

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9	Integration and Test	<p>Integrate and Test the LAT (excluding electrical integration). This includes developing and executing I&T plans and procedures, developing, prototyping, fabricating, assembling, and testing I&T MGSE and elements of EGSE. Also includes environmental test planning and execution. This subsystem will integrate and test the EM units, Calibration Unit (CU) and flight LAT. This subsystem will verify the GLAST instrument Monte Carlo (MC) by comparing data collected in beam tests from EM units, CU, and LAT to MC predictions (NB: all beam tests are not accelerator beam tests). I&T will use the beam test data and MC to perform science verification, analysis, and calibration (SVAC) on all of these units. I&T will perform a set of tests in orbit, during the initial part of instrument commissioning (Phase 0), that are based on tests developed during ground I&T. Full performance test and baseline test which will be used to assure LAT performance prior to and post all configuration tests. These tests will be sufficient to demonstrate that the LAT instrument is working properly before transfer to the ISOC. To accomplish much of this work, I&T will develop and focus Collaboration support for beam test, SVAC, environmental test, and Phase 0 on orbit activities.</p>	SLAC	E. Bloom	Fabrication/ Commissioning
4.1.9.1	I&T Management	<p>Provide program scheduling, cost accounting, and performance tracking and reporting for entire subsystem. Support development of subsystem specifications, verification plans, and interfaces with neighboring subsystems. Control subsystem environmental requirements and performance metrics. Support quarterly team meetings and project reviews. Travel to meetings and site visit for test support. Develop and focus Collaboration support for beam test, SVAC, environmental test, spacecraft and launch vehicle integration and Phase 0 on orbit activities.</p>	SLAC	E. Bloom	Fabrication/ Commissioning
4.1.9.1.1	Management and Engineering	<p>Provide program scheduling, cost accounting, and performance tracking and reporting for entire subsystem. Support development of subsystem specifications, verification plans, and interfaces with neighboring subsystems. Control subsystem environmental requirements and performance metrics. Support quarterly team meetings and project reviews, and travel thereto. Develop and focus Collaboration support for beam test, SVAC, environmental test, and Phase 0 on orbit activities. Control subsystem requirements metrics. Develop maintain and control LAT performance metrics. Prep and attend review, IDT meetings, etc.</p>	SLAC	E. Bloom	Fabrication/ Commissioning

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.1.2	Travel	Travel for subsystem support of team meetings, vendor visits, and technical meetings for engineering and professional staff. This includes travel required to support integration and test activities. Travel for subsystem attendance at reviews and other meetings. Travel for vendor visits. Travel for targeted meetings with other members of GLAST. Travel for instrument testing. Travel for SC integration. Travel for LV integration. All I&T department travel funds are held at this level.	SLAC	E. Bloom	Fabrication
4.1.9.1.3	I&T Support	Workstation, and Laptop Computers and software for supporting engineering effort for I&T.	SLAC	E. Bloom	Fabrication
4.1.9.2	Quality Assurance	Support Quality Assurance activities for the subsystem. QA activities include helping develop procedures and collecting quality records. Also includes developing training programs for other LAT personnel involved in LAT I&T activities.	SLAC	D. Marsh	Fabrication
4.1.9.2.1	Reliability	Perform reliability analysis of subsystem	SLAC	D. Marsh	Fabrication
4.1.9.2.2	QA	Develop written procedures and specifications for the procurement, fabrication, assembly, and testing of all subsystem components and assemblies. Work with sub-contractors to ensure uniform compliance to standards and procedures, and to verify performance. Collect records and test data, and verify performance for subsystem components, and for incoming flight hardware to be integrated. Develop and implement LAT training program for integration training of subsystem personnel.	SLAC	D. Marsh	Fabrication
4.1.9.3	Instrument Science Operations Center (ISOC) Coordinator	Ensure the orderly transition to the ISOC for LAT on-orbit operations. Leverage the development of the online software systems to minimize ISOC cost. Capture and retain LAT engineering knowledge in the operations team. Validate and verify all flight operations procedures, command and telemetry database entries, calibration procedures, and ISOC hardware and software prior to instrument delivery. Maximize the use of I&T opportunities for training instrument operators and science observers.	SLAC	D. Lung (acting)	Fabrication
4.1.9.3.1	Management and Engineering	Management and Engineering on a departmental basis. Travel to meetings and site visit for test support. Help I&T management develop and focus Collaboration support for Phase 0 on orbit activities.	SLAC	D. Lung (acting)	Fabrication
4.1.9.3.2	Prep	Coordinate online software, SVAC activities with ISOC planning	SLAC	D. Lung (acting)	Fabrication
4.1.9.3.3	EM-1	Coordinate online software, SVAC activities with ISOC planning.	SLAC	D. Lung (acting)	Fabrication
4.1.9.3.4	Calibration Unit	Coordinate online software and SVAC activities with ISOC planning.	SLAC	D. Lung (acting)	Fabrication

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.3.5	Flight Unit	Coordinate online software and SVAC activities with ISOC planning and activities. Validate and verify all flight operations procedures, command and telemetry database entries, calibration procedures, and ISOC hardware and software prior to instrument delivery. Maximize the use of I&T opportunities for training instrument operators and science observers.	SLAC	D. Lung (acting)	Fabrication
4.1.9.4	Mechanical Ground Support Equipment	Supports the other I&T departments, the observatory I&T, and launch, in their MGSE needs. This support begins with the EM-1 and continues through launch. This includes development, fabrication or procurement, assembly and qualification testing of all needed MGSE. It also includes support during use of the equipment. Work in this department should be coordinated with Mechanical Systems.	SLAC	E. Gawehn	Fabrication/ Commissioning
4.1.9.4.1	Management and Engineering	Provide program scheduling, cost accounting, and performance tracking and reporting for department. Support development of department specifications, verification plans, and interfaces with neighboring departments. Control department environmental requirements and performance metrics. Control departments requirement metrics. Travel to meetings and site visit for test support.	SLAC	E. Gawehn	Fabrication/ Commissioning
4.1.9.4.2	Prep	Develop and Prototype EM-1, CU and LAT MGSE equipment. Develop mechanical interface documentation to ACD, CALORIMETER, ELECTRONICS, MECHANICAL, TRACKER subsystems. Develop and prototype Van de Graff accelerator support and containment design. Develop and prototype LAT shipping container design. Develop interface documentation to spacecraft.	SLAC	E. Gawehn	Fabrication
4.1.9.4.2.1	Concept Development	Develop concepts for EM-1, CU, LAT Shipping Container MGSE	SLAC	E. Gawehn	Fabrication
4.1.9.4.2.2	Calibration Test Development	Conceptual design of Mechanical Calibration test equipment.	SLAC	E. Gawehn	Fabrication
4.1.9.4.2.3	Mechanical Interface Documentation	Obtain interface documentation to other Subsystems (ACD, Cal, Tkr, elec, Mech, S/C). This should be coordinated with Mechanical Systems Engineering	SLAC	E. Gawehn	Fabrication
4.1.9.4.3	EM-1	Fabricate or procure, assemble and test MGSE for use during EM-1 integration and test. Fabricate, assemble, and test Bld 33 Van de Graff accelerator support and containment. Support the MGSE needs in other I&T departments. Support EM-1 integration and test activities	SLAC	E. Gawehn	Fabrication
4.1.9.4.3.1	Engineering EM-1 Unit MGSE	Develop and detail MGSE for EM-1.	SLAC	E. Gawehn	Fabrication
4.1.9.4.3.2	Engineering Van De Graff MGSE	Detail containment and support stand for Van de Graff.	SLAC	E. Gawehn	Fabrication

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.4.4	Calibration Unit	Fabricate or procure, assemble, and test MGSE for use during CU integration and test and beam test. Support the MGSE needs in other I&T departments. Support CU integration and test activities.	SLAC	E. Gawehn	Fabrication
4.1.9.4.4.1	Engineering	Develop, detail plans and equipment to support the Calibration Unit MGSE.	SLAC	E. Gawehn	Fabrication
4.1.9.4.4.2	Equipment and Preparation	Procure and Assemble MGSE for Calibration Unit.	SLAC	E. Gawehn	Fabrication
4.1.9.4.4.3	(Reserved)				
4.1.9.4.4.4	Calibration Unit Beam Test MGSE	Provide MGSE support during the Beam Test.	SLAC	E. Gawehn	Fabrication
4.1.9.4.5	Flight Unit	Fabricate or procure, assemble, and test MGSE for use during LAT integration and test. Fabricate LAT shipping container. Fabricate or procure, assemble and test MGSE for use during LAT environmental test at the vendor's facility. Support the MGSE needs in other I&T departments. Support LAT integration and test activities.	SLAC	E. Gawehn	Fabrication
4.1.9.4.5.1	LAT Integration	Provide engineering, preparation, fabrication of Flight Unit MGSE	SLAC	E. Gawehn	Fabrication
4.1.9.4.5.1.1	Engineering	Develop, detail MGSE for flight unit, including procedures, support stand, cart, lift rigging, staging table, misc. equip, calibration detector, mounting stand, base isolated pallet, rigging forklift harness, transport box, misc. transport containers.	SLAC	E. Gawehn	Fabrication
4.1.9.4.5.2	Integration Preparation	Fab/Assemble LAT Int. Equip, Fab/Assemble LAT Transport, Storage Equip, Prepare Integration Clean Room	SLAC	E. Gawehn	Fabrication
4.1.9.4.5.2.1	Fab/Assemble LAT Int. Equip	Procure/ assemble, support tand, cart, lift rigging, staging table, misc. equipment and fixtures	SLAC	E. Gawehn	Fabrication
4.1.9.4.5.2.2	(Reserved)				
4.1.9.4.5.2.3	Fab/Assemble LAT Transport, Storage Equip	Procure/assemble. LAT mounting stand, base isolated pallet, rigging forklift harness, dry transport box, misc. transport containers.	SLAC	E. Gawehn	Fabrication
4.1.9.4.5.2.4	Prepare Integration Clean Room	Support installation of stands in clean room, support of load testing, survey alignment support, test installed stands.	SLAC	E. Gawehn	Fabrication
4.1.9.4.5.3	LAT Airplane test support	Support LAT Airplane test plans and detail/design required fixturing/MGSE. Procure, assemble, test airplane fixturing/MGSE, including obtaining required certifications.	SLAC	E. Gawehn	Fabrication
4.1.9.4.5.3.1	Engineering	Support LAT Airplane test plans and detail/design required fixturing/MGSE.	SLAC	E. Gawehn	Fabrication
4.1.9.4.5.3.2	LAT Airplane test preparation	Procure, assemble, test airplane fixturing/MGSE, including obtaining required certifications.	SLAC	E. Gawehn	Fabrication
4.1.9.4.5.4	LAT Mechanical Testing	Support LAT mechanical testing plans and design/detail Vib mounts. Procure, assemble, test vibration test mount/equipment.	SLAC	E. Gawehn	Fabrication
4.1.9.4.5.4.1	Engineering	Support LAT mechanical testing plans and design/detail Vib mounts.	SLAC	E. Gawehn	Fabrication
4.1.9.4.5.4.2	Mechanical Vibration Testing Preparation	Procure, assemble, test vibration test mount/equipment.	SLAC	E. Gawehn	Fabrication

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.4.5.5	(Reserved)				
4.1.9.4.5.6	(Reserved)				
4.1.9.5	Online Software	Develop, test, and support software used to collect data from the EM units, CU and LAT test stands, saves them to persistent storage, and to monitor and control the test stand and data acquisition system. We define a "test stand" to be a collection of hardware and embedded software that communicates with the online software system via Ethernet over a Local Area Network. The Online Software department is responsible for the online software, workstations on which the online software operates, and network connections. The online software includes a test executive that communicates with the embedded system to control the test stand, collects data from the hardware under test, a scripting language, Graphical User Interface (GUI) tools, a database, analysis tools, and a mechanism to archive data. The Online Software Department will also provide a code management and release control system. The Online Software department is responsible for the design and implementation of a standard test suite (scripts) used to qualify the instrument sensors and accompanying electronics. The supplied tools will allow people external to the online department to develop independent test procedures (scripts) for specific situations as they find appropriate. The ELECTRONICS Subsystem is responsible for substantial elements of the test stand. Thus, there will be close coordination between the Online Software department and ELECTRONICS Subsystem. We expect that the online software system will evolve into the Instrument Science Operations Center (ISOC) software system that controls, monitors and collects data from the orbiting instrument.	SLAC	R. Claus	Fabrication
4.1.9.5.1	Management and Engineering	Provide program scheduling, cost accounting, and performance tracking and reporting for department. Support development of department specifications, verification plans, and interfaces with neighboring departments. Control department environmental requirements and performance metrics. Control departments requirements metrics. Travel to meetings and site visit for test support. Responsible for coordination of EGSE activities with ELECTRONICS and ISOC subsystems.	SLAC	R. Claus	Fabrication
4.1.9.5.1.1	Configuration management	Provide and establish a software configuration management system	SLAC	R. Claus	Fabrication
4.1.9.5.1.1.1	Version control	Track software revisions	SLAC	R. Claus	Fabrication
4.1.9.5.1.1.2	Release control	Track software releases	SLAC	R. Claus	Fabrication
4.1.9.5.1.1.3	Release building and distribution	Arrange for a system that builds and distributes software releases	SLAC	R. Claus	Fabrication
4.1.9.5.1.1.4	Problem reporting/tracking database	Arrange for a system that users use to report problems and tracks their resolution	SLAC	R. Claus	Fabrication

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.5.1.2	COTS software	Selection, procurement and familiarization of COTS software required for EGSE/Online	SLAC	R. Claus	Fabrication
4.1.9.5.1.2.1	Software evaluation and selection	Formulation of selection criteria of COTS software	SLAC	R. Claus	Fabrication
4.1.9.5.1.2.2	Software procurement & licenses	Procurement of COTS software	SLAC	R. Claus	Fabrication
4.1.9.5.1.2.3	Bootstrap effort	Effort required to learn use of COTS software	SLAC	R. Claus	Fabrication
4.1.9.5.1.2.4	Support contracts	COTS software maintenance and support contracts	SLAC	R. Claus	Fabrication
4.1.9.5.1.2.5	Consulting costs	Consulting contracts to enhance, or provide additional deliverables to us, of COTS software	SLAC	R. Claus	Fabrication
4.1.9.5.1.2.6	Training	COTS software training of end-users	SLAC	R. Claus	Fabrication
4.1.9.5.1.2.7	Updates	COTS software version updates	SLAC	R. Claus	Fabrication
4.1.9.5.1.3	WBS	Time spent on preparing the WBS	SLAC	R. Claus	Fabrication
4.1.9.5.1.4	PDR	Time spent on PDR	SLAC	R. Claus	Fabrication
4.1.9.5.1.5	CDR	Time spent on CDR	SLAC	R. Claus	Fabrication
4.1.9.5.1.6	Management Activities	Day to Day Management Activities	SLAC	R. Claus	Fabrication
4.1.9.5.2	Prep	Establish online software system architecture. Establish specific software tools for EM-1 and CU (EM-2) applications. Establish vendor communications and begin training for selected products. Staff up programming labor per budget and schedule.	SLAC	R. Claus	Fabrication
4.1.9.5.2.1	Definition of Requirements	Effort spent on understanding the problem to be solved and establishing a list of requirements	SLAC	R. Claus	Fabrication
4.1.9.5.2.2	Documents	Activities surrounding the production of various documents	SLAC	R. Claus	Fabrication
4.1.9.5.2.3	Test Stands	Activities surrounding the establishment of test stands	SLAC	R. Claus	Fabrication
4.1.9.5.3	EM-1	Develop and fabricate or procure, assemble, and test the EM1 online software and workstations used to develop test and qualify sensor hardware and electronics for EM-1. Distribute these units to ELECTRONICS, ACD, CAL, TRACKER, and I&T Subsystems. Support the software and workstations at the various venues used by the Subsystems. The latter may be done by remote networking techniques.	SLAC	R. Claus	Fabrication
4.1.9.5.3.1	Eng Model 1 Test stand S/W devel and support	Development and support of EM1 test stand software	SLAC	R. Claus	Fabrication
4.1.9.5.3.1.1	SCL/hardware interface definition and implementation	Work with Electronics and Flight Software groups to establish the software interface to the hardware in SCL	SLAC	R. Claus	Fabrication
4.1.9.5.3.1.1.1	TEM	Work with Electronics and Flight Software groups to establish the software interface to the TEM in SCL	SLAC	R. Claus	Fabrication
4.1.9.5.3.1.1.2	AEM	Work with Electronics and Flight Software groups to establish the software interface to the AEM in SCL	SLAC	R. Claus	Fabrication
4.1.9.5.3.1.1.3	GEM	Work with Electronics and Flight Software groups to establish the software interface to the GEM in SCL	SLAC	R. Claus	Fabrication
4.1.9.5.3.1.2	Command/Monitor GUI tool	Use of the command/monitor GUI tool to produce GUIs for test stand use	SLAC	R. Claus	Fabrication

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.5.3.1.3	Relational Databases, tools and integration	Work to create local (MS ACCESS) and central (Oracle) database schemas. Create synchronization tool. Integration with SCL	SLAC	R. Claus	Fabrication
4.1.9.5.3.1.4	Visualization tool and integration	Work to augment and integrate a visualization tool with SCL	SLAC	R. Claus	Fabrication
4.1.9.5.3.1.5	Persistent data storage method and format	Work to establish a method and format for storing persistent event data	SLAC	R. Claus	Fabrication
4.1.9.5.3.1.6	Test report generation and archiving	Work to automatically generate and archive test reports	SLAC	R. Claus	Fabrication
4.1.9.5.3.1.7	SCL databases and scripts	Create SCL databases and scripts as starting points and training tools for end users	SLAC	R. Claus	Fabrication
4.1.9.5.3.1.8	Release	Testing, production, distribution, and support of EM-1 software releases	SLAC	R. Claus	Fabrication
4.1.9.5.3.2	Eng Model 2 Test stand S/W devel and support	Extension of the EM1 online software to EGSE EM2 and support thereof	SLAC	R. Claus	Fabrication
4.1.9.5.3.2.1	EM-2 software development	Development work to extend the EGSE EM1 code base to the EGSE EM2 level	SLAC	R. Claus	Fabrication
4.1.9.5.3.2.2	Instrument Power Supply	Design, implement, test and release IPS software	SLAC	R. Claus	Fabrication
4.1.9.5.3.2.3	Spacecraft Interface Simulator	Design, implement, test and release SIS software	SLAC	R. Claus	Fabrication
4.1.9.5.3.2.4	Release	Support of EM-2 software releases	SLAC	R. Claus	Fabrication
4.1.9.5.4	Calibration Unit	Develop and fabricate or procure, assemble, and test the CU online software and workstations used to develop test and qualify sensor hardware and electronics for the CU. Help create test scripts in coordination with the IFCT, Particle Test, and SVAC, departments. The CU test stands are used for accelerator beam tests and other beam tests with the CU. The CU test stands are also used for developing flight software. Support the software and workstations at the various venues used by I&T.	SLAC	R. Claus	Fabrication
4.1.9.5.5	Flight Unit	Develop and fabricate or procure, assemble, and test the LAT online software and workstations used to develop test and qualify sensor hardware and electronics for the LAT. Help create test scripts in coordination with the IFCT, and SVAC departments. The LAT test stands are used when the instrument is undergoing, shakedown, environmental, airplane, and pre-launch tests. Support the software and workstations at the various venues used by I&T.	SLAC	R. Claus	Fabrication
4.1.9.6	Integration, Facilities, Configuration and Test (IFCT)	Develop I&T plans for the EM units, CU, and LAT. Develop procedures, and equipment. Layout, spec, and procure equipment and facilities needed for LAT integration at SLAC. Train and certify technician support for LAT flight hardware handling. Provide on-going operational support of integration facilities and staff. Supervise I&T work in Bld 33.	SLAC	L. Wai	Fabrication/ Commissioning

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.6.1	Management and Engineering	Develop and implement I&T plans for EM units, CU, and LAT. Supervise I&T activities in Bld 33 and manage Bld 33. Implement training and certification of technician support for LAT flight hardware handling. Supervise technician support at all LAT flight hardware test venues. Provide program scheduling, cost accounting, and performance tracking and reporting for department. Support development of department specifications, verification plans, and interfaces with neighboring departments. Control department environmental requirements and performance metrics. Control departments requirements metrics. Travel time to meetings and site visit for test support	SLAC	L. Wai	Fabrication/ Commissioning
4.1.9.6.2	Prep	Prepare I&T EM units, CU, and LAT plans for department. Prepare Bld 33 for I&T activities. Staff up technician labor for I&T activities per budget and schedule. Establish training procedures and work procedures.	SLAC	L. Wai	Fabrication
4.1.9.6.2.1	Technician Training	Establish training procedures and work procedures.	SLAC	L. Wai	Fabrication
4.1.9.6.2.1.1	Contamination Control	Train I& T Technicians for clean room procedures	SLAC	L. Wai	Fabrication
4.1.9.6.2.1.2	Flight Hardware Training	Train I&T technicians for flight hardware assembly, electrostatic discharge, and handling.	SLAC	L. Wai	Fabrication
4.1.9.6.2.1.3	Crane/Critical Lift	Train I&T technicians for safe operation of 5-ton crane in clean room high bay. Train technicians for safe operation of 15-ton crane in building 33.	SLAC	L. Wai	Fabrication
4.1.9.6.2.2	Clean Room Lab Operations	Specify, purchase, and set-up clean room systems.	SLAC	L. Wai	Fabrication
4.1.9.6.2.2.1	Real-Time Monitoring	Specify, purchase, and set-up electronic data acquisition systems for temperature, humidity, and particle count.	SLAC	L. Wai	Fabrication
4.1.9.6.2.2.2	Cleanroom Materials and Services	Specify and procure cleanroom de-contamination equipment, clean room storage cabinets, services, and decommission upon completion.	SLAC	L. Wai	Fabrication
4.1.9.6.2.2.3	Receiving Inspection	Prepare receiving inspection plan and test receiving inspection procedures.	SLAC	L. Wai	Fabrication
4.1.9.6.2.2.4	Controlled Storage	Coordinate controlled storage plan with flight hardware subsystem engineers. Prepare and test controlled storage procedures.	SLAC	L. Wai	Fabrication
4.1.9.6.2.3	Computers and Office Materials	Plan and specify materials and services needed for continuous operation of the integration area.	SLAC	L. Wai	Fabrication
4.1.9.6.2.3.1	Computers	Specify and purchase computer workstations.	SLAC	L. Wai	Fabrication
4.1.9.6.2.3.2	Office Materials and Supplies	Specify and purchase meeting area equipment.	SLAC	L. Wai	Fabrication
4.1.9.6.2.4	Flight Hardware Integration Tools	Specify and purchase flight hardware integration tools.	SLAC	L. Wai	Fabrication
4.1.9.6.2.4.1	Integrated Tower Metrology	Specify and purchase metrology system for LAT integration	SLAC	L. Wai	Fabrication
4.1.9.6.2.4.2	Electrical Test Tools	Specify and purchase electrical test tools to be used during mechanical intergration.	SLAC	L. Wai	Fabrication

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.6.2.4.3	Mechanical Assembly Tools	Specify and purchase assembly tools.	SLAC	L. Wai	Fabrication
4.1.9.6.2.4.4	Mechanical Test Tools	Specify and build mechanical mating test equipment.	SLAC	L. Wai	Fabrication
4.1.9.6.3	EM-1	Develop procedures and plans for the EM-1 unit. Perform EM-1 mechanical integration. Coordinate test equipment and fixtures with MGSE, online software, and particle test departments. Coordinate testing of assembled EM-1 with beam test, online and SVAC departments.	SLAC	L. Wai	Fabrication
4.1.9.6.3.1	EM-1 Integration	Develop, test and practice procedures for integration of EM-1 unit; execute integration procedures.	SLAC	L. Wai	Fabrication
4.1.9.6.3.1.1	Single Tower Model	Design and build model for single tower integration.	SLAC	L. Wai	Fabrication
4.1.9.6.3.1.2	Integration Procedure	Develop, test and practice single tower integration procedure.	SLAC	L. Wai	Fabrication
4.1.9.6.3.1.3	Preparation	Prepare for EM-1 integration.	SLAC	L. Wai	Fabrication
4.1.9.6.3.1.4	EM-1 Grid	Integrate EM-1 grid onto MGSE.	SLAC	L. Wai	Fabrication
4.1.9.6.3.1.5	EM-1 Tower	In coordination with electronics subsystem Integrate EM-1 tracker tower, calorimeter module, and front-end electronics. Perform cable mating, cable tie down, and electrical tests.	SLAC	L. Wai	Fabrication
4.1.9.6.3.2	Van De Graf Test	Develop, test and practice procedures for exposure of EM-1 unit to Van De Graf radiation; execute test.	SLAC	L. Wai	Fabrication
4.1.9.6.3.2.1	Test Procedure	Develop, test and practice procedure for single tower Van De Graf exposure.	SLAC	L. Wai	Fabrication
4.1.9.6.3.2.2	Preparation	Prepare for EM-1 Van De Graf exposure.	SLAC	L. Wai	Fabrication
4.1.9.6.3.2.3	Test Execution	Expose EM-1 to Van De Graf radiation.	SLAC	L. Wai	Fabrication
4.1.9.6.3.3	(Reserved)				
4.1.9.6.4	Calibration Unit	Develop procedures and plans for the Calibration Unit. Perform Calibration Unit mechanical integration and tests. Coordinate test equipment and fixtures with MGSE, online software, and particle test. Coordinate transport, installation and testing of assembled Calibration Unit with MGSE, online software, particle test and SVAC departments.	SLAC	L. Wai	Fabrication
4.1.9.6.4.1	Calibration Unit Integration	Develop, test and exercise procedures for Calibration Unit integration; integrate Calibration Unit.	SLAC	L. Wai	Fabrication
4.1.9.6.4.1.1	Calibration Unit Model	Design and build four tower Calibration Unit model for integration procedure development, test, and exercise.	SLAC	L. Wai	Fabrication
4.1.9.6.4.1.2	Integration Procedure	Develop, test and exercise integration procedure for Calibration Unit; determine cable tie-down points.	SLAC	L. Wai	Fabrication
4.1.9.6.4.1.3	Preparation	Prepare for calibration unit integration.	SLAC	L. Wai	Fabrication
4.1.9.6.4.1.4	Calibration Unit Grid	Mate Calibration Unit Grid to MGSE.	SLAC	L. Wai	Fabrication
4.1.9.6.4.1.5	Towers A&B	Integrate Towers A&B.	SLAC	L. Wai	Fabrication
4.1.9.6.4.1.6	Towers 1&2	Integrate Towers 1&2	SLAC	L. Wai	Fabrication
4.1.9.6.4.1.7	Cross-Unit Electronics	Mechanically Integrate relevant cross-unit electronics; perform cross-unit cable tie-down.	SLAC	L. Wai	Fabrication
4.1.9.6.4.2	Van De Graf Test	Develop, test, and practice procedure for Calibration Unit exposure to Van De Graf radiation; execute 4 tower exposure test.	SLAC	L. Wai	Fabrication

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.6.4.2.1	Test Procedure	Coordinate development of procedures for 4-tower Van De Graf test with Particle Test manager. Test and practice procedures for test using Calibration Unit Model.	SLAC	L. Wai	Fabrication
4.1.9.6.4.2.2	Preparation	Prepare for Calibration Unit 4-tower exposure test.	SLAC	L. Wai	Fabrication
4.1.9.6.4.2.3	Test Execution	Perform Calibration Unit 4-tower exposure test.	SLAC	L. Wai	Fabrication
4.1.9.6.4.3	SLAC Particle Beam Test	Develop, test and practice procedures for exposure of Calibration unit to End Station A particle beams; execute test beam procedures.	SLAC	L. Wai	Fabrication
4.1.9.6.4.3.1	Test Procedure	Coordinate development of Test Beam procedures with Particle Test Manager. Test and practice procedures using Calibration Unit Model. Test and practice procedures for transport of Calibration Unit to End Station A.	SLAC	L. Wai	Fabrication
4.1.9.6.4.3.2	Preparation	Prepare for Calibration Unit Particle Beam Test.	SLAC	L. Wai	Fabrication
4.1.9.6.4.3.3	Transport CU to End Station A	Transport Calibration Unit to End Station A.	SLAC	L. Wai	Fabrication
4.1.9.6.4.3.4	Test Execution	Execute Test Beam Procedures.	SLAC	L. Wai	Fabrication
4.1.9.6.4.3.5	Transport CU to Bldg.33	Transport Calibration Unit to Building 33 Clean Room Area.	SLAC	L. Wai	Fabrication
4.1.9.6.4.3.6	De-integrate CU	Remove flight parts from the Calibration Unit	SLAC	L. Wai	Fabrication
4.1.9.6.5	Flight Unit	Develop procedures and plans for the LAT. Perform LAT mechanical integration and tests. Coordinate test equipment, fixtures and test scripts with MGSE, online software, particle test, and SVAC departments. Coordinate transport, testing of assembled LAT with environmental test, MGSE, online software, and particle test and SVAC departments.	SLAC	L. Wai	Fabrication
4.1.9.6.5.1	LAT Integration	Develop, test and practice procedures for integration of LAT. Prepare and execute procedures.	SLAC	L. Wai	Fabrication
4.1.9.6.5.1.1	LAT Integration Model	Design and build LAT Integration Model.	SLAC	L. Wai	Fabrication
4.1.9.6.5.1.2	Integration Procedure	Develop, test and practice procedures for integration of LAT. Determine cable tie-down points. Determine thermal readout points and practice thermocouple wiring, tie-down, and final cut-off. Determine accelerometer cable routing, tiedown, and removal.	SLAC	L. Wai	Fabrication
4.1.9.6.5.1.3	Preparation	Prepare for integration of LAT.	SLAC	L. Wai	Fabrication
4.1.9.6.5.1.4	LAT Grid	Mate LAT Grid to MGSE.	SLAC	L. Wai	Fabrication
4.1.9.6.5.1.5	Towers 3&4	Integrate Towers 3&4.	SLAC	L. Wai	Fabrication
4.1.9.6.5.1.6	Towers 5&6	Integrate Towers 5&6.	SLAC	L. Wai	Fabrication
4.1.9.6.5.1.7	Towers 7&8	Integrate Towers 7&8.	SLAC	L. Wai	Fabrication
4.1.9.6.5.1.8	Towers 9&10	Integrate Towers 9&10	SLAC	L. Wai	Fabrication
4.1.9.6.5.1.9	Towers 11&12	Integrate Towers 11&12	SLAC	L. Wai	Fabrication
4.1.9.6.5.1.A	Towers 13&14	Integrate Towers 13&14	SLAC	L. Wai	Fabrication
4.1.9.6.5.1.B	Towers 15&16	Integrate Towers 15&16	SLAC	L. Wai	Fabrication
4.1.9.6.5.1.C	(Reserved)				
4.1.9.6.5.1.D	LAT Survey	Survey Full LAT	SLAC	L. Wai	Fabrication
4.1.9.6.5.1.E	LAT-wide Electronics	Mechanically Integrate LAT-wide electronics. Perform cable tie-down and flight hardware cable connection mates coordinated with electronics subsystems.	SLAC	L. Wai	Fabrication

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.6.5.1.F	ACD	Integrate ACD.	SLAC	L. Wai	Fabrication
4.1.9.6.5.1.G	Cross-LAT Thermal Plate	Integrate Cross-LAT Thermal Plate	SLAC	L. Wai	Fabrication
4.1.9.6.5.2	Comprehensive Test	Develop, test and practice procedures for comprehensive test of LAT. Execute procedures.	SLAC	L. Wai	Fabrication
4.1.9.6.5.2.1	Test Procedure Development	Develop, test and practice procedures for LAT comprehensive test. Develop, test, and practice procedures for GSE cooling of LAT during full LAT multi-day data taking ground tests.	SLAC	L. Wai	Fabrication
4.1.9.6.5.2.2	Preparation	Prepare for LAT comprehensive test.	SLAC	L. Wai	Fabrication
4.1.9.6.5.2.3	Execute Test	Execute LAT comprehensive test.	SLAC	L. Wai	Fabrication
4.1.9.6.5.3	SLAC Thermal Cycle test	In coordination with environmental test department. Develop procedures for SLAC thermal cycle test of LAT (subsequently cancelled).	SLAC	L. Wai	Fabrication
4.1.9.6.5.3.1	Test Procedure Development	Develop procedures for SLAC thermal cycle test (subsequently cancelled).	SLAC	L. Wai	Fabrication
4.1.9.6.5.3.2	Preparation	Prepare for SLAC thermal cycle test of LAT.	SLAC	L. Wai	Fabrication
4.1.9.6.5.3.3	Execute Test	Execute SLAC thermal cycle test of LAT.	SLAC	L. Wai	Fabrication
4.1.9.6.5.4	Airborne Cosmic Test	Develop, test and practice procedures for end-to-end airborne cosmic test of LAT. Execute procedures.	SLAC	L. Wai	Fabrication
4.1.9.6.5.4.1	Test Procedure Development	Develop, test and practice procedures for LAT airborne cosmic test. Develop, test and practice procedures for transport of LAT to and from airplane. Document all procedures.	SLAC	L. Wai	Fabrication
4.1.9.6.5.4.2	Preparation	Prepare for LAT airborne cosmic test.	SLAC	L. Wai	Fabrication
4.1.9.6.5.4.3	LAT Transport to airplane	Execute procedures for transport of LAT to airplane.	SLAC	L. Wai	Fabrication
4.1.9.6.5.4.4	Test Execution	Execute procedures for LAT airborne cosmic test.	SLAC	L. Wai	Fabrication
4.1.9.6.5.4.5	LAT Transport from airplane	Execute procedures for transport of LAT from airplane.	SLAC	L. Wai	Fabrication
4.1.9.6.5.5	Environmental Test	In coordination with environmental test department, coordinate, develop, test and practice procedures for LAT environmental tests. Execute procedures.	SLAC	L. Wai	Fabrication
4.1.9.6.5.5.1	Test Procedure Development	Coordinate test procedures with Environmental Test Manager. Develop, test and practice procedures for LAT environmental tests. Develop, test and practice procedures for transport of LAT to and from Environmental Test Facility.	SLAC	L. Wai	Fabrication
4.1.9.6.5.5.2	Preparation	Prepare for LAT environmental test.	SLAC	L. Wai	Fabrication
4.1.9.6.5.5.3	Test Execution	Execute procedures for LAT environmental tests.	SLAC	L. Wai	Fabrication
4.1.9.6.5.5.4	LAT Transport	Execute procedures for transport of LAT from environmental test facility	SLAC	L. Wai	Fabrication
4.1.9.6.5.6	Final Comprehensive Test	Develop, test and practice procedures for LAT final comprehensive test. Execute procedures.	SLAC	L. Wai	Fabrication

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.7	Particle Test	Develop, plan, and lead in the implementation of particle tests for the EM units, CU, and LAT. Particle tests will include ground cosmic rays and Van de Graff photons for the EM units; ground cosmic rays, Van de Graff photons, and accelerator beam tests for the CU; ground cosmic rays, Van de Graff photons, and end-to-end test in an airplane using cosmic rays at altitude for the LAT. These tasks will require close coordination with all other departments in I&T. To accomplish much of this work, the particle test manager will help I&T management develop and focus Collaboration support.	SLAC	G. Godfrey	Fabrication
4.1.9.7.1	Management and Engineering	Lead development, planning, and implementation of all GLAST particle beam tests. Provide program scheduling, cost accounting, and performance tracking and reporting for department. Support development of department specifications, verification plans, and interfaces with neighboring departments. Control department environmental requirements and performance metrics. Control departments requirements metrics. Responsible for SLAC interface to the SLAC Experimental Facilities Department. Work with subsystem management to develop and focus Collaboration support for beam test. Travel time to meetings and site visit for test support	SLAC	G. Godfrey	Fabrication
4.1.9.7.1.1	Document	Document the beamline and gross instrument geometries. Document the beam event info data content. Transmit documentation to SVAC for inclusion in the MC simulation	SLAC	G. Godfrey	Fabrication
4.1.9.7.1.2	Procedures	Write Procedures for all Particle Tests	SLAC	G. Godfrey	Fabrication
4.1.9.7.2	Prep	Prepare EM units, CU, and LAT particle test plans for department. Working with MGSE and online software, install Van de Graff accelerator, prepare cosmic ray setup in Bld 33, and test. Working in close coordination with IFCT, staff up technician labor for particle tests per budget and schedule. Establish training and work procedures. Begin planning for particle tests in airplane and at environmental test vendor. This should be done in close coordination with the environmental test manager. Help develop and focus Collaboration support for these activities.	SLAC	G. Godfrey	Fabrication
4.1.9.7.2.1	Van de Graff	Move, install, refurbish and test Van de Graff	SLAC	G. Godfrey	Fabrication
4.1.9.7.3	EM Units	Lead in the implementation of ground cosmic ray and Van de Graff photon beam tests on EM units. This activity should be closely coordinated with IFCT, online software, and SVAC departments. Help develop and focus Collaboration support for these activities.	SLAC	G. Godfrey	Fabrication

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.7.4	Calibration Unit	Prepare EM units, CU, and LAT particle test plans for department. Working with MGSE and online software, install Van de Graff accelerator, prepare cosmic ray setup in Bld 33, and test. Working in close coordination with IFCT, staff up technician labor for particle tests per budget and schedule. Establish training and work procedures. Begin planning for particle tests in airplane and at environmental test vendor. This should be done in close coordination with the environmental test manager. Help develop and focus Collaboration support for these activities.	SLAC	G. Godfrey	Fabrication
4.1.9.7.4.1	Make Modifications to SLAC A-Line	Make modifications to SLAC-A Line	SLAC	G. Godfrey	Fabrication
4.1.9.7.4.2	Setup Beam Line in ESA	Setup the Beam Line in SLAC ESA	SLAC	G. Godfrey	Fabrication
4.1.9.7.5	Flight Unit	Develop the MGSE concepts for the LAT shipping container in close coordination with the MGSE department. Lead in the detailed planning, scheduling, and implementation of ground cosmic ray, Van de Graff photon, and airborne cosmic ray tests on LAT. This activity should be closely coordinated with IFCT, online software, environmental test, and SVAC departments. Help develop and focus Collaboration support for these activities.	SLAC	G. Godfrey	Fabrication
4.1.9.8	Environmental Test	Environmental Test is responsible for the preparation and execution of LAT environmental tests and for supporting mission level environmental testing. Responsible for coordinating and performing EMI/EMC, modal survey and random vibration/acoustic testing, thermal balance and thermal cycling, and other environmental tests as directed by the LAT verification test plan. Responsible for coordinating with other I&T departments to complete the environmental tests. Responsible interface with the environmental test facility	SLAC	M. Lovellette	Fabrication
4.1.9.8.1	Management and Engineering	Provide program scheduling, cost accounting, and performance tracking and reporting for department. Support development of department specifications, verification plans, and interfaces with neighboring departments. Control department environmental requirements and performance metrics. Control departments requirements metrics. Responsible interface with the environmental test facility. Help I&T management develop and focus Collaboration support for environmental test activities. Travel time to meetings and site visit for test support	SLAC	M. Lovellette	Fabrication
4.1.9.8.1.1	(Reserved)				
4.1.9.8.1.2	Meeting Support	Provide support for design and test readiness reviews for environmental test activities	SLAC	M. Lovellette	Fabrication
4.1.9.8.1.3	Test requirements definition	Define requirements, goals and success criteria for environmental tests	SLAC	M. Lovellette	Fabrication

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.8.2	Prep	Responsible for detailed preparation, environmental test flow, detailed schedule of activities, coordination with other I&T departments, coordination with environmental test facility.	SLAC	M. Lovellette	Fabrication
4.1.9.8.2.1	Test plan preparation	Prepare test plans for environmental test activities. Incorporate these test plans into the system test plan and verify that all test requirements will be satisfied after the completion of environmental test.	SLAC	M. Lovellette	Fabrication
4.1.9.8.2.2	Test Fixture Preparation	Prepare fixtures for LAT environmental testing with MGSE department	SLAC	M. Lovellette	Fabrication
4.1.9.8.2.3	Test Procedure Preparation	Prepare test procedure for LAT environmental testing	SLAC	M. Lovellette	Fabrication
4.1.9.8.3	EM Units	Support EM units integration and test as required or requested by other departments.	SLAC	M. Lovellette	Fabrication
4.1.9.8.4	Calibration Unit	Support CU integration and test as required or requested by other departments. Little or no work is currently planned for environmental testing of the CU.	SLAC	M. Lovellette	Fabrication
4.1.9.8.5	Flight Unit	Coordinate and perform the LAT environmental tests. Coordinate with the other I&T departments and subsystems to complete LAT performance and science verification tests required during the environmental test phase. Coordinate all activities with the environmental test facility and environmental test facility personnel.	SLAC	M. Lovellette	Fabrication
4.1.9.8.5.1	(Reserved)				
4.1.9.8.5.2	EMI test	Perform EMI test on flight unit	SLAC	M. Lovellette	Fabrication
4.1.9.8.5.3	Vibro/acoustic testing	Perform vibroacoustic testing on flight unit	SLAC	M. Lovellette	Fabrication
4.1.9.8.5.3.1	Modal Survey	Perform a Modal Survey on the flight unit	SLAC	M. Lovellette	Fabrication
4.1.9.8.5.3.2	Sine Sweep	Perform a Sine Sweep on the flight unit	SLAC	M. Lovellette	Fabrication
4.1.9.8.5.3.3	Acoustic	Perform an Acoustic on the flight unit	SLAC	M. Lovellette	Fabrication
4.1.9.8.5.4	TVAC testing	Perform thermal vacuum testing on flight unit	SLAC	M. Lovellette	Fabrication
4.1.9.8.5.5	Environmental Test report generation	Prepare environmental test report	SLAC	M. Lovellette	Fabrication
4.1.9.9	Science Verification, Analysis & Calibration (SVAC)	Coordinate and help perform the data analysis for particle beam and cosmic ray tests. These tests are designed to ultimately calibrate the LAT, and to validate the Monte Carlo simulations that will be used to verify the LAT science performance requirements. The SVAC department plan builds gradually on the knowledge acquired from low-level calibration tests on hardware units by the subsystems, in the process of I&T, and from particle tests using EM units, mainly the CU, and finally applied to the LAT.	SLAC	E. do Couto e Silva	Fabrication

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.9.1	Management and Engineering	Lead development, planning, and implementation of all GLAST SVAC activities. Provide program scheduling, cost accounting, and performance tracking and reporting for department. Support development of department specifications, verification plans, and interfaces with neighboring departments. Control department requirements and performance metrics. Responsible main interface with Science Analysis Software Subsystem. Help I&T management develop and focus Collaboration support for SVAC activities. Travel time to meetings and site visit for test support	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.2	Prep	Develop and design the SVAC plan. Coordinate with the ISOC, online software, and particle test departments to develop tests and the software to implement the SVAC plan. Working in close coordination with the online software department, staff up programmer labor for SVAC activities per budget and schedule. Help develop and focus Collaboration support for these activities. Working with I&T management, write IRD(s) with SAS subsystem that establishes reconstruction software and Monte Carlo deliverables and schedule from SAS, and establishes calibration products and other deliverables and schedule from the SVAC department.	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.2.1	Documentation	Produce documentation to support SVAC activities.	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.2.1.1	General	General documentation to support SVAC activities	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.2.1.2	Interface Control Documents	ICDs to support SVAC activities	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.2.1.3	SVAC Plan for EM	Data analysis plan for the Engineering Model	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.2.1.4	SVAC Plan for CU	Data analysis plan for the Calibration Unit	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.2.1.5	SVAC Plan for LAT	Data analysis plan for the LAT	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.2.1.6	Databases	Description of databases	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.2.2	Monte Carlo Simulation	Monte Carlo simulation activities prior to beam tests, to check parameter space , geometry and general infrastructure	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.2.2.1	Geometry	Geometry implementation and documentation	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.2.2.2	GISMO	Preparation to validate beam test parameter space	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.2.2.3	GEANT4	Preparation to validate beam test parameter space and alignment algorithms	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.2.3	Database	Development of infrastructure for the SVAC database	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.3	EM-1	Prototype high and low level calibration algorithms and the calibration database. Perform data analysis on ground cosmic ray and Van de Graaff photon data. Help develop and focus Collaboration support for these activities.	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.3.1	Monte Carlo Simulation	Produce and validate Monte Carlo simulation for comparison with real data	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.3.1.1	Geometry	Geometry implementation and documentation	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.3.1.2	Histograms	Develop of quality check histograms for MC validation	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.3.2	Infrastructure	Ensure that electronic catalog of runs and calibration algorithms are available.	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.3.3	EGSE	Produce calibration scripts related to EGSE.	SLAC	E. do Couto e Silva	Fabrication

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.9.3.4	Database	Develop SVAC prototype database.	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.3.5	Data Analysis	Perform low-level, high-level calibrations and demonstrate that van de Graf can be used for future tests. Produce a final report with results.	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.4	SVAC General Support	Provide general support for the SVAC department including; support Tracker mini-tower tests, integration preparation, mini-tower cosmic ray analysis, Van de Graaff data analysis, SVAC ISOC coordination support, Survey Support, LAT Data Analysis.	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.5	Flight Unit	Obtain data from each individual LAT FU for high level and low-level calibrations. Calibrate the ACD tiles after the ACD is integrated to the LAT. Analyze this data along with extensive data obtained from ground cosmic rays and the Van de Graff photon beam. Use the results of the data analysis to check parallel Monte Carlo simulations on the full LAT. Also, use this data to perform full inter-tower alignment on the ground. Use Data from metrology measurements of the LAT to check ground cosmic ray alignment procedure. Perform calibrations and alignment during environmental tests (e.g. to verify temperature dependence). Help develop and focus Collaboration support for these activities.	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.5.1	Monte Carlo Simulation	Provide support of Monte Carlo simulation for LAT lead by SAS.	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.5.2	Infrastructure	Ensure that electronic catalog of runs and calibration algorithms are available.	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.5.3	EGSE	Produce calibration scripts related to EGSE.	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.5.4	Database	Implement final SVAC database.	SLAC	E. do Couto e Silva	Fabrication
4.1.9.9.5.5	Data Analysis	Perform low-level, high-level calibrations, science verification and publish a paper with results.	SLAC	E. do Couto e Silva	Fabrication
4.1.9.A	I&T Mission Support	Support planning and execution of Observatory and LV integration and test. Provide technician and engineering support of Observatory I&T through launch and on-orbit check out.	SLAC	E. Bloom	Fabrication/ Commissioning
4.1.9.A.1	I&T Mission Support - Management	Oversee I&T organization during Mission I&T Phase	SLAC	E. Bloom	Fabrication/ Commissioning
4.1.9.A.2	I&T Mission Support - QA	Provide QA support during Mission Phase	SLAC	D. Marsh	
4.1.9.A.3	I&T Mission Support - ISOC	Coordinate online software, particle test, and SVAC activities with ISOC activities. Maximize the use of I&T opportunities for training instrument operators and science observers. Validate and verify all flight operations procedures, command and telemetry database entries, calibration procedures, and ISOC hardware and software prior to instrument commissioning. Ensure the orderly transition to the ISOC for LAT on-orbit operations.	SLAC	D. Lung (acting)	Fabrication

GLAST/LAT Work Breakdown Structure - Integration and Test Subsystem

WBS	Task	Description	Responsibility	Manager	Phase
4.1.9.A.4	I&T Mission Support - MGSE	Fabricate or procure, assemble, and test MGSE as needed for use during LAT integration to spacecraft and subsequent tests. Support observatory integration at spacecraft vendor's facility. Support launch vehicle integration to observatory and subsequent launch at the launch site.	SLAC	TBD - Mechanical Engineer	
4.1.9.A.5	I&T Mission Support - Online	Support the software and workstations at the various venues used by I&T. These will include observatory integration and test, launch, and orbit Phase 0 commissioning.	SLAC	R. Claus	Commissioning
4.1.9.A.6	I&T Mission Support - IFCT	Support planning and execution of Observatory and LV integration and test. Provide on-site and SLAC technician and engineering support of Observatory I&T through launch and on-orbit check out.	SLAC	L. Wai	Fabrication/ Commissioning
4.1.9.A.7	I&T Mission Support - Particle	Lead in the planning and execution of ground cosmic ray tests at the observatory integration vendor and launch pad. Provide on-site support of Observatory cosmic ray tests through launch and on-orbit check out.	SLAC	G. Godfrey	Commissioning
4.1.9.A.8	I&T Mission Support - Environmental	Work with spacecraft and launch vehicle providers to plan environmental testing during the observatory level phase. Provide oversight of the observatory level environmental tests. Support launch and Phase 0 commissioning of LAT on orbit.	SLAC	M. Lovellette	Fabrication/ Commissioning
4.1.9.A.9	I&T Mission Support - SVAC	Perform low-level calibrations during and after spacecraft integration. Check alignment of LAT using ground cosmic rays after observatory integration, but before launch. Perform the first on-orbit calibration during the Phase 0 commissioning of the LAT. Also during Phase 0, test Special calibration modes for low and high level calibrations and schemes for selecting Galactic Cosmic Rays from high Z elements. This work is to be completed prior to transfer of a working LAT to the Instrument Science Operation Center (ISOC).	SLAC	E. do Couto e Silva	Fabrication/ Commissioning