

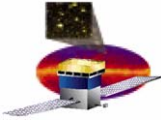
GLAST Large Area Telescope

Instrument Flight Software

**LAT Monthly
May 24, 2005**

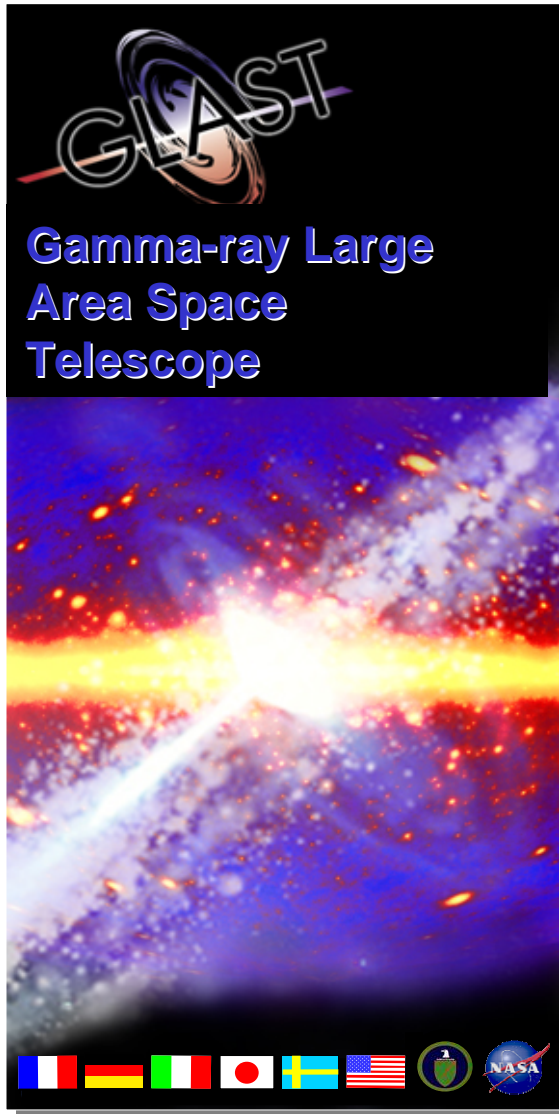
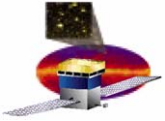
Terry Schalk

Stanford Linear Accelerator Center

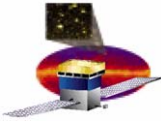


Outline

- **Where We're At (Current Status)**
- **Demonstrations**
 - **Completed demos**
 - **Scheduled demos**

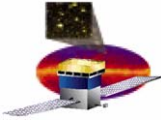


Current Status



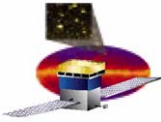
Current Status

- **Majority of software packages are complete or substantially complete**
 - **Complete:**
 - All required functionality is implemented
 - Some level of testing has been performed
 - **Complete with known liens:**
 - Specific, identified functionality must be added
 - Changes and retrofits may be needed to reflect changes in other packages
- **Test procedures and scripts are underway**
 - Updates of previously-developed procedures and scripts to conform to Virtual Spacecraft (VSC) interface are in progress
- **Minor delays due to SLAC-wide power outage**



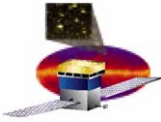
May Activities

- **FSW Candidate Release**
 - **First CR, designated B0-0-1**
 - **Release-specific command and telemetry documentation provided along with the CR**
- **Lockheed Thermal Control Test System**
 - **System resembles ISIS in scope and structure**
 - **T. Waite tasked with building this system**
 - **Some effort required from J.J. Russell**
- **LAT Thermal Control (LTC)**
 - **Basic testing with simple thermal control sensor setup is complete**
 - **The software successfully reads ADC counts from the PDU**
- **Time Hack Services (THS)**
 - **Time hack processing now integrated with new version of ITC**
 - **THS runs on SIU (mv2304) and EPU (RAD750) combined system**
 - **Next steps: test on an all-RAD750 setup**
- **LAT Instrument Manager (LIM, mode controller package)**
 - **Design document updated**
 - **Development and testing continues**



May Activities (2)

- **Inter-task Communications (ITC, CTS, LCS)**
 - Test suite underway, but pre-empted by work on Lockheed thermal control simulator system
 - Remaining effort: SSR output pathway
 - Must wait for completion of Lockheed simulator and ITC unit test suite
- **Boot Code (PBC and SBC)**
 - Minor ITC-related updates to PBC code for the EPU
- **LAT Physics Acquisition (LPA)**
 - First public version of the event/gamma filter code (EFC) released
- **LAT Event Formats (LEF)**
 - This package defines how science data is structured for output on the SSR
 - With Lockheed thermal control simulator work mainly moved to Tony Waite, work can continue on LEF
- **LAT Computer Manager (LCM)**
 - Memory scrubber control complete



May Activities (3)

- **LAT Charge Injection (LCI)**
 - Design document updated to reflect current reality
 - Data compression code is complete
 - All functionality in place except for data transportation to SSR (depends on ITC)
- **FSW Test Team**
 - Good progress made on Python interface package, the Test Team's front-end interface to the Virtual Spacecraft
 - Testers have already coded test scripts against the interface, though test script completion and dry runs have a dependency against availability of the VSC
 - Infrastructure for generating Monte Carlo physics data files for physics-related tests underway
 - Most utility code to be shared across test suites is complete
 - Detailed progress on procedures and scripts later in presentation



FSW Package Status

- Packages in **blue text** are under CCB control at the build level
- Packages in **green text** are under CCB control at the package level (pending completion of LIM and CFG packages)

Function	Planned Code/Unit Testing Complete	Status	Remaining Effort (person weeks)	Forecast Code/Unit Testing Complete	Continuing Activities
Processor Basic Services (PBS, PBI)	Complete	100% coded	0	Complete	None
VxWorks (VXW)	Complete	100% coded	0	Complete	None
Code Management Extra (CMX)	Complete	100% coded	0	Complete	None
ZLIB Compression Tools (ZLIB)	3/19/04	95% coded	1	5/31/05	Output compression
RAD750 Board Support (RAD750)	8/25/04	100% coded	0	Complete	None
SIB Board Driver (SIB)	6/04/04	100% coded	0	Complete	None
Primary Boot (PBC)	10/30/04	100% coded	0	Complete	Testing of EPU boot
Secondary Boot (SBC)	10/30/04	100% coded	0	Complete	None
File Upload (FILE)	11/30/04	100% coded	0	Complete	None
CCSDS Packet Utilities (CCSDS)	9/01/04	100% coded	0	Complete	None



FSW Package Status (2)

Function	Planned Code/Unit Testing Complete	Status	Remaining Effort (person weeks)	Forecast Code/Unit Testing Complete	Continuing Activities
FSW Error Messaging (MSG)	12/15/04	100% coded	0	Complete	None
LAT Communications Board Driver (LCBD)	12/15/04	100% coded	0	Complete	None
Command and Telemetry Data Bus Driver (CTDB)	6/04/04	100% coded	0	Complete	None
Inter-task Communications (ITC)	4/08/05	95 % coded	1	5/31/05	SSR interface
LCB Service (LCS)	3/07/05	95% coded	1	5/31/05	SSR interface
Command and Telemetry/1553 Service (CTS)	3/07/05	100% coded	0	Complete	None
Instrument Configuration (LATC)	12/01/04	100% coded	0	Complete	None
Command and Telemetry Data Dictionary (LCAT)	1/10/05	LCAT tool complete	0	Complete	None
CPU monitor package (MON)	4/15/05	coded	0	Complete	None



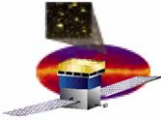
FSW Package Status (3)

Function	Planned Code/Unit Testing Complete	Status	Remaining Effort (person weeks)	Forecast Code/Unit Testing Complete	Continuing Activities
Startup package (CFG)	4/15/05	80% complete	3	6/17/05	Developing initialization scripts
File and Memory Mgmt (LFS, MEM)	11/30/04	100% coded	0	Complete	None
Power/Initialize GASU (PIG)	11/15/04	100% coded	0	Complete	Bug fixes.
LAT Electronics Module (LEM)	11/30/05	100% coded	0	Complete	Bug fixes.
Housekeeping (LHK)	3/22/05	100% coded	0	Complete	None
LAT Computer Manager (LCM)	4/30/05	95% coded	1	5/31/05	Telecommands
Thermal Control (LTC)	3/22/05	100% coded	0	Complete	None
Instrumented Memory Managers (IMM)	4/30/05	100% coded	0	Complete	None
Time Hack Services (THS)	4/30/05	95% coded	0	Complete	Testing



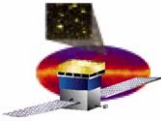
FWS Package Status (4)

Function	Planned Code/Unit Testing Complete	Status	Remaining Effort (person weeks)	Forecast Code/Unit Testing Complete	Continuing Activities
Spacecraft Messages (LSM) – includes Attitude Processing (ATT)	4/30/05	95% coded	1	5/23/05	Testing
Mode Control (LIM)	4/30/05	Coding has begun	1	5/27/05	In progress at NRL
LAT Multiplexed Counters (LMC)	4/15/05	100% coded	0	4/30/05	Testing
Charge Injection Calibration (LCI)	4/18/05	80% coded	3	6/20/05	Consignment (write to SSR; needs ITC)
LAT Event Formatting (LEF)	6/15/05	20% coded	2	6/15/05	Work continues
Event Monitoring (EMP)	12/1/04	100% coded	0	Complete	Bug fixes
Diagnostics (LDF)	5/15/05	Not started	3-4	7/5/05	Related to calibration; will continue after LCI completed
LAT Physics (LPA)	5/31/05	95% coded	1	5/31/05	Configuration, CNO
Event Integrity and Delivery (EDS)	3/22/05	100% coded	0	Complete	Bug fixes



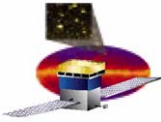
FSW Package Status

Function	Planned Code/Unit Testing Complete	Status	Remaining Effort (person weeks)	Forecast Code/Unit Testing Complete	Continuing Activities
Event Filtering (EFC)	3/22/05	100% coded	0	Complete	Bug fixes.
GRB Detection and Response	6/30	Not started	4	6/30/05	Deferred until completion of filter & diagnostics



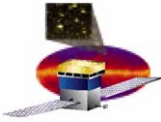
FSW Test Procedure and Script Status

Test Suite Name	Tests	Engineer	Planned Procedure Development	Actual Procedure Development	Test Script Dry Run Date (VSC and CR0-3-0 dependencies)
1553 Interface (IF1553)	3	Shantha	April 1	3/3	May 30
FSW and LAT Initialization (FSWINI)	15	Igor K.	April 1	15/15	June 15
File Management (FILMGT)	10	Shantha	April 1	10/10	June 1
Memory Upload and Dump Verification (MEMMGT)	9	Shantha	April 8	9/9	June 2
Vehicle Signals Interface Verification (VSGIFV)	3	Mark Mao	April 15	3/3	June 15
LAT Time Signal Processing (TIMPRC)	4	Mark M.	April 15	4/4	June 16
Command Functional (CMDFNC)	10	Shantha	April 22	9/10	May 31
Narrowband Telemetry Verification (NBTLMV)	5	Shantha	April 29	2/5	June 2
Event Filtering (EVTFIL)	4	Igor V.	April 29	4/4	June 6
T&DF, TKR, CAL, and ACD Internal Configuration Test (SIUCFG)	4	Igor K.	April 29		June 22

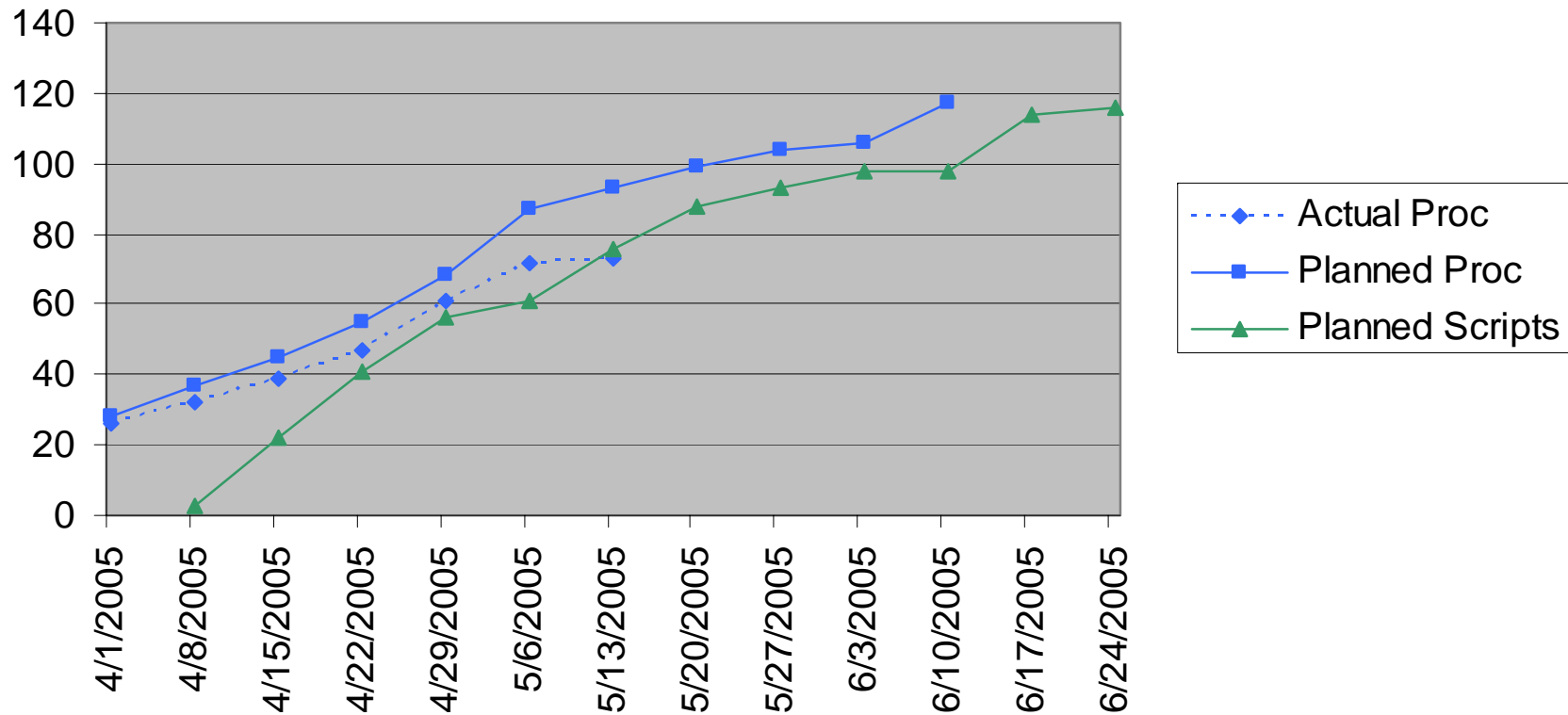


FSW Test Procedure and Script Status (2)

Test Name	Tests	Engineer	Planned Procedure Development	Actual Procedure Development	Test Script Dry Run Date
Operational Modes – Mode Control and Standard Operation Modes (OPMODE)	12	Igor K.	May 6		June 16
SIU/EPU CPU-to-CPU Communications Functional Test (IPCFNC)	1	Igor K.	May 13		June 6
LAT Event Performance Monitoring and Operations (EVTPMO)	5	Igor V.	May 13	5/5	June 9
Electronic Calibration (FECALB)	5	Igor K.	May 20		June 29
LAT Thermal Control System (THRMCS)	14	Shantha	May 20		June 17
Wideband Telemetry Verification (WBTLMV)	1	Igor V.	May 20	1/1	June 20
Operational Modes –Diagnostic and Calibration Modes (DCMODE)	11	Igor K.	June 6		July 13
GRB Handling/Repoint Requests and Logic (GRBREQ)	5	Igor V.	July 1	5/5	July 20
GRB Detection and Location (GRBPRC)	2	Igor V.	July 1	2/2	July 20



FSW Test Procedure and Script Status



- **Minor reorganization of the test suites:**
 - **Number of suites from 20 to 19**
 - **Number of test procedures reduced from 124 to 117**



FSW Phased Integration Plan

Package Suite	Release Date	Integration Focus	Package List	Confirm Integration Using
Base (B0-0-X)	May 6 (complete)	ITC, multi-CPU operations Boot code, counters Watchdog File and memory management Diagnostic telemetry (Alert telemetry) (Housekeeping) Driver and utility code Attitude (part 1), Spacecraft messages (part 1), time hack (part 1), computer manager Ground tools	ITC, CTS, LCS PBC, SBC, PBS/PBI, VXW, LMC,ZLIB (part I), RAD750, SIB, CCSDS, CTDB, MSG, LCBD, PIG, CMX, IMM, LEM, ZLIB MON FILE, LFS, MEM LHK ATT (part 1), LSM (part 1), THS (part 1), LCM (part 1) <u>Ground: LCAT, SCP, LCP, LCBT, SIIS, CLI, GRL</u>	<u>Regression Suite</u> Test Stand and hardware setup: •S/C crate •SIU crate •EPU crates (2) •GASU •(Alert telemetry and Housekeeping integration must be confirmed on the full Testbed)
A (B-0-1-X)	May 31	Event filtering and deadtime monitoring Event monitoring (trigger rates, VETO rates) Ground tools	LPA (part I), including EFC, EDS, ZLIB (part II), LCS (to SSR) <u>Ground: LCAT, SCP, LCP, LCBT, SIIS, CLI, GRL</u>	<u>Regression Suite</u> S/C crate, SIU crate, EPU crates, and Testbed: •FES & TEMs •GASU •PDU



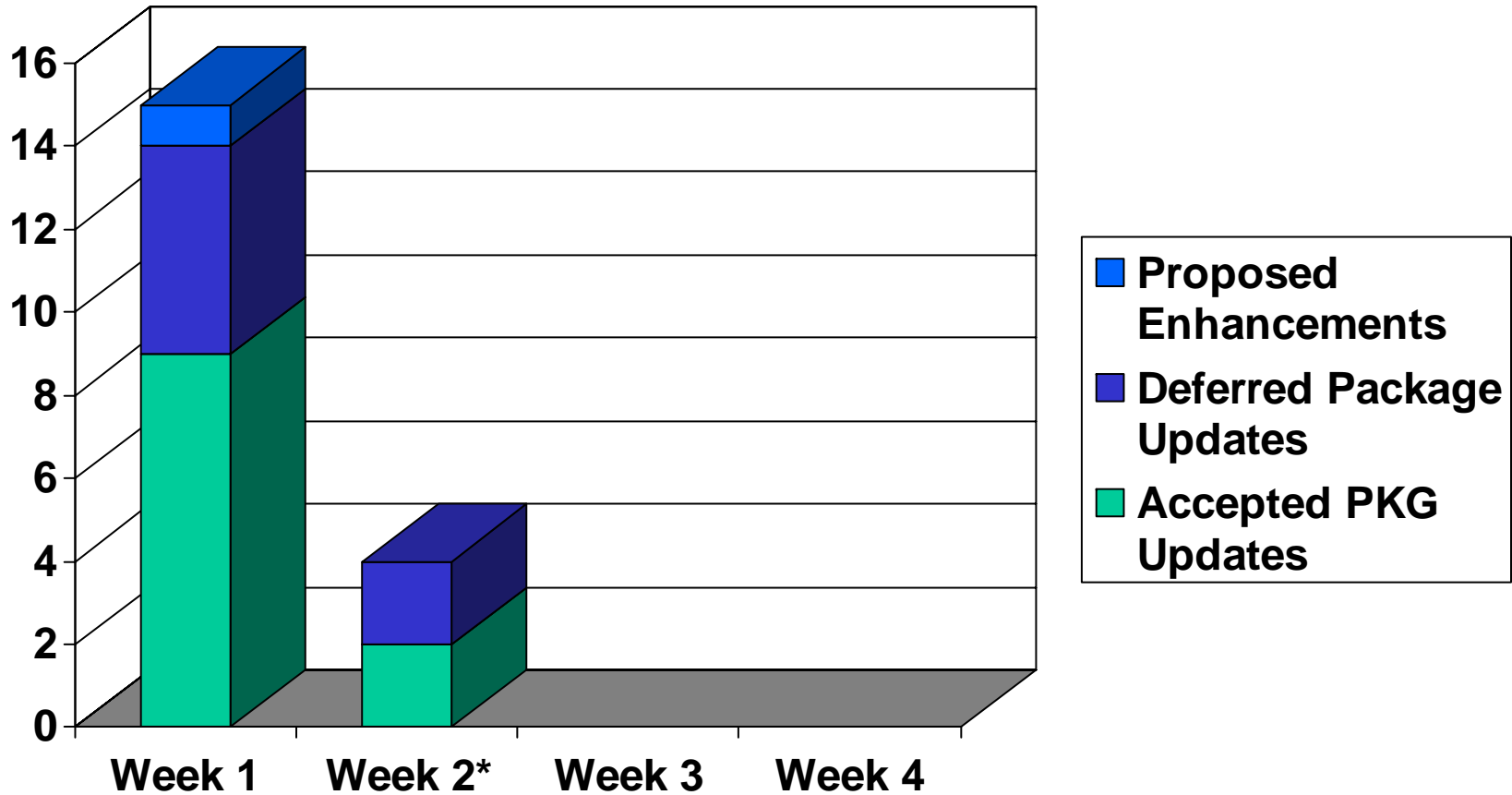
FSW Phased Integration Plan (2)

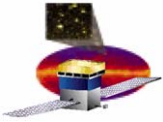
Package Suite	Release Date	Integration Focus	Package List	Confirm Integration Using
B (B-0-2-X)	June 14	Spacecraft interfaces (discretes, 1553 messages) – part 2 Attitude/time (part 2) Mode control Thermal Control FSW configuration and startup Ground tools	ATT (part 2), LSM (part 2), THS (part 2) LIM LTC CFG <u>Ground: LCAT, SCP, LCP, LCBT, SIIS, CLI, GRL</u>	<u>Test script dry run</u> VSC Testbed Env. simulator board (RTD + thermistor)
C (B-0-3-X)	June 28	Charge injection calibration Instrument configuration Ground tools	LCI LATC <u>Ground: LCAT, SCP, LCP, LCBT, SIIS, CLI, GRL</u>	<u>Test script dry run</u> VSC Testbed Mini-tower
D (B-0-4-X)	July 12	Diagnostics Computer manager	LPA (part 2) LDF LCM (part 2)	<u>Test script dry run</u> VSC Testbed
Full (B-0-5-X)	July 19	GRB Detection and Response	GRB	<u>Test script dry run</u> VSC Testbed



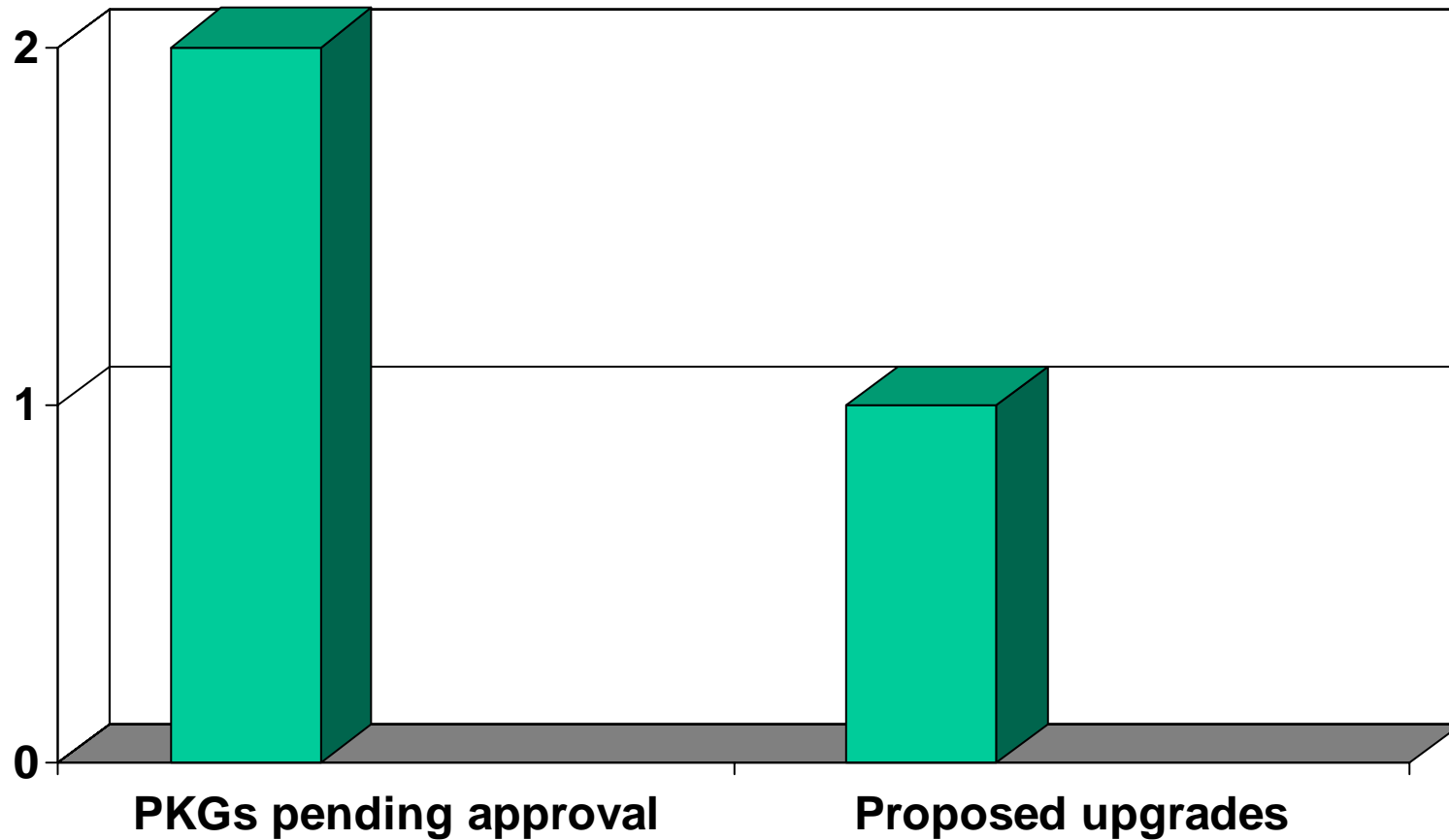
Change Tracking

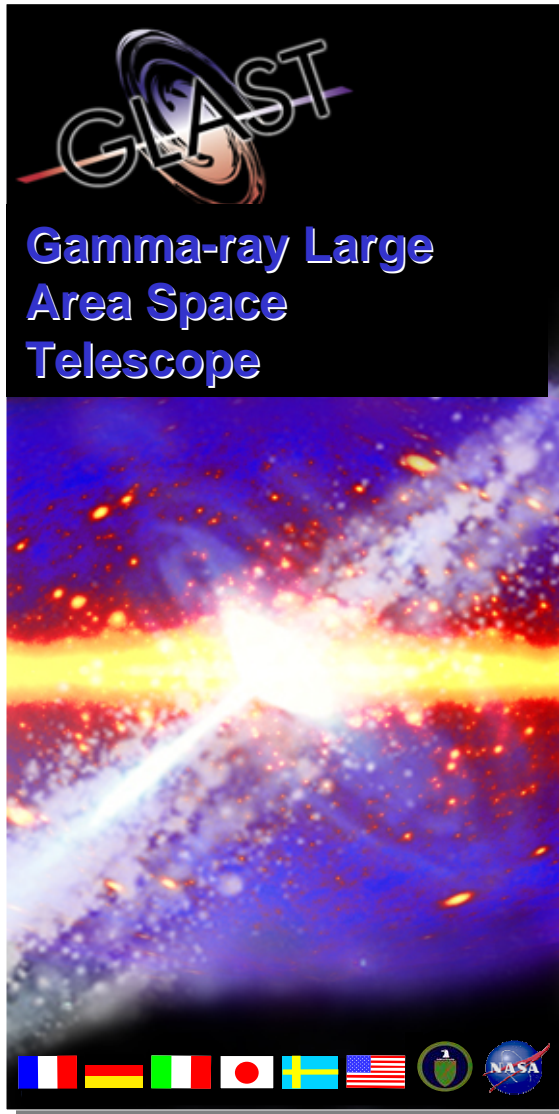
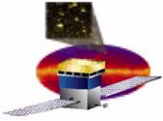
JIRA Issues on FSW CCB Agenda



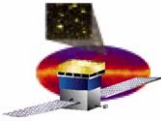


Change Status – Open issues



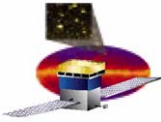


Demonstrations



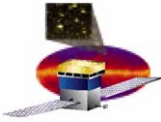
Completed Demonstrations

- 1553 Interface
- LCB Driver, Instrument Register Configuration
- SIU and EPU Boot
- File Upload to SIU
- Spacecraft Interfaces
 - **Capability to handle Magic 7 and discrete signals**
- Housekeeping (collected by single CPU)
- File and Memory Management on SIU
- Thermal Control System
- Basic Processing of Attitude and Time Messages
- Inter-task, Inter-CPU Communications
 - **Base Candidate Release based upon completion of ITC Service Layer and integration with calling packages**
- Watchdog



Upcoming Demos

<i>Demo</i>	<i>Num of Rqmts</i>	<i>Date</i>
Secondary Boot Code and File and Memory Management	3 2	5/27/05
Command Processing, Housekeeping, and Alert Telemetry	6 3 1	6/3/05
Event Monitoring and Delivery, Event Filtering, and Deadtime Monitoring	7 3 2	6/10/05
LAT Communications Board Driver, 1553 Communications Driver, and Spacecraft Interfaces	2 5 NA	6/17/05



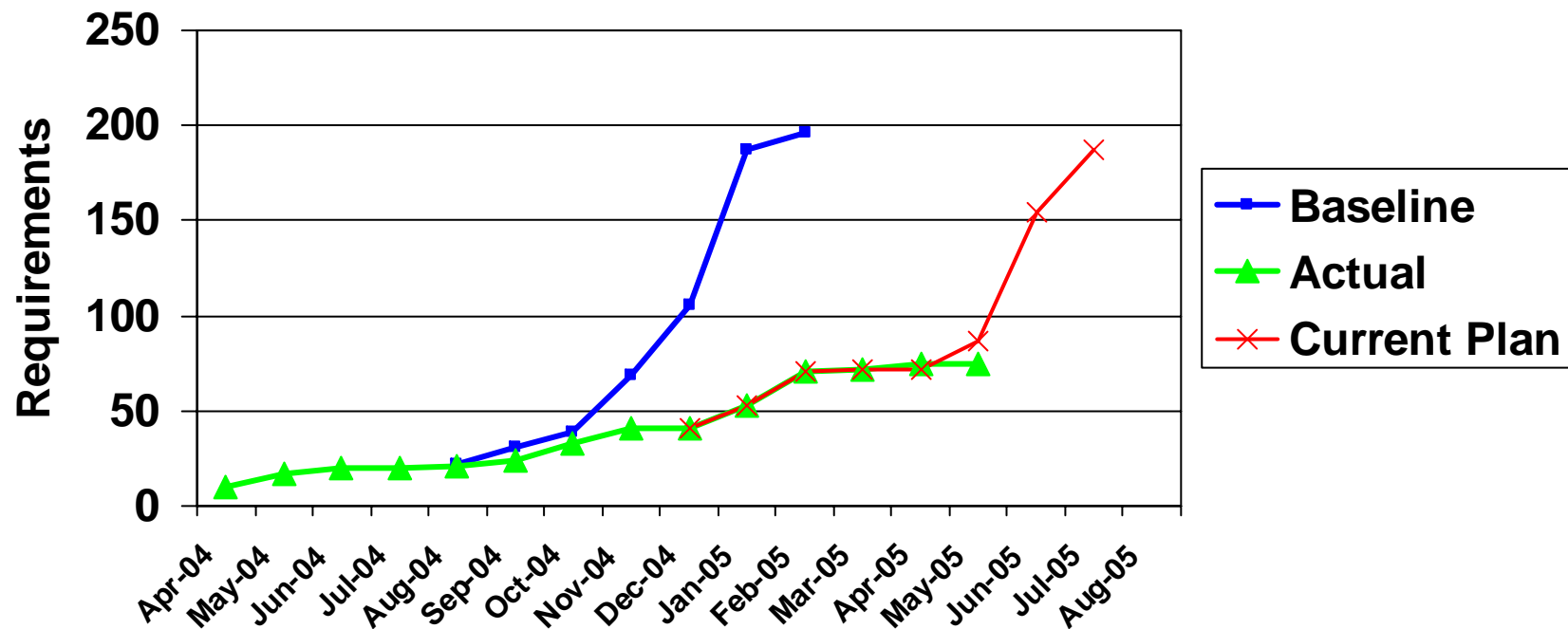
Upcoming Demos (2)

Demo	Num of Rqmts	Date
Mode Control, Safety, SAA Transit, and Thermal Control System	8 4 2 8	6/24/05
Charge Injection Calibration and Configuration	23 3	7/1/05
Diagnostics	18	7/5/05
Hardware Interfaces with the GBM, GRB Detection, and GRB Response	1 5 9	7/8/05



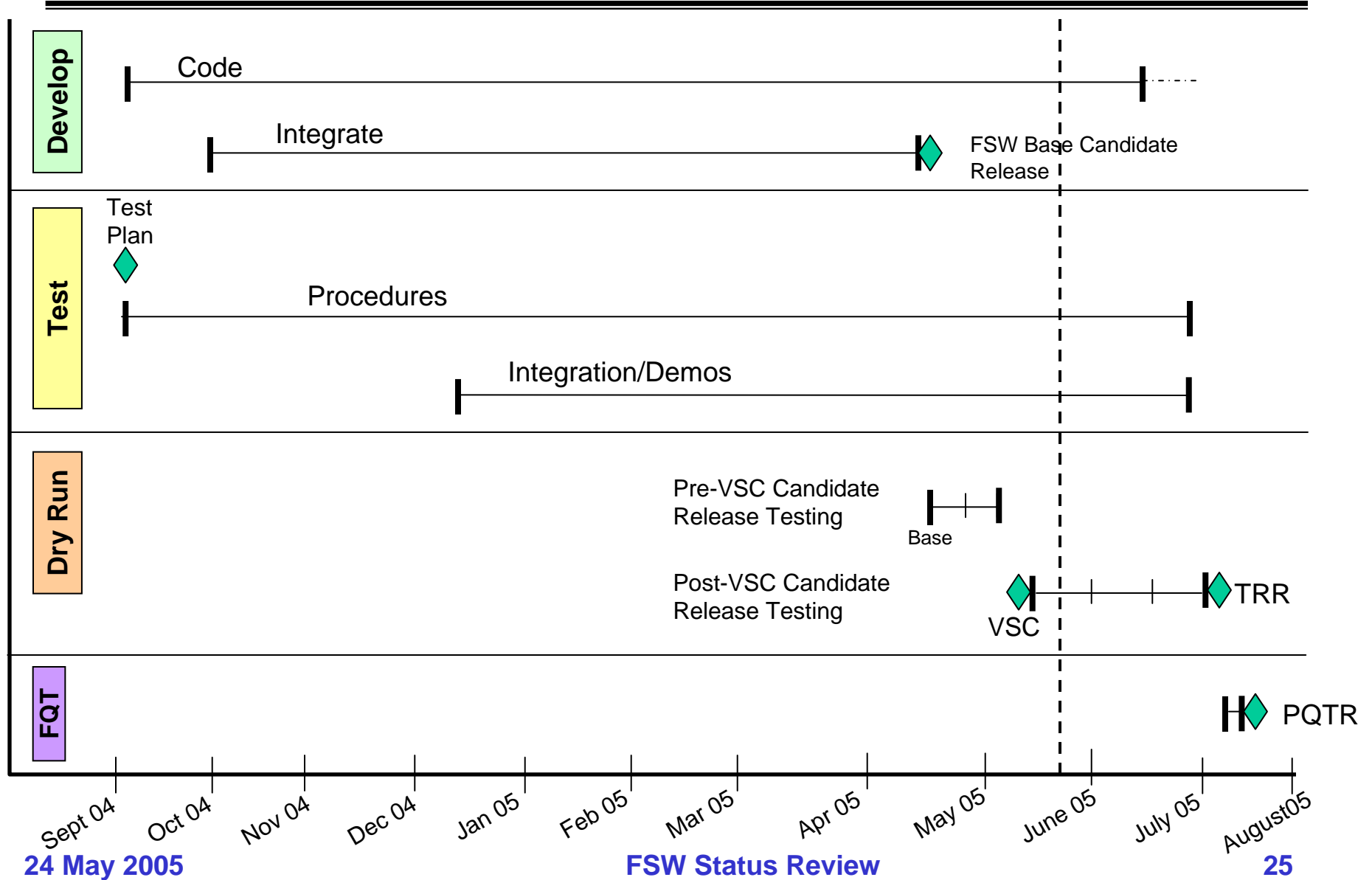
Demo to Requirements Mapping

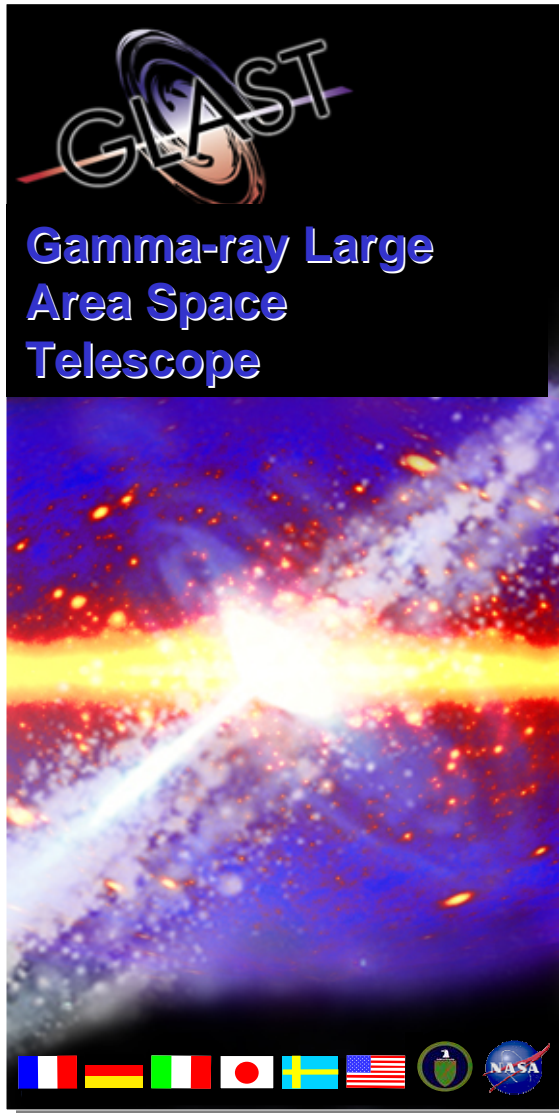
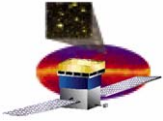
Status thru May





FSW Develop and Test Schedule Through FQT



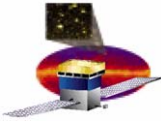


Glossary & Backup



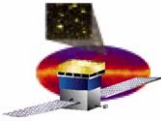
Glossary of FSW Terms

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)



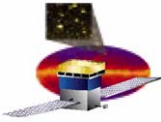
Glossary of FSW Terms (2)

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



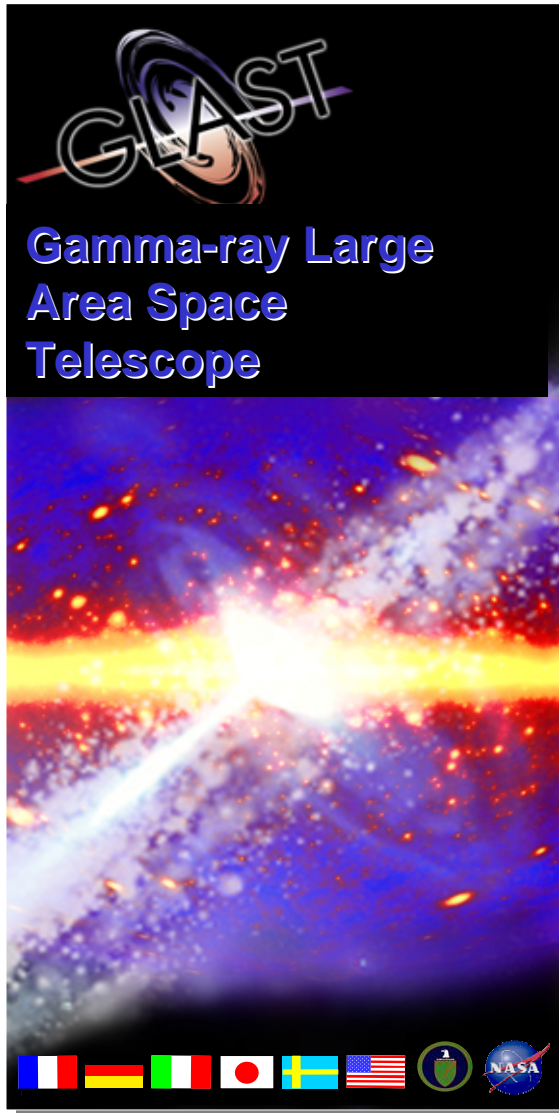
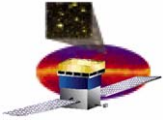
Glossary of FSW Terms (3)

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

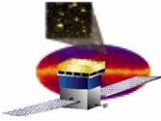


Getting to the TRR



Getting to the TRR

- Integration approach starts with an initial set of packages constituting a “Candidate Release” (CR)
 - After successful demonstration and shakeout of a Candidate Release, another set of packages is added
 - This new suite of packages becomes the next Candidate Release
- Approach uses two milestones for functional blocks bundled into a CR:
 - FSW package functionality is confirmed by demonstration
 - Test script functionality is confirmed by dry runs
 - Also revalidates that required packages are still functional
 - Scripts executed using the VSC



Test Readiness Review

- **Review package status**
 - **Identify missing functionality and bugs**
- **Review test procedure/script status**
 - **Dry runs must be complete in all areas to be performed in FQT**
 - **Some functional areas may be deferred**
- **Review documentation**
 - **FSW Design Document (complete draft)**
 - **FSW User Manual (complete draft)**
 - **Test Plan**
 - **Version Description Document**