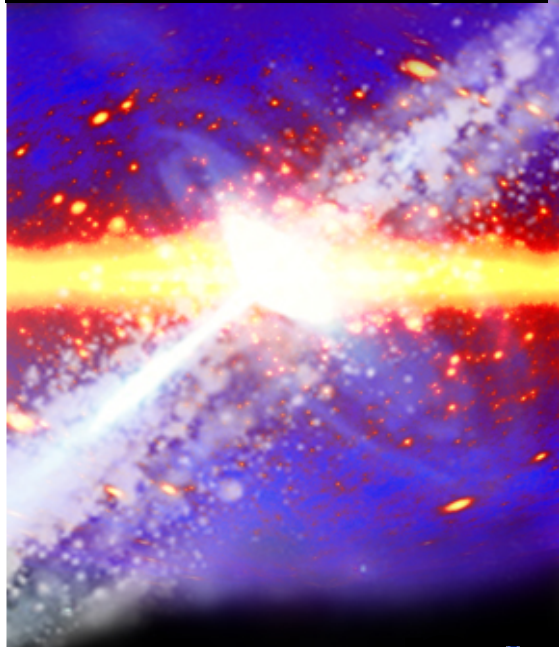**Gamma-ray Large Area Space Telescope**

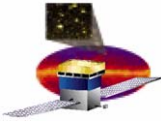# GLAST Large Area Telescope

Instrument Flight Software

Monthly Status Review
**November 3, 2004**

Jeff Fisher

**Stanford Linear Accelerator Center**

October Issues

- **Work stoppage and DOE inspection**
  - Reviewed safety issues beginning Monday, October 18.
  - All JHAMs and other documentation complete for all staff. All required safety training is complete.
  - Scheduled work has resumed
    - Development and testing continue on personal workstations.
    - FSW Testbed and test benches are available for use.

- **EEPROM Activities**
  - Numerous meetings to discuss mitigation strategies
  - Two options in software:
    - Use discretes to select the boot image
   - Use checksums to verify boot code integrity
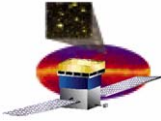
October Activities

- **Expanded FSW code management system**
  - **New capabilities for existing CMX system**
    - **Automatically rebuild the entire FSW codebase**
  - **This expanded tool will support delivery of formal, integrated FSW releases through the Flight Unit candidate release and on into the FSW maintenance phase.**

- **ISIS Development**
  - **All ISIS FSW development is complete, and development build testing is nearly complete**

- **Primary and Secondary Boot**
  - **Improvements made to memory testing, exception handling, bridge chip initialization code**
  - **Completed EPU boot code (to be demonstrated this morning)**
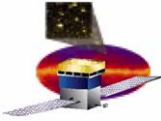
October Activities (2)

- **File and Memory Management**
  - **Work at NRL continues**

- **Intertask Communications System (ITC)**
  - **Phase 2 of ITC development for CPU to CPU communications behind schedule**

- **LAT Communications Board Driver**
  - **Driver implementation is complete**
  - **Latest version to ship to ACD group at Goddard**

- **LAT Communications Board Test**
  - **Shipped fully tested LCB driver and hardware to NRL to support their CPU to CPU work (including EPU boot code development)**

- **LAT Electronics Module Package (LEM)**
  - **Continue testing ability of LEM to write all hardware registers**
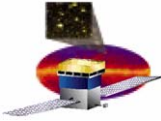
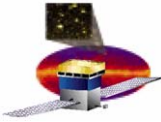# October Activities (3)

- **Power-On and Initialize GASU Package (PIG)**
  - **Latest major release October 21.**
  - **Used extensively, for several weeks, on the Testbed and on test benches**
    - **Controls initialization of the LCB and LATp communications**
    - **Controls power-on of hardware components**

- **Attitude/Time Processing**
  - **Design for this function has begun at NRL**

- **Housekeeping**
  - **Recoded and tested against new low rate science counter set**
  - **Fully operable within new LAT internal communications infrastructure (LCB driver and LEM)**
  - **New version of design document (LAT-TD-02905) completed**
    - **Meeting last Friday with ISOC for knowledge transfer**

- **FES**
  - **Wrote file management system to handle the large number of data files stored on FES PCs**
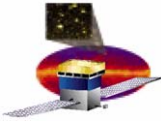
Response to September RFAs

- **RFA 1**: Calibration – Establish an ICD between FSW and Ground Calibration
  - **ISOC and FSW are working to establish the content of a comprehensive ICD, which will include a definition of the calibration data to be exchanged**

- **RFA 2:** Requirements/Test of Modes – FSW should clarify how the LAT FSW Requirement Modes and FSW Implementation Modes are addressed through FSW test. This is an area that should lead to an update of requirements so test is complete.
  - **This RFA will be addressed**

- **RFA 3:** Gamma Ray Bursts – Clarify requirement and design for Gamma Ray Burst data capture. Make a clear commitment that attempting to meet this requirement will not be allowed to cause a schedule delay.
  - **FSW clearly recognizes the importance of this issue and will not allow GRB burst capture to impact schedule**

Response to September RFAs (2)

- **RFA 4**: Mode Control – Provide clear, complete definitions of the three physics acquisition modes
  - **This RFA will be addressed**

- **RFA 5:** Requirement TBX Closure – Define deadlines for resolution of requirement TBXs and clearly communicate the deadlines to the appropriate LAT systems
  - **Response in process. Systems Engineering is currently working with LAT subsystems to resolve remaining items.**

- **RFA 6**: Management – Clarify the approach to meeting deadlines for successful full integration of the flight software. Especially how integration problems will be handled
  - **Hired full time engineer devoted to integration issues**
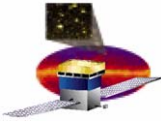 - **This engineer will develop an integration process**

Development Status/Schedule

| Layer	Function	Planned Code/Unit Testing Complete	Status	Remaining Effort (person weeks)	Forecast Code/Unit Testing Complete
OS	Processor Basic Services (PBS, VXW)	Complete	100% coded	0	Complete
Boot	Primary Boot	10/30/04	SIU code complete EPU complete	0	Complete
Boot	Secondary Boot	10/30/04	100% coded	0	Complete
Driver	LAT Communications Board Driver (LCBD)	12/15/04	95% coded	1	12/15/04
Service	LCB Service (LCS)	11/30/04	30% coded	4	1/07/05
Service	Command and Telemetry/1553 Service (CTS)	11/30/04	80% coded	1	12/07/04
Comm	Abstract/Inter-task Communications (ITC)	10/30/04	60% coded	3	11/30/04
N/A	Instrument Configuration	12/01/04	95% coded	2	12/01/04
N/A	Command and Telemetry Data Dictionary	1/10/05	LCAT tool complete C&T definitions in process	2	1/10/05
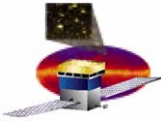
Development Status/Schedule (2)

| Layer	Function	Planned Code/Unit Testing Complete	Status	Remaining Effort (person weeks)	Forecast Code/Unit Testing Complete
Apps	File and Memory Mgmt (LFS, File/Object)	11/30/04	50% coded	3	11/30/04
Apps	Housekeeping (LHK)	10/15/04	95% coded	1	12/07/04
Apps	Thermal Control (LTC)	12/01/04	70% coded	3	12/01/04
Apps	Spacecraft Interfaces (LSM)	11/15/04	Coding begins Oct 2004	3	12/07/04
Apps	Watchdog (LSW)	11/15/04	70% coded	3	12/15/04
Apps	Mode Control (LIM)	11/15/04	Coding begins after ITC	3	1/15/05
Apps	Power/Initialize GASU (PIG, part of Basic Services layer)	11/15/04	99% coded	1	11/15/04
Apps	Diagnostics (LDF)	11/15/04	Being reassigned	4	01/07/05
Apps	Charge Injection Calibration (LCI)	12/15/04	Coding begins November	8	01/15/05

Development Status/Schedule (3)

| Layer	Function	Planned Code/Unit Testing Complete	Status	Remaining Effort (person weeks)	Forecast Code/Unit Testing Complete
Apps	Event Integrity and Delivery (part of LPA)	1/05/05	60% coded	3	1/05/05
Apps	Event Filtering (part of LPA)	1/05/05	80% coded	3	1/05/05
Apps	GRB Detection and Response (part of LPA)	1/05/05	60% coded	2	1/05/05
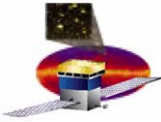
Requirements to Demo Mapping

Demo Status thru September
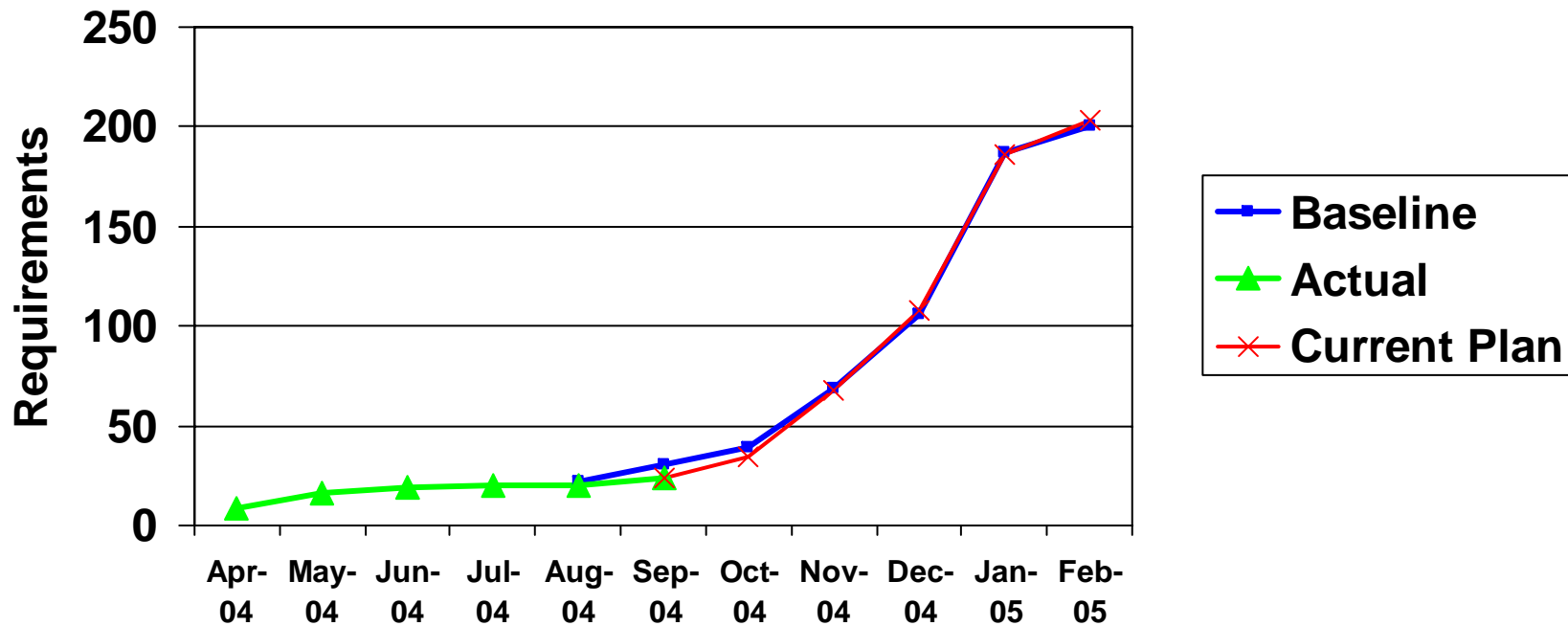
- Only fully demonstrated requirements shown in graph (one of many metrics)
- September demo: 5 requirements successfully demonstrated, 9 were in baseline plan
- Plan for 4 not demonstrated
  - (2) Configuration & readback (partial to date) → December
  - Science data rate → November
  - Discrete from GBM → January (during GRB-focused demo)
- This month: 9 expected (boot functions, including EPU)
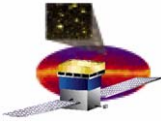
FSW Test Status

- **LAT FSW Qualification Test Plan (TD-00786-03)**
  - **Requirements to Test Matrix updated to match new SRS Version 4**
    - **New requirements count: 196**
  - **Approved by FSW CCB on October 21**
  - **Currently under LAT-wide review, deadline for comments Nov 11**
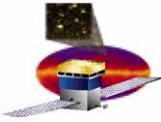
- **Overall progress on test scripts and test procedures**
  - **31 of 196 test scripts and procedures written**
  - **8 of 8 1553 Interface test scripts and procedures written**
  - **23 of 23 FSW and LAT Initialization test scripts and test procedures written**
  - **To comply with Goddard's request for a "test as you fly" strategy, existing test scripts recoded for use with LATTE**
    - **Having adopted this strategy, the Test Team will take over the monthly FSW demonstrations**

- **Staffing**
  - **Mark Mao, a Stanford graduate student, joined the team**
    - **Assigned to Vehicle Signals Interface testing**
  - **Igor Volobouev to start in approximately two weeks**
    - **Testing physics requirements**
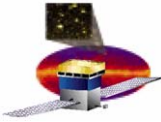 - **Lawrence Jeung, Test Team and FSW integration, started November 1**
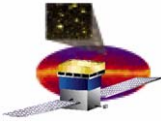
FSW Test Script and Procedure Progress
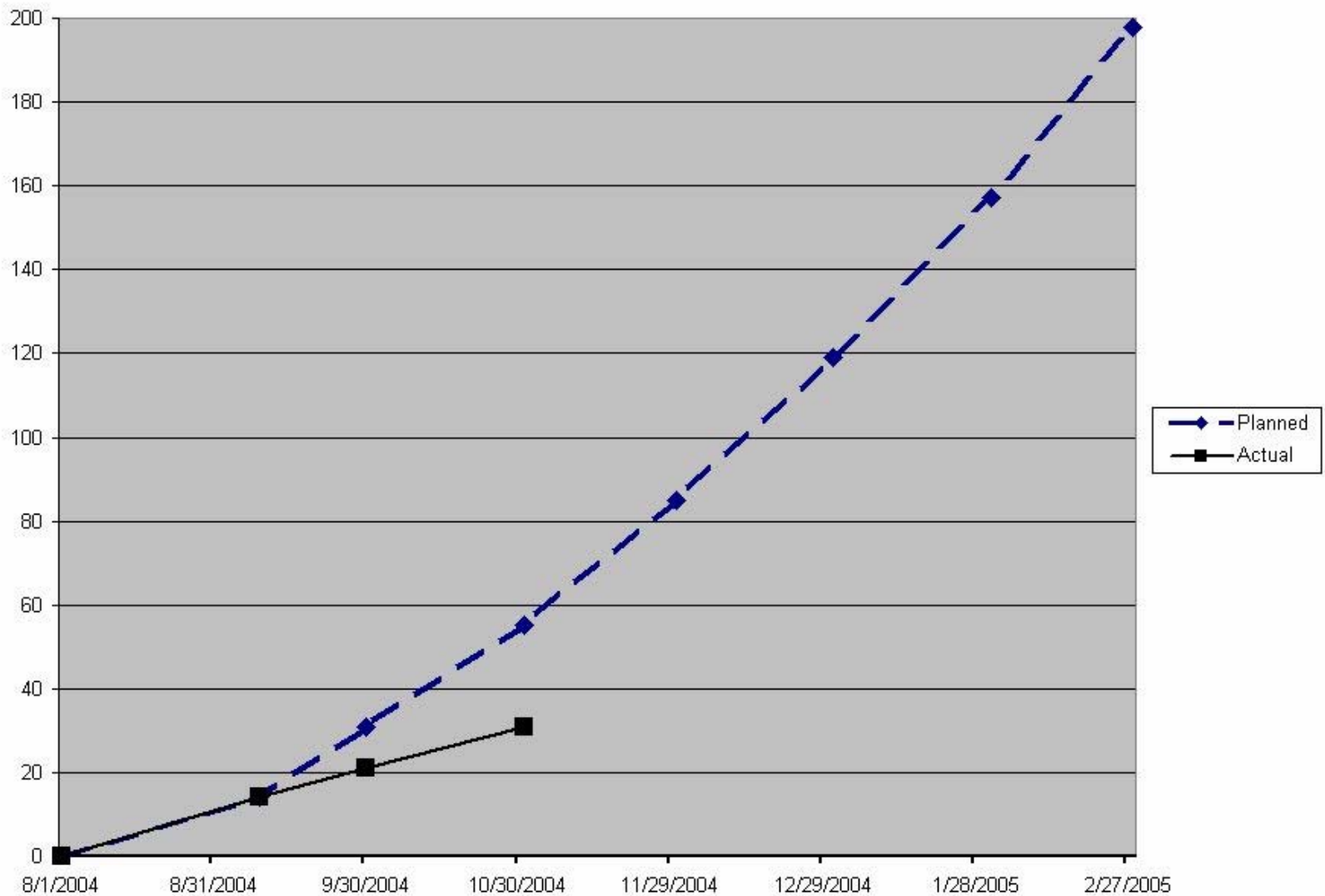
FSW Test Readiness Status/Schedule

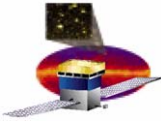| Test Name	Test Type	Responsible Eng.	Planned Procedure/Script Development	Actual Procedure/Script Development
1553 Interface Test	1	Shantha	Sep-04	Sep-04
FSW and LAT initialization	9a	Igor	Sep-04	Sep-04
Command Functional	2a	Shantha	Oct-04	Oct-04
SIU/EPU CPU-to-CPU Communications Functional Test	6a	Igor	Oct-04	Nov-04
FSW and LAT re-initialization and recovery	9b	Igor	Oct-04	Oct-04
File Management and Memory Upload and Dump Verification	2b	Shantha	Nov-04	Nov-04
Vehicle Signals Interface Verification	5	Mark Mao	Nov-04	Nov-04
LAT Thermal Control System (TCS)	15	Eric	Nov-04	Feb-05
LAT Pointing Calculations	10a	Igor V.	Nov-04	Nov-04
Electronic Calibration	8b	Igor	Nov-04	Nov-04
Narrowband Telemetry Verification	3	Shantha	Dec-04	Dec-04
Additional Science Processing – Repointing Logic	12b	Igor V.	Dec-04	Dec-04
EPU Internal Configuration Test	6b	Igor	Dec-04	Dec-04

FSW Test Readiness Status/Schedule

Test Name	Test Type	Responsible Eng.	Planned Procedure/Script Development	Actual Procedure/Script Development
Operational Modes – Safe Modes	13a	Eric	Dec-04	Dec-04
Event Filtering – Reception of Events and Verification of Filtering Algorithm	8a	Igor V	Dec-04	Dec-04
Wideband Telemetry Verification	4	Shantha	Jan-05	Jan-05
GRB Handling/Repointing Requests	11	Igor V	Jan-05	Jan-05
T&DF, TKR, CAL, and ACD Internal Configuration Test	7	Igor	Jan-05	Jan-05
Additional Science Processing – GRB detection and location	12a	Igor V	Jan-05	Jan-05
Operational Modes – Science Modes	13b	Eric	Jan-05	Jan-05
LAT Time Signal Processing	10b	Igor	Feb-05	Feb-05
LAT Diagnostic and Calibration Modes	14	Eric	Feb-05	Feb-05
LAT Event Performance Monitoring and Operations	16	Igor V	Feb-05	Feb-05

Next 3 Month's Activities

- **ISIS Build and Test scripts, TRR, FQT & Delivery**
- **Development of Flight Unit modules**
- **Development of Flight Unit test scripts**
- **Finish developing formal release process**
  - **Complete new code management tool**

- **Make PROM go/no-go decision**
- **Boot mitigation**