

AntiCoincidence Detector

**GLAST Large Area Telescope:
Cost/Schedule Review
March 2, 2005
AntiCoincidence Detector (ACD)
Subsystem
WBS: 4.1.6**

David J. Thompson
Thomas E. Johnson
NASA Goddard Space Flight Center
Subsystem Manager/Instrument Manager

David.J.Thompson@nasa.gov
Thomas.E.Johnson@nasa.gov

Significant Accomplishments

- **Completed flight PMT mechanical and electrical assembly. Final 12 PMTs began the coating process on February 23.**
- **Completed vibration and TVAC on first two flight Electronics Chassis.**
- **Completed assembly of Electronics Chassis's #2-5. Five down, three to go.**
- **Made some progress on the EGSE.**
- **Started Integration of the first flight Electronics Chassis into the full ACD.**

Near Term Milestones

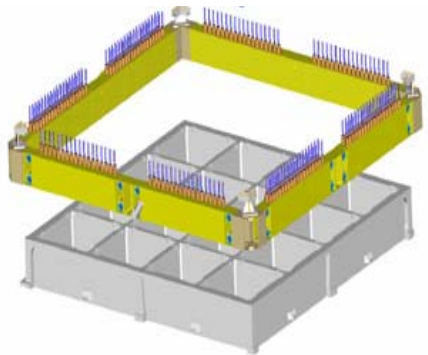
Milestone Description	Date	New Date	Status/Notes
Complete PMT Assembly	January, 2004	<u>2/25/05</u> <u>3/4/05</u>	<u>Nearing the end, final PMTs in coating.</u> <u>Mechanical parts availability and quality has impacted completion.</u>
Complete Flight Mechanical Drawings	September	<u>2/18/05</u> <u>2/28/05</u>	<u>COMPLETE</u>
Thermal vacuum test Qual/Flight Spare Electronic Chassis using fully functional EGSE	12/15/04	<u>1/24/05</u>	<u>COMPLETE. Open liens due to EGSE issues.</u>
Complete 1 st Electronic Chassis Assembly and Functional Test	1/26/05	<u>2/3/05</u>	<u>COMPLETE. Open liens due to EGSE issues</u>
Flight TSA integration complete (except 2 bottom rows)	1/28/05		<u>COMPLETE</u>
(4) electronic chassis vib/ tvac tested and RFI	3/5/05		<u>Slight delay due to weather, should recover by working through weekend of 3/5 & 6.</u> <u>Status on next slides.</u>
(4) electronic chassis vib/ tvac tested and RFI	3/28/05	<u>3/12/05</u>	<u>Electronic Chassis testing descopes accelerated schedule</u>
ACD Integration Complete	4/6/05	<u>3/23/05</u>	<u>Electronic Chassis testing descopes accelerated schedule</u>
ACD Functional Test AntiCoincidence Detector	4/13/05	<u>3/30/05</u>	<u>Electronic Chassis testing descopes accelerated schedule</u>

PMT Assembly - Schedule of Events

PMT QTY.	Cleaning (Materials)	Mechanical Assembly	Electrical Asm. & Test	Thermal Cycle	Coating & Enclosures	Connector Installation	Light Tight Testing
	IN / OUT	IN / OUT	IN / OUT	IN / OUT	IN / OUT	IN / OUT	IN / OUT
1 - 10	Done	Done	Done	Done	Done	Done	Done
11 - 17	Done	Done	Done	12/3 / 12/6	12/6 / 12/10	12/10 / 12/13	12/13 / 12/13
18 - 33	Done	Done	11/30 / 12/3	12/3 / 12/6	12/6 / 12/10	12/10 / 12/13	12/14 / 12/15
34 - 64	12/1 / 12/2	12/6 / 12/10	12/8 / 12/15	12/15 / 12/16	12/16 / 12/30	1/3 / 1/5	1/6 / 1/8
65 - 95	12/2 / 12/3	12/13 / 12/17	12/15 / 12/21	12/22 / 12/23	12/27 / 1/5	1/5 / 1/6	1/7 / 1/10
96 - 126	12/6 / 12/7	12/20 / 12/30	12/22 / 12/28	12/29 / 12/30	1/3 / 1/10 > 2/1 / 2/8	1/11 / 1/13 > 2/9 / 2/10	1/13 / 1/15 > 2/11 / 2/14
127 - 157 > 127 - 150	12/6 / 12/7	1/3 / 1/7 > 1/31	1/5 / 1/11 > 1/31 / 2/3	1/12 / 1/13 > 2/4 / 2/5	1/13 / 1/1/21 > 2/7 / 2/12	1/24 / 1/25 > 2/14 / 2/14	1/26 / 1/28 > 2/14 / 2/15
158 - 188 > 151 - 174	12/7 / 12/8	1/10 / 1/14 > 2/1 / 2/6	1/12 / 1/19 > 2/7 / 2/10	1/20 / 1/21 > 2/10 / 2/11	1/21 / 1/28 > 2/11 / 2/18	1/28 / 1/31 > 2/18 2/21	2/1 / 2/4 > 2/22 / 2/23
189 - 209 > 175 - 200	12/7 / 12/8	1/18 / 1/21 > 2/7 / 2/16	1/20 / 1/26 > 2/14 - 2/17	1/27 / 1/28 > 2/17 / 2/18	1/31 / 2/4 > 2/23 / 3/3	2/7 / 2/8 > 2/24 / 3/4	2/9 / 2/11 > 2/24 / 3/4

- All PMTs have been thermal cycled, with a 100% success rate!
- The PMTs are nearing completion and are finally off of the critical path

Electronics Chassis Assembly and Test Plan – Completion Dates



Base Electronics Assembly (1)

8X
←

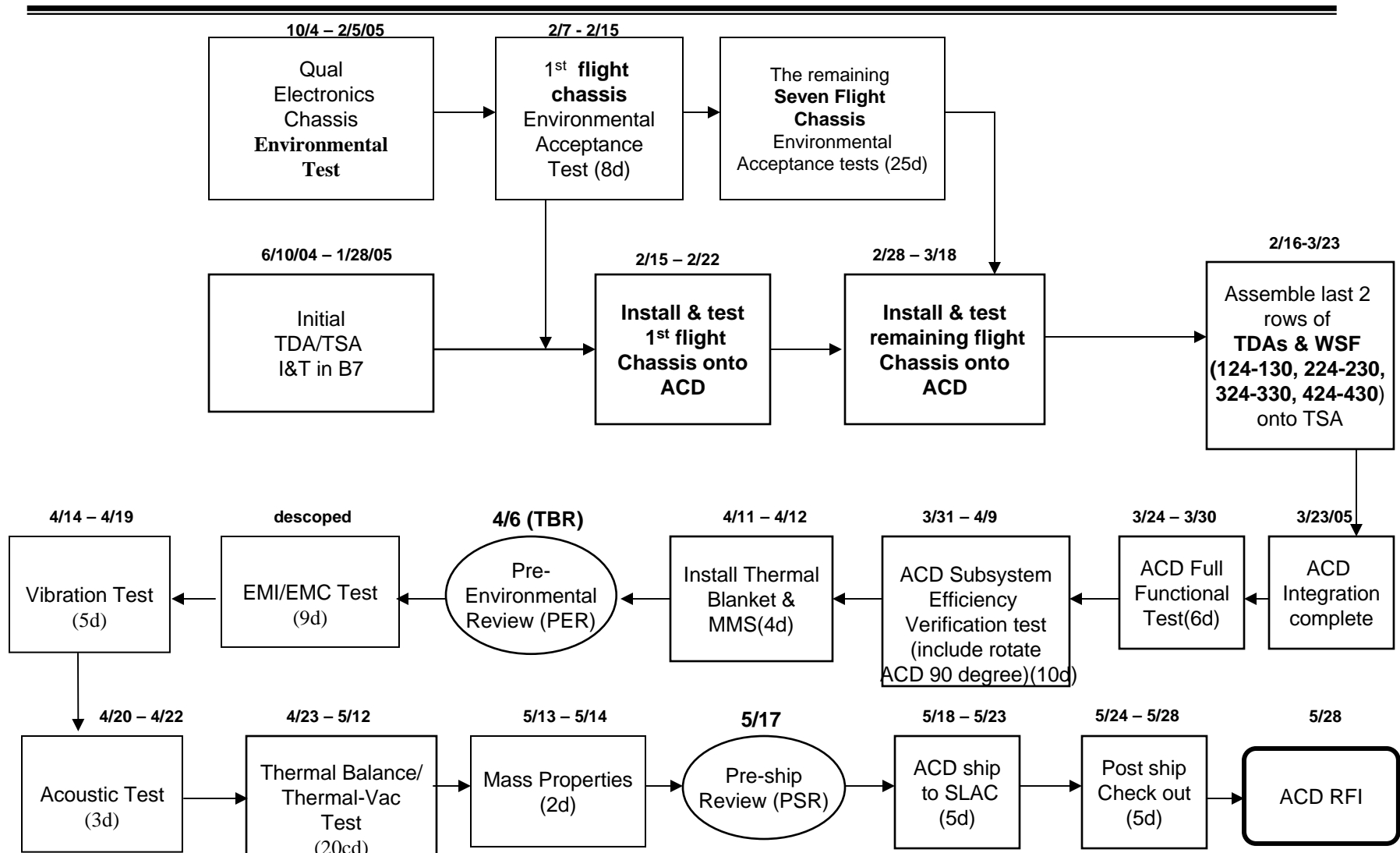


Electronics Chassis (8) (4 double + 4 single)

Electronics Chassis	Assembly	EMI/EMC	Vibration	Thermal Vacuum
Qualification / Flight Spare	Complete	Qualification (completed)	Qualification (completed)	12 cycles (completed)
#1	Complete	Not planned	Complete	Complete
#2	Complete	Not planned	Complete	Complete
#3	Complete	Not planned	In progress	3/4/05 > 3/7/05
#4	Complete	Not planned	In progress	3/4/05 > 3/7/05
#5	Complete	Not planned	3/2/05 > 3/7/05	3/10/05 > 3/12/05
#6	2/23/05 > 3/3/05	Not planned	3/9/05 > 3/11/05	Descoped
#7	3/1/05 > 3/4/05	Not planned	3/11/05 > 3/14/05	Descoped
#8	3/2/05 > 3/7/05	Not planned	3/11/05 > 3/14/05	Descoped

AntiCoincidence Detector

Schedule Flow



Threats to Schedule

- **Testing.** The ACD schedule from here to delivery is dominated by testing of electronics chassis and then the full ACD. We do not yet have all the test scripts we need, due to a long series of problems with script development, some of our own making and some due to issues with LATTE and the test stand hardware.
- **EMI Waivers.** Two aspects requiring Change Request:
 - The ACD qualification chassis did not meet all the EMI/EMC requirements. There are no simple fixes.
 - The principal ACD descope is to eliminate EMI testing at the full ACD level, which requires a waiver of this test requirement.
- **Phototube Cap Magnetic Shield.** ACD tried to save some money by using steel instead of mu-metal. Shields did not work well enough. Back-up of getting limited quantity of mu-metal shields was delayed in the Goddard shop. Starting installations without shields, but this may cause some delay later.

EGSE – Test Stands

Recent Activities

- Jim Panetta found errors in two ACD scripts that had been giving us problems. Thanks, Jim!
- Upgrade to LATTE 4.6.5 failed. New reset requirement is not expected by any ACD scripts. Backed off to 4.6.4.
- Crashes in long runs traced to memory leak(s), which could be either our or LAT software or both. Hard to track down.
- Continuing to debug scripts and do troubleshooting.

Test Script Status: 31 scripts needed. 28 working, 3 in development.

- **Plan:** make needed improvements in some working scripts, based on experience with thermal vacuum tests; then work on three scripts needed for full ACD operation (this month). Looking for more help with script development and testing.

Bottom Line: We are testing flight hardware with EGSE that is still in development, proceeding at risk and accumulating liens.

ACD Problem /Failure Report Status

As of 2/24/05 a total of 165 PR's have been generated.

- ▶134 PR's have been closed

- ▶31 PR's open

A total of 12 PFR's have been generated.

- ▶2 PFR's are open.
 - ▶1 Yellow, 1 Green

- ▶10 PFR's closed

ACD Schedule Variances

- **4.1.6 – ACD Subsystem (-\$415K cum, +\$47K current)**
 - **The overall schedule variance has been slowly improving since September 2004!**
- **4.1.6.4 BEA Schedule Variances (-\$77K cum, +\$51K current)**
 - **Variance is continuing to improve. Will be zero by the end of March.**
- **4.1.6.7 ACD I&T (-\$300K cum, +\$0K current)**
 - **This will begin to improve as the ACD is integrated and goes into testing.**
- **4.1.6.B GSE (-\$22K cum, \$0K current)**
 - **(\$22K) – Shipping container work being pushed out to reduce manpower.**

ACD Cost Variances

- 4.1.6 ACD (-\$844K cum, -\$150K current period)
 - **Overall summary, as already identified, we need to be rebaselined.**
- 4.1.6.1 ACD Project Management/Sys Eng/Science (+\$229K cum,+\$62K current period)
 - Science support lower than planned and a lag in accruals. (+\$138K)
 - Systems Engineering Support running lower than planned (+\$16K)
 - MPS/Lab Tax (+\$38K)
 - Software maintenance (-\$18K)
- 4.1.6.2 Safety and Mission Assurance (-\$156K cum, -\$42K current period)
 - Increased level of QA support (1 FTE) not in the baseline plan, but covered in rebaseline. **Substantial increase (~2x) in rates not planned.**
- 4.1.6.3 Tile Shell Assembly (-\$191K cum, -\$15K current period)
 - (-\$91K) - Design and analysis manpower
 - (-\$98K) - **Fabrication charge backs higher than planned** and increased fabrication and material costs required to resolve light leak issues.

ACD Cost Variances

- 4.1.6.4 Base Electronics Assembly (-\$515K cum, -\$62K current month)
 - (-\$185K) – Labor for PMTs and chassis testing
 - (-\$279K) – Materials, no earned value, but incurring costs on PMT tasks that are in progress, but not completed. **Fabrication overrun on PMT housings and rails (\$50K)**. Cost overruns identified in the rebaseline estimate
 - (-\$44K) - SLAC ASIC charges.
- 4.1.6.5 MMS/TB (-\$24 cum, -\$45K current month)
 - Cost variance identified in rebaseline.
- 4.1.6.6 ACD Mech Qual and Cal Unit (-\$68K cum, -\$3K current month)
 - (-\$15K) – Tracker costs erroneously charged to the ACD
- 4.1.6.7 I&T (-\$139K cum, -\$10K current month)
 - Have not received credit for the amount of work done.
 - TSA Integration manpower overrunning.
 - Unplanned work on EGSE issues.
- 4.1.6.B Ground Support Equipment (+\$22K cum, -\$36K current month)
 - (-\$22K) – Schedule variance
 - (-\$45K) – **Labor for EGSE software support.**
 - (+\$87K) – Materials. Not billed for work completed