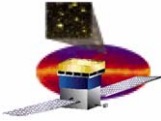**Gamma-ray Large Area Space Telescope**

GLAST Large Area Telescope

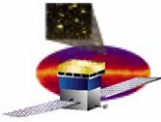**Instrument Flight Software**

**LAT Monthly
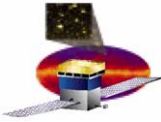June 30, 2005**

Terry Schalk

U. C. Santa Cruz

FSW Development Roadmap

- **We have a baseline FSW build and the focus of activity is moving from individual pkgs to builds that have been demonstrated to the extent possible on the test bed**

- **Incremental builds with objectives**

  - **Builds that allow test team to prepare formal procedures/scripts, learn about code**

  - **Builds that increase complexity of internal SW dependencies**

  - **Leave time to resolve unexpected problems before system test**

  - **Spread knowledge of how to exploit FSW during system test**

FSW Phased Integration Plan

Package Suite	Release Date	Integration Focus	Package List	Confirm Integration Using
B (B-0-2-X)	June 14	Spacecraft interfaces (discretes, 1553 messages) – part 2 Attitude/time (part 2) Mode control Thermal Control FSW configuration and startup Ground tools	ATT (part 2), LSM (part 2), THS (part 2) LIM LTC CFG Ground: *LCAT, SCP, LCP, LCBT, SIIS, CLI, GRL*	Test script dry run VSC Testbed Env. simulator board (RTD + thermistor)
C (B-0-3-X)	June 30	Charge injection calibration Instrument configuration Ground tools	LCI LATC Ground: *LCAT, SCP, LCP, LCBT, SIIS, CLI, GRL*	Test script dry run VSC Testbed Mini-tower
D (B-0-4-X)	July 12	Diagnostics Computer manager CFG Event Filters	LPA LDF LCM (part 2)	Test script dry run VSC Testbed
Full (B-0-5-X)	July	GRB Detection and Response	GRB	Test script dry run VSC Testbed

Candidate Release 0-2-0 Software

- **0-2-0 includes the following packages (packages under FSW CCB control shown in blue):**

ATT V1-1-2	LCBD V1-2-9	MON V0-1-0
CCSDS V3-3-2	LCBT V1-4-2	MSG V2-0-3
CLI V0-0-7	LCM V0-1-0	PBC V4-4-0
CMX V2-4-2	LCP V0-7-0	PBI V0-0-7
CTDB V5-2-2	LCS V1-0-0	PBS V2-9-0
CTS V2-1-0	LEM V4-2-2	PIG V8-0-2
ELF V1-1-2	LFS V1-3-0	RAD750 V1-3-3
EXPAT V1-0-0	LHK V6-0-2	SBC V1-1-1
FILE V3-4-0	LIM V1-0-0	SCP V0-8-0
GRL V1-0-0	LMC V0-1-0	SIB V1-2-1
IMM V0-1-0	LSM V2-2-0	SIIS V0-0-2
ITC V3-1-1	LTC V0-2-1	THS V1-0-4
LATC V6-2-1	LTX V2-4-1	VXW V6-8-0
LCAT V1-4-1	MEM V5-2-0	VXWPC V0-1-0
		XLX V6-3-0
		ZLIB V2-1-2
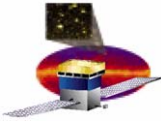
Change Tracking-New JIRA Issues

Legend:
- ■ Proposed Bug Fix/Enhancement
- ■ Updates to "uncontrolled" PKGs

Categories: May*, June
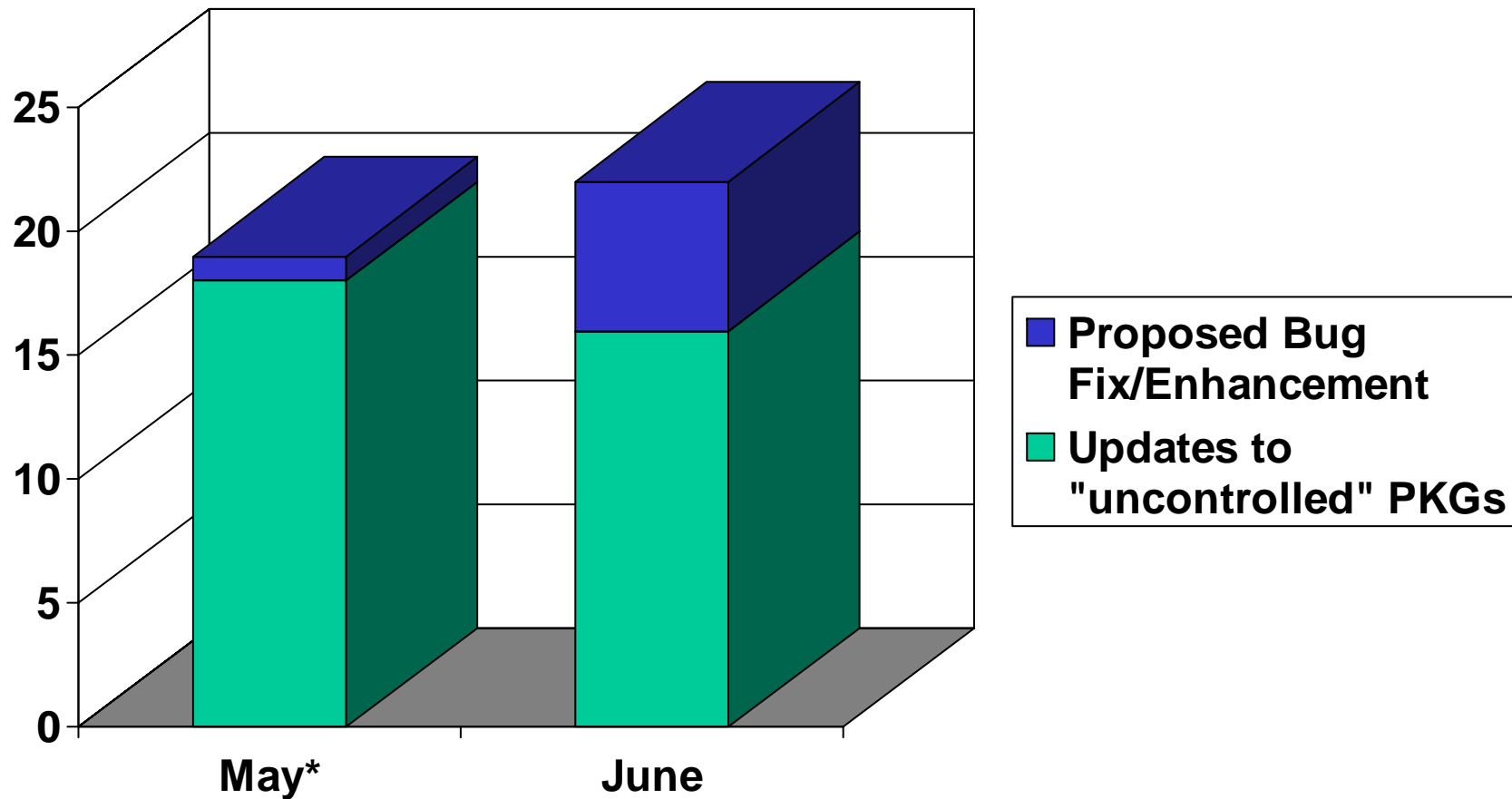
* JIRA use began May 11

June Activities

- **A build (v0-2-0) with CCB controlled packages was completed Including**
  - **Mode Control with**
    - **Main-feed on**
    - **Power on & off**

- **24 of 40 FSW packages have been placed under package-level CCB control; and**

- **now that the VSC is delivered the FSW Test team is running draft test scripts against this baseline.**

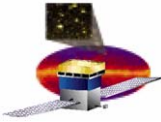- **Weekly hardware scheduling meeting for test lab & FES**
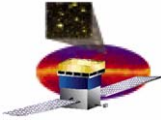
June Activities

- **Lockheed Thermal Control Test System**
  - **FSW ready**
  - **Goes to Lockheed July 12-th**
- **LAT Thermal Control (LTC)**
  - **Fixed heat pipe indicator logic for telemetry**
  - **Fixed status values for raw sensor value reported in telem**

- **Time Hack Services (THS)**
  - **Tested on an all-RAD750 setup (SIU & 2 EPU's)**
  - **SIU distributing and EPU's receiving msg-s correctly after modification to EPU boot code**
  - **Modified some warning msgs**
- **LAT Instrument Manager (LIM, mode controller package)**
  - **After v0-2-0 build added LOAD-SHED, SAFE-MODE, SAA-ENTER, SAA-EXIT, CALIBRATION and DIAGNOSTICs**
  - **Updated tests to verify handling added functionality**
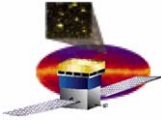
June Activities

- **Upgraded Operating System (VXW)**
  - **Allows C++ support**
  - **Allows all time-stamps to be driven by GPS time**

- **LAT Physics Acquisition (LPA)**
  - **First public version of the event/gamma filter code (EFC) is released**
  - **Ran timing tests**
  - **Contents of summary telemetry defined**
  - **Added error codes to filter init sequence**
  - **Tested multiple filter framework**

- **LAT Event Formats (LEF)**
  - **Compression algorithms have been prototyped**
  - **Code written to output events in variety of formats (raw to highly compressed)**

- **LAT Computer Monitoring (LCM)**
  - **Commands added to:**
    - **Dump current SW module list**
    - **Configure RAD750 memory scrubber**
   - **Set telemetry response to RAD750 hw errors**
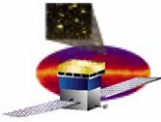
June Activities

- **LAT Charge Injection (LCI)**
  - Worked with subsystems to evaluate their current calibration usage and some modification made to code base to reflect real hardware in prep for V0-3-0 build
  - Design document updated to reflect current reality
  - All base functionality in place except for data transportation to SSR (depends on ITC)

- **FSW and VSC**
  - 1553 bus-controller driver for VSC upgraded to reflect true bus schedule now need to upgrade VSC software to use it

- **CFG**
  - Complicated by variety of environments and hrdw configs it has to run in
    - Teststands
   - Real LAT
    - Testbed

Gamma-ray Large
Area Space
Telescope
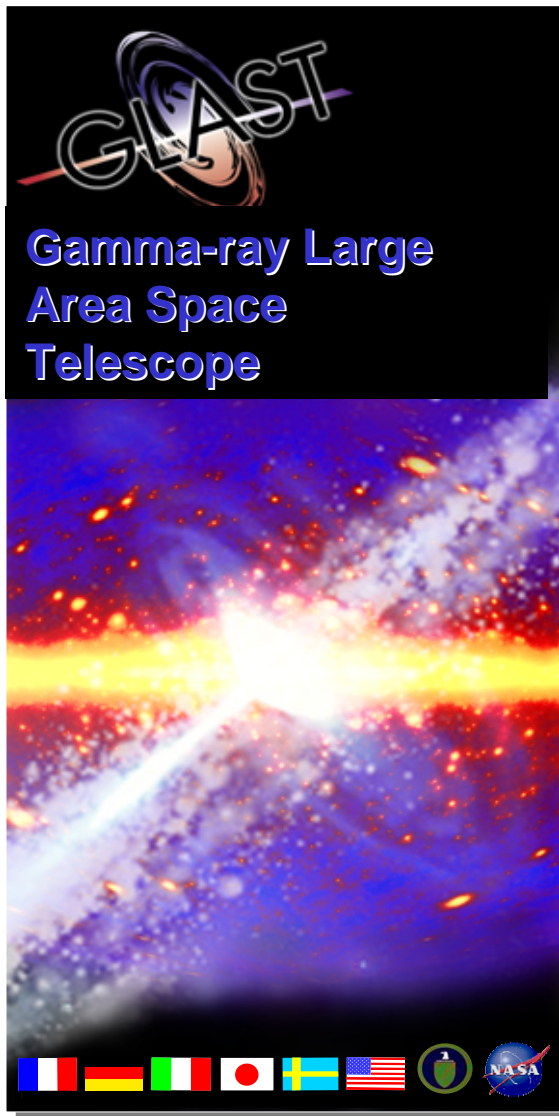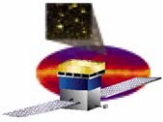
Testing-Demonstrations

Change in FSW Demonstrations

- **Motivation: provide interim measure of progress**
- **Up until now**
  - **Demonstration of requirements against ad hoc collections of FSW packages**
  - **Significant extra effort to put together demonstrable procedure, with only moderate reuse**
- **Moving forward**
  - **VSC now in place so real test scripts can be exercised**
  - **Planned scripts mapped to outstanding requirements to be demonstrated**
  - **Schedule of demonstrating outstanding requirements based on script dry runs follows**
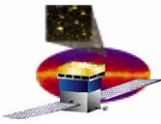
Script dry run plan to demonstrate outstanding requirements

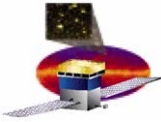| Function (# of requirements)	Date
Secondary boot checksum (1), HSK anomaly response (1)	6/30/05
SIU to EPU file copy (1), Commands + 1553 interface (10), Science data (2)	7/14/05
Charge injection (22)	7/22/05
Thermal control (8)	8/5/05
Event filtering (4)	8/11/05
Configuration (3)	8/11/05
Discrete interfaces (3)	8/19/05
Event monitoring and deadtime (7)	8/23/05
Mode control (14)	8/25/05
Diagnostics (18)	9/8/05
GRB detection and response (14)	9/20/05
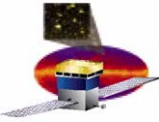
Requirements-to-Demo Mapping

Status thru 28 June
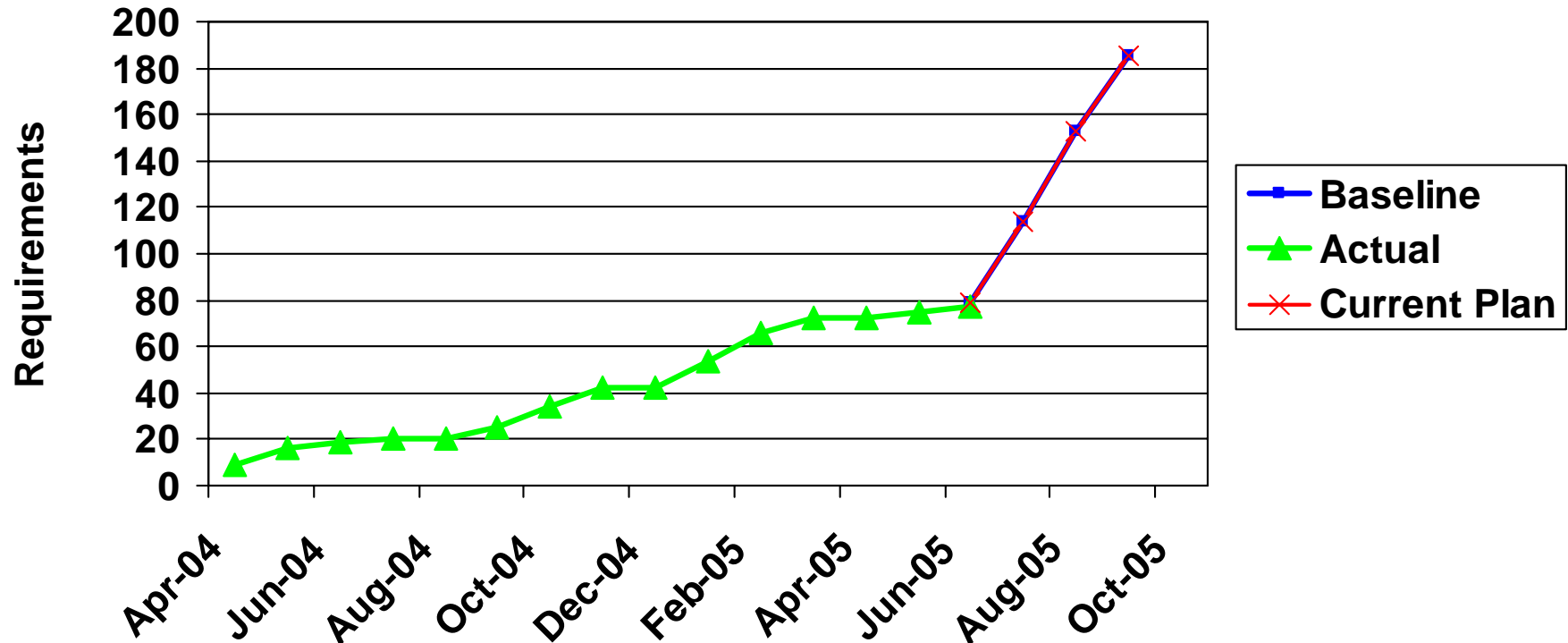
- **May: Secondary boot (2), EPU memory dump (1)**
- **June: Low rate science (1), Demand telemetry (1)**

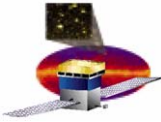| Test Suite	Procedure Milestones				Script Milestones		
	Draft Complete	FSW CCB Approved	LAT Approved	IVV Review	Initial Dry Run	Script Peer Review	Formal Dry Run
FSW Initialization (FSWINI)	x ☑				6/30/2005		
Memory Management (MEMMGT)	x ☑				7/6/2005		
File Management (FILMGT)	x ☑				7/13/2005		
Wideband Telemetry Verification (WBTLMV)**	x ☑				7/14/2005		
Command Functional (CMDFNC)	x ☑				7/14/2005		
Charge Injection Calibration (FECALB)	6/28/2005				7/22/2005		
Thermal Control System (THRMCS)	7/11/2005				8/1/2005		
Time Signal Processing (TIMPRC)*	x ☑				8/5/2005		
Vehicle Signals Interface Verification (VSGIFV)	x ☑				8/8/2005		
CPU-CPU Communications (IPCFNC)	7/13/2005				8/10/2005		
Event Filtering (EVTFIL)	x ☑				8/11/2005		
Instrument Configuration via the SIU (SIUCFG)	7/13/2005				8/11/2005		
Event Performance Monitoring and Operations (EVTPMO)	x ☑				8/23/2005		
Operational Modes (OPMODE)	x ☑				8/25/2005		
Narrowband Telemetry Verification (NBTLMV)	6/29/2005				8/31/2005		
Diagnostics (DCMODE)	7/27/2005				9/8/2005		
GRB Response (GRBREQ)	x ☑				9/13/2005		
GRB Detection and Location (GRBPRC)	x ☑				9/20/2005		

*Dates TBR - recently reassigned
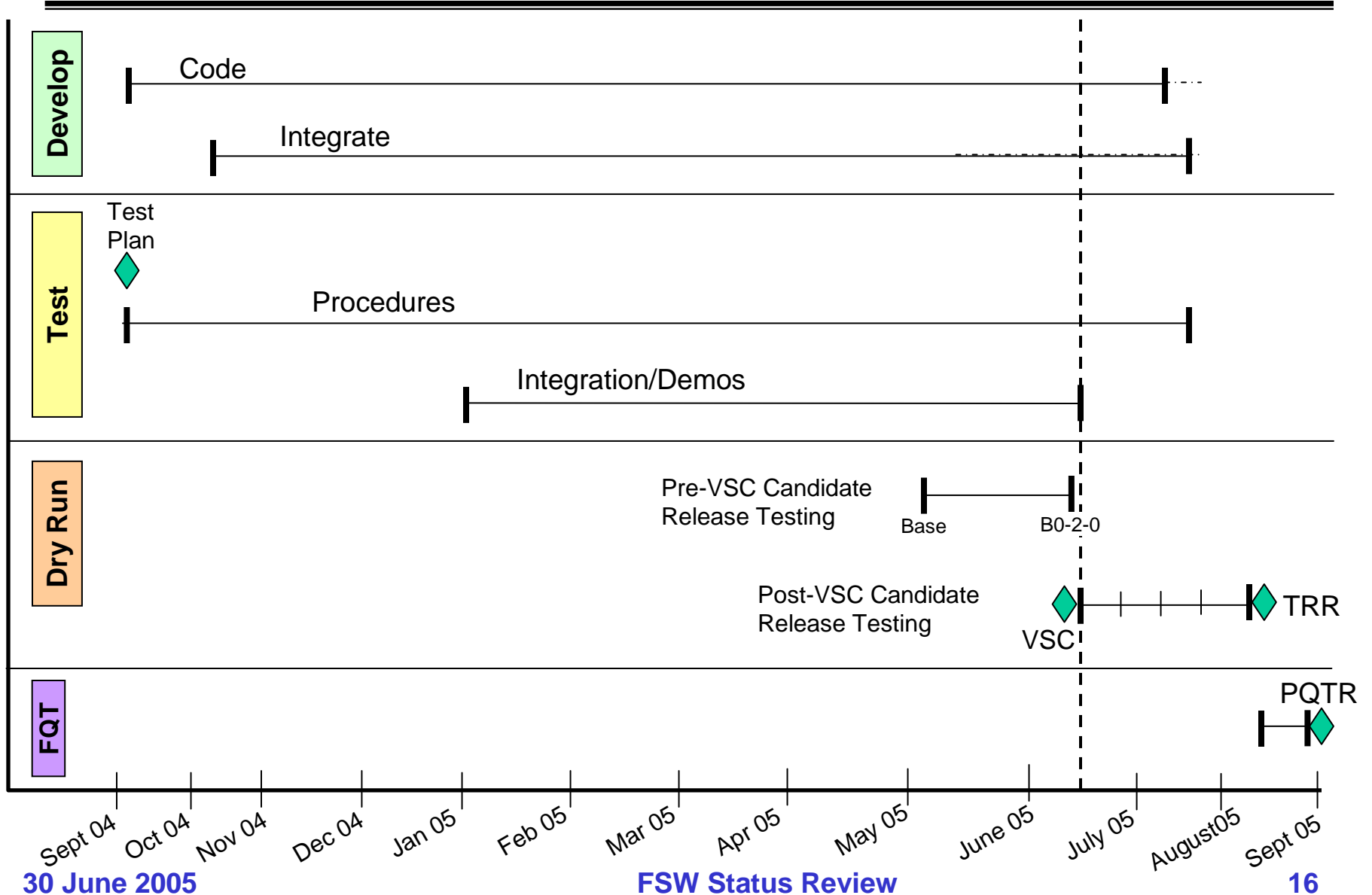**Awaiting OSC SSR implementation
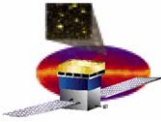
Test Script Schedule Mitigation

- **Ongoing mitigation steps as procedures are reviewed**
  - **Simplification of tests where appropriate**
  - **Combining tests where appropriate**
- **Investigate streamlining review process**
- **Consider adding test team members**
- **Consider a "rolling" script/FQT process**
  - **Don't require all scripts complete before start of FQT**
  - **Start FQT with completed scripts prioritized toward key functionality**

FSW Develop and Test Schedule Through FQT

Develop

Code

Integrate

Test

Test Plan

Procedures

Integration/Demos

Dry Run

Pre-VSC Candidate Release Testing

Base   B0-2-0

Post-VSC Candidate Release Testing

VSC   TRR

FQT

PQTR

Sept 04 Oct 04 Nov 04 Dec 04 Jan 05 Feb 05 Mar 05 Apr 05 May 05 June 05 July 05 August05 Sept 05

FSW Outstanding Issues

- **CR 0-3-0 Release at the end of the month**
  - *Provide charge injection calibration FSW*
- **Finish the FSW startup/configuration sequence**
- **Finalize and implement the basic science data output format**
- **Complete work on the science data interface to get data out via the SSR**
- **How to Drive FSW**

  - *Individual FSW applications have table-driven configurations*
    - *Large number of configuration parameters*
  - *Over the next 2 months, user groups can begin taking ownership of the configuration tables affecting their subsystems and define appropriate sets of operational parameters*
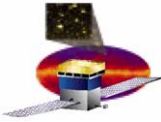
Gamma-ray Large Area Space Telescope
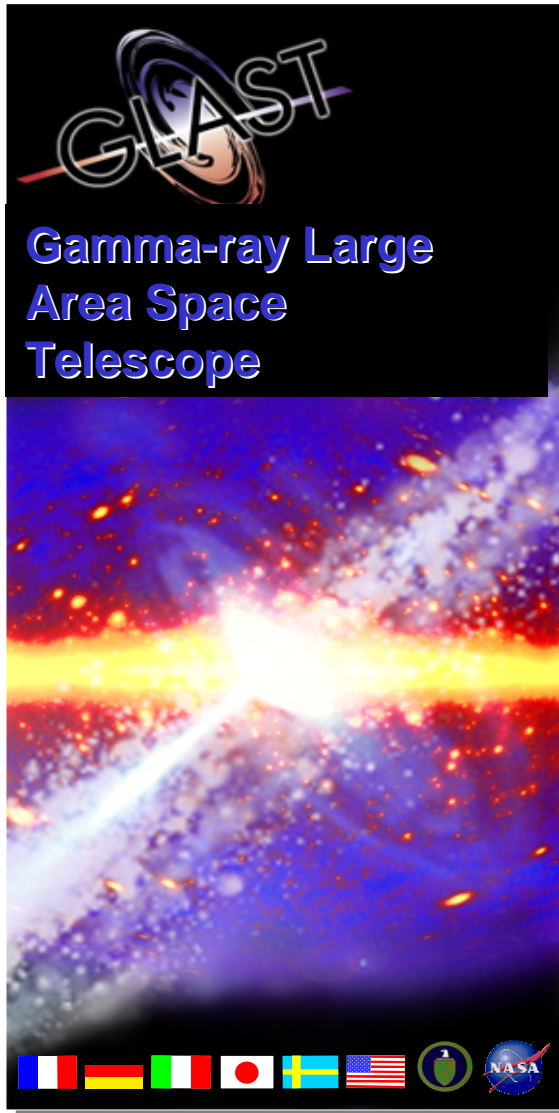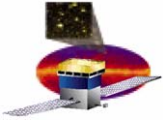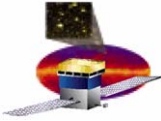
Glossary

Glossary of FSW Terms

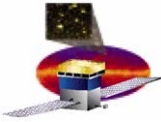| Term	Definition
ATT	Attitude Processing (package)
CCSDS	CCSDS Packet Utilities (package)
CFG	FSW Configuration and Initialization (package)
CR	Candidate releases: series of software builds with increasingly complete suite of FSW.
CTS	Command and Telemetry Service (package)
CTDB	Command and Telemetry Data Bus (1553) Driver (package)
EDS	Event Delivery Service
EFC	Event Filter Code
FILE	File Upload (package)
FQT	Formal Qualification Testing
GRB	Gamma Ray Burst
IMM	Instrumented Memory Manager (package)
ITC	Inter-task Communications Toolkit (ITC)
LATC	LAT Configuration (LTC)
LCBD	LAT Communications Board Driver (package)
LCM	LAT Computer Manager (package)
LCI	LAT Charge Injection Calibration (package)
LCS	LCB Communications Service (package)

Glossary of FSW Terms (2)

Term	Definition
LDF	LAT Diagnostics Framework (package)
LFS	LAT File System (package)
LHK	LAT Housekeeping (package)
LIM	LAT Instrument Manager (package)
LMC	LAT Multiplexed Counters (package)
LPA	LAT Physics Acquisition
LSM	LAT Spacecraft Messages (package)
LSW	LAT Software Watchdog (package)
LTC	LAT Thermal Control (package)
Magic 7	Set of data messages sent from Spacecraft to SIU: Attitude message (at 5 Hz), Timetone message (1 Hz), Ancillary message (1 Hz)
MEM	Memory Management (package)
MON	CPU Monitor (package)
MSG	FSW internal error messaging (package)
PBC	Primary Boot Code (package)
PBS	Processor Basic Services (package)
PIG	Power-up and Initialize GASU (package)
PQTR	Post Qualification Test Review
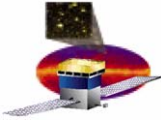
Glossary of FSW Terms (3)

Term	Definition
RAD750	RAD750 Board Support (package)
SBC	Secondary Boot Code (package)
SIB	SIB Board Driver (package)
THS	Time Hack Services (package)
TRR	Test Readiness Review
VSC	Virtual Spacecraft: Spacecraft simulator constructed at SLAC
VXW	VxWorks BSP (package)
ZLIB	ZLIB Compression Tools (package)

FSW Ground Software

- **LCAT (LAT Command and Telemetry tool)**
  - Generates ITOS data definitions for ISOC and corresponding C code structures for FSW developers.
  - Development of the tool is complete. Periodic minor upgrades.

- **SCP (Spacecraft Control Program) and LCP (LAT Control Program)**
  - Developer tools used to simulate the SC and LAT sides of the flight environment

- **LCBT (LAT Communications Board Test suite)**
  - Comprehensive LCB test suite
  - No further development effort required

- **SIIS (Spacecraft to Instrument Interface Simulator)**
  - Utilities for creating and manipulating MOC Level 0 data files, and reading AstroRT archive files
  - No further development anticipated

- **CLI (Command Line Interface), GRL (GNU Readline)**
  - Very low level developer utility packages
  - No development or maintenance effort involved with these package