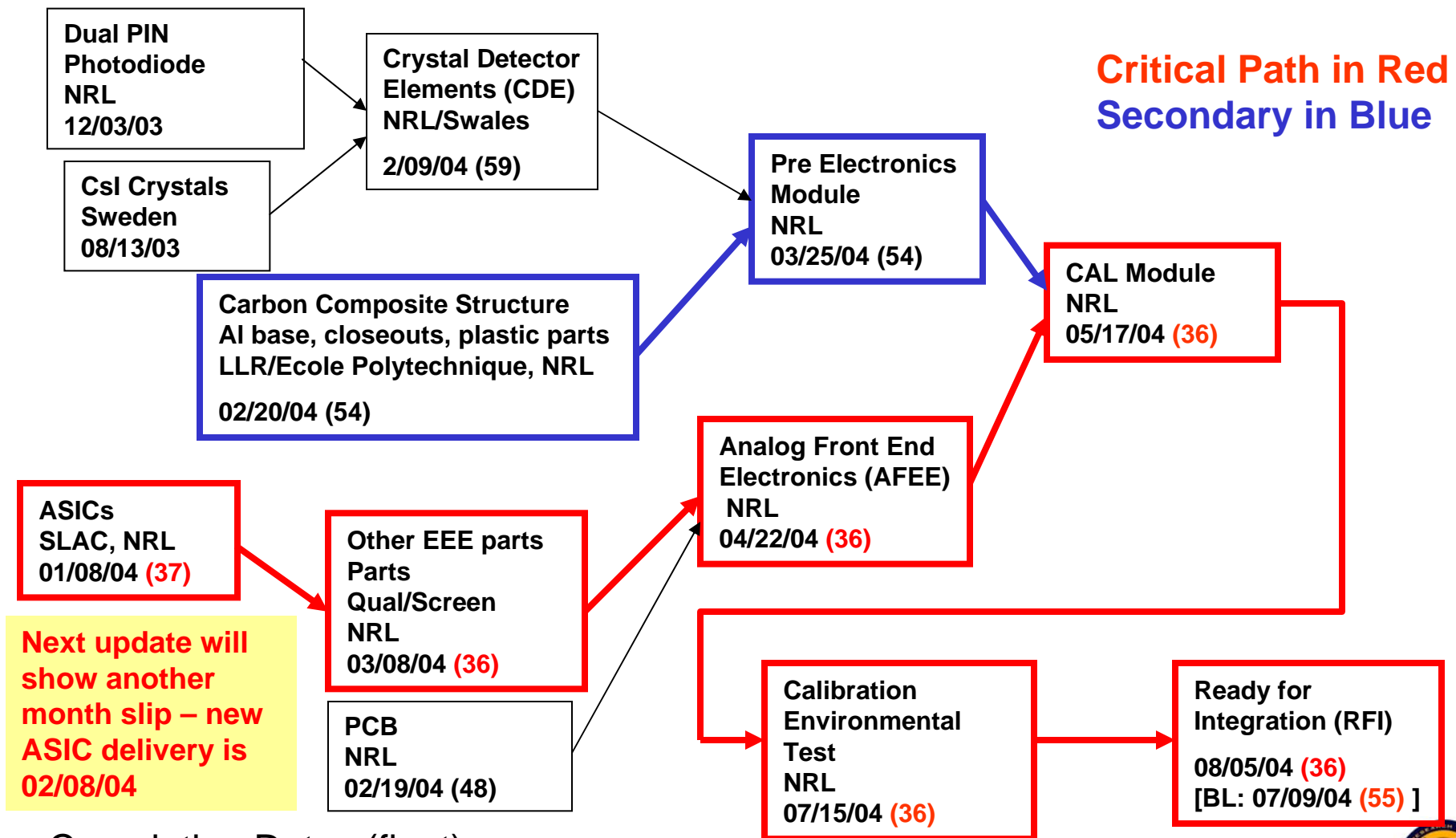


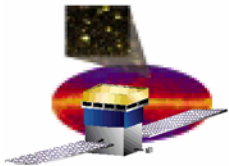


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PMCS Critical Path Protoflight Module (FMA)

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Drawing Release Summary

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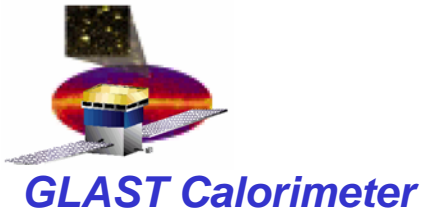
Flight Hardware Drawings

Element	Total Dwgs	Completed Dwgs	Comments
CDE	6	6	
AFEE	10	4	Schematics, Assy Dwgs, Parts Lists, Released after completion of prototype testing
Structure	20	18	Revised module assembly drawing, ECO on base plate.
TOTAL	36	28	78% Complete

Total Drawings – Flight hardware + fab tooling and GSE

- Identified: 141
- Completed: 112 (79%)





Issues and Concerns

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❑ **EEE Parts**

- **ASIC packaging, qualification and testing.**
- **Execution of functional testing of GCFE**
 - Requires 7 test GSE and supporting software for GCFE – 11,000 parts.
- **Readiness for sample testing (10%) at –30, +25, +85 C**
 - Modified test board with thermal forcing unit and enclosure.
 - Thermal forcing unit is being set up.

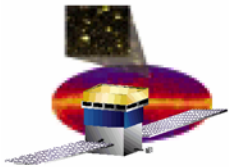
❑ **AFEE Assembly**

- **Verify redesign of AFEE layout.**
 - Prototype boards have been received and are being assembled.
 - Routing and handling of PDA wires to AFEE board are still concerns but new board layout looks promising.

❑ **Composite Structure manufacture**

- **Adequate resources to sustain build and test rate.**
- **Scheduling of vibration facilities (vendor) for strength tests.**





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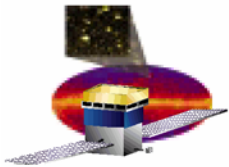
Open Design / EM / Manufacturing Issues

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❑ EMI/EMC performance

- Outstanding issues are closing holes thru base plate around AFEE-TEM cable and getting good shield on cable.
- Design of aluminum cable shield is not complete.
- EM testing failed EMI/EMC specs for CAL. Will not be able to test design changes until FMA. Still need testable spec and reasonable test configuration.





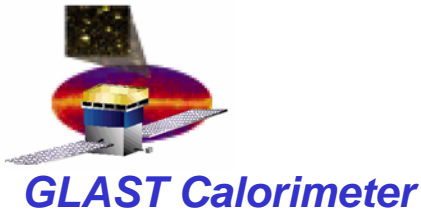
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Documentation and Qualification Program

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- ❑ **CDE manufacture and test procedures – 100% complete**
- ❑ **Composite Structure manufacture and test procedures – 100% complete**
- ❑ **EEE qualification and screening procedures – 80% complete**
- ❑ **ASIC documentation – need GCFE9A design and operation parameters specification.**
- ❑ **AFEE PCB manufacture and assembly**
 - **Procurement specifications – 100% complete**
 - **Parts lists and assembly drawings – 95% complete**
 - **AFEE functional test procedure – 50% complete.**
- ❑ **PEM Assembly and Test**
 - **EM versions of procedures exist. Need modifications for flight – mainly tooling changes**
- ❑ **Module Assembly and Qualification/Acceptance**
 - **EM versions of procedures exist from EM qualification program. Need modifications for flight protoflight/acceptance testing.**





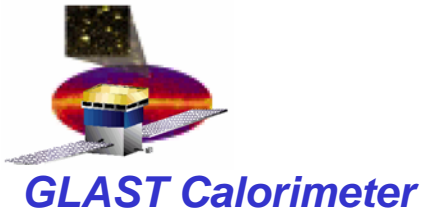
PMCS - Dec '03 Cost Variances

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❑ Cost Variance: + \$1,596 cum

- **+250: Mgmt, Eng, R&QA, ~ ½ labor, ½ travel**
- **+841: CDE Manuf.**
 - Expect to realize significant savings (>200K) in mgmt labor
 - Expect to realize significant savings (100 – 300K) in tooling costs. Currently working w/ ½ of planned tooling without problem.
 - Remaining is delays in invoicing and approximations in representation of the work.
- **+116: PEM**
 - Invoicing delay in facilities preparation
 - 50-50 task for machining – started but no invoices.
- **+175: AFEE**
 - Delays in GSE invoicing with potential for cost savings.
 - NRL-contributed thermal-vac chamber
- **+193: Module Ass'y & Test**
 - Invoicing for mech and elect GSE handled as 50-50 tasks in PMCS.



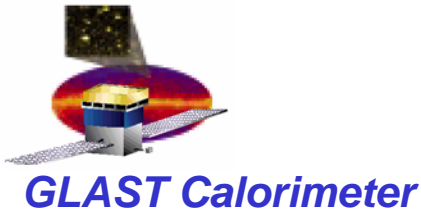


PMCS - Dec '03 Schedule Variances

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- ❑ **Schedule Variance: - \$316 cum**
 - **- 27: CDE Manuf.**
 - Completion of DPD qualification testing, completion of PDA tooling
 - **- 77: PEM**
 - Delay in start of machining
 - **- 208: AFEE**
 - Delay in delivery of ASICs causing delay in screening and qualification work





Actions to obtain Zero Schedule Variance

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- ❑ Make time run backwards
- ❑ Major schedule slip has been caused by delay in delivery of ASICs from ASAT – now about 8 weeks
- ❑ Mitigations
 - Accelerate screening and qualification programs to facilitate improved date for assembly of AFEE cards. This will improve delivery of FMA but will not likely get back on schedule.
 - TVAC FMA by itself rather than waiting for FMB
 - Assemble first 9 modules as quickly as possible (~ 1/week), rather than the 2 week cadence in PMCS. This could incrementally improve deliveries until modules 9 – 16 are back on schedule.

