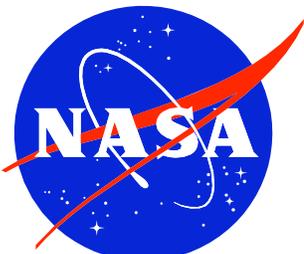


**GAMMA-RAY LARGE AREA  
SPACE TELESCOPE  
(GLAST)**

**SCIENCE SUPPORT CENTER  
FUNCTIONAL  
REQUIREMENTS  
DOCUMENT**

Revision A

December June 11286, 20042



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**GODDARD SPACE FLIGHT CENTER  
GREENBELT, MARYLAND**

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GAMMA-RAY LARGE AREA SPACE TELESCOPE  
(GLAST)

SCIENCE SUPPORT CENTER  
FUNCTIONAL REQUIREMENTS DOCUMENT

REVISION A

June~~December~~ 14~~28~~6, 2004~~2~~

NASA Goddard Space Flight Center

Greenbelt, Maryland

# **GLAST SCIENCE SUPPORT CENTER FUNCTIONAL REQUIREMENTS DOCUMENT**

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# 1 PURPOSE

This document defines the functional requirements that must be met by the GLAST Science Support Center (SCC).

The SSC is one of a number of organizations that constitute the GLAST ground operations system. The Mission Operations Center (MOC) will control the spacecraft by transmitting commands, and receiving the telemetry. The MOC will perform Level 0 processing, which removes transmission artifacts from the telemetry, and then will transmit these data to the other organizations. Each instrument team will maintain its own Instrument Operations Center (IOC)—the Instrument Science and Operations Center (ISOC) for the LAT team and the GBM IOC (GIOC)—which will monitor the health of its instrument, take remedial action if necessary, perform the Level 1 processing, and support the instrument team’s scientific studies. The two IOCs will transmit the Level 1 data and other data products to the GSSC; the GSSC will have a backup capability for performing Level 1 processing. The GSSC and the IOCs will have joint responsibility for the definition of the relevant science analysis tools and for the representation of the instrument response functions; GSSC scientists will participate in the development of the science tools. The GSSC will be responsible for supporting the astronomical community’s use of GLAST data by running the guest investigator (GI) program, providing analysis software and expertise, and disseminating GLAST data and results. The GSSC will be responsible for the mission’s timeline. Finally, the GSSC will archive the mission’s data.

This document first provides a list of acronyms (§2) and a glossary of key terms and concepts (§3). The relevant documents from which these requirements are derived are listed in §4. Finally, the actual requirements are presented (§5); traceability to the Ground System Requirements Document (GSRD) is included. Some requirements trace directly back to the Mission System Specification (MSS) document-is included; references to MSS requirements are preceded by “MSS”. Where a requirement is found in both documents, the MSS requirement is provided in italics for information only. The appendices provide traceability and verification matrices.

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## 2 ACRONYMS

<del>ATC</del>	<del>Absolute Time Command</del>
<del>ATS</del>	<del>Absolute Time Sequence</del>
<del>ASDC</del>	<del>ASI Science Data Center</del>
<del>ASI</del>	<del>Agenzia Spaziale Italiana</del>
DEC	Declination
EPO	Education and Public Outreach
GBM	GLAST Burst Monitor
<del>GI</del>	<del>Guest Investigator</del>
GIOC	GBM IOC
GOF	Guest Observer Facility
GRB	Gamma-Ray Burst
GSFC	Goddard Space Flight Center
<del>GIGSSC</del>	<del>Guest Investigator Science Support Center</del>
HEASARC	High Energy Astrophysics Science Archive Research Center
HQ	Headquarters
IOC	Instrument Operations Center
<del>ISOC</del>	<del>Instrument Science Operations Center</del>
LAT	Large Area Telescope
LHEA	Laboratory for High Energy Astrophysics
<del>LIOC</del>	<del>LAT IOC</del>
MOC	Mission Operations Center
MSS	Mission System Specification
NASA	National Aeronautics and Space Administration

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NRA	NASA Research Announcement
OGIP	Office of Guest Investigator Programs
PI	Principal Investigator
RA	Right Ascension
SAA	South Atlantic Anomaly
<del>SSC</del>	<del>Science Support Center</del>
SWG	Science Working Group
TBD	To Be Determined
TBR	To Be Reviewed
TDRSS	Tracking and Data Relay Satellite System
TOO	Target of Opportunity

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### 3 GLOSSARY

**Analysis**—Predicted performance using calculations to show compliance with specified performance (MSS §1.4).

**Archive**—A collection of data that the HEASARC maintains in perpetuity as a record of the mission and for the use of the scientific community.

**Database**—A collection of data that the GSSC maintains for use by the GSSC and the community it serves during the GLAST mission.

**Demonstration**—Observed compliance of functional operation or behavior with that specified (MSS §1.4).

**Inspection**—Visual proof of existence of specified characteristics or properties (MSS §1.4).

**Level 0 data**—The raw data from the spacecraft after the telemetry packets have been time-ordered and repeated packets from a given spacecraft downlink have been removed. The data streams from the spacecraft and the instruments are separated. The processing that produces Level 0 data is called Level 0 processing.

**Level 1 data**—Data from which many of the instrumental artifacts have been removed and that are ready for astrophysical data analysis. LAT Level 1 data consist of reconstructed events. The processing that produces Level 1 data is called Level 1 processing.

**Level 2 data**—The results of analysis of Level 1 data such as spectral fits and source detections. The processing that produces Level 2 data is called Level 2 processing.

**Level 3 data**—Compendia of Level 2 data.

**Phase 0**—The first 60 days after launch during which the spacecraft and instruments are turned on and checked out.

**Phase 1**—The first year of scientific operations after launch and checkout during which the spacecraft will survey the sky and the instrument teams will validate the data.

**Phase 2**—The mission after the conclusion of Phase 1 until the spacecraft leaves orbit or is turned off.

**Test**—Measurement of performance to show compliance with specified performance (MSS §1.4).

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Verification—The process of proving that the implementation satisfies the requirement. The central question is whether the system is built right. The methods of showing compliance with requirements are Inspection, Demonstration, Analysis and Test, as defined above (MSS §1.4).

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## 4 APPLICABLE DOCUMENTS

- [GLAST Ground System Requirements Document \(GSRD\), 433-RQMT-0006](#)
- “GLAST Large Area Telescope Flight Investigation: An Astro-Particle Physics Partnership Exploring the High-Energy Universe,” P. Michelson, PI.
- “GLAST Burst Monitor,” C. Meegan, PI.
- NASA/DOE Memorandum of Understanding
- GLAST Level I Requirements Document
- Mission System Specification ([MSS](#)), 433-SPEC-0001
- Operations Concept Document, 433-OPS-0001
- Science Requirements Document, 433-SRD-0001
- Project Data Management Plan (PDMP), 433-PLAN-0009

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## 5 REQUIREMENTS

### 5.1 General Requirements

High level requirements from the Mission Systems Specification apply to this document.

#### 5.1.1 Launch Date

The design, development and operational readiness of the GSSC shall meet the launch date specified on the master schedule for the project. (MSS §3.5.1.6)

#### 5.1.2 Operational Lifetime

The operational lifetime of the GSSC shall be the same as, or greater than, that of the spacecraft, which is a minimum of 5 years with a goal of 10 years, following an initial period of in-orbit checkout. (GSSC0040 and MSS §3.5.1.8)

#### 5.1.3 Coordinate Systems

The GSSC shall use the J2000 inertial coordinate system, using Right Ascension (RA) and Declination (DEC), as a standard means of identifying and reporting celestial objects and of communicating pointing directions. (SYS0190, SYS0200, MSS §3.5.1.10.1 and §3.5.1.10.2)

#### 5.1.4 Units of Measurement

The GSSC shall observe the current NASA policy directive, NPD 8010.2C, "Use of the Metric System of Measurement in NASA Programs." Metric units shall be used with the following exceptions: angular measure may be expressed in degrees, minutes and seconds; photon and particle energy may be expressed in eV; and English units may be used for mechanical fabrication. (SYS0010 and MSS § 3.5.1.12)

#### 5.1.5 Maintenance

The GSSC shall be maintained for the entire mission lifetime with no loss in GSSC capability or performance. (SYS0120 and GSSC1000)

#### 5.1.6 Time Units

The GSSC shall use Universal Time Coordinate (UTC) time as the time base for all operations activities. (SYS0040)

#### 5.1.7 Availability

The GSSC shall assist the ground system in operating the GLAST observatory 24 hours per day, every day of the year. (SYS1000)

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## 5.2 Facilities

### 5.2.1 Location

The GSSC shall be part of the Office of Guest Investigator Programs (OGIP) within the Laboratory for High Energy Astrophysics (LHEA) at NASA's Goddard Space Flight Center (GSFC). LHEA will provide the GSSC with office space. The GSSC will be mission-unique.

### ~~5.2.2 Network Security~~

~~The GSSC shall be connected to the MOC and the IOCs by an intranet of wide area networks that is closed to, or protected from, public users of the external internet. (SYS0500 and MSS §3.5.1.2)~~

### ~~5.2.35.2.2~~ Security of Information Technology

The GSSC shall comply with NGP-NPR 2810.1 ([http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal\\_ID=N\\_PG\\_2810\\_0001\\_&page\\_name=main](http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PG_2810_0001_&page_name=main)). (SYS0500)

### ~~5.2.45.2.3~~ Website Section 508 Compliance

The GSSC website shall comply with federal Section 508 requirements using the HEASARC style guide ([http://heasarc.gsfc.nasa.gov/docs/heasarc/Style\\_Guide/sec508.html](http://heasarc.gsfc.nasa.gov/docs/heasarc/Style_Guide/sec508.html)).

## 5.3 Supporting the Guest Investigator (GI) Program

The GSSC shall organize and administer the GLAST GI program. (GSSC0050)

### 5.3.1 Development of the NASA Research Announcements (NRAs)

With the guidance of NASA HQ, the GSSC shall write the NRAs along with the relevant supporting documents (e.g., mission plan, descriptions of the instruments, sensitivity tables). NASA HQ will establish the policies governing the NRA (e.g., regarding the number of TOOs allowed per cycle), and will revise, ratify and release the NRAs. The first NRA will be released approximately a year ~~(TBR)~~ before launch, and subsequent NRAs will be released annually.

### 5.3.2 Support of the Peer Selection Review

#### 5.3.2.1 Tools for Preparing Proposals

The GSSC shall provide software, sensitivity tables and other tools to assist with the preparation of the proposals.

##### 5.3.2.1.1 Different Accuracy and Generality Levels

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The proposal preparation tools shall provide proposers with different levels of accuracy and generality in planning their proposals.

#### 5.3.2.1.2 Multimission Comparisons

The proposal preparation tools shall permit comparisons of the fluxes in different gamma-ray detectors. For example, a tool will predict the LAT photon flux from an EGRET detection.

#### 5.3.2.1.3 Orbit Fidelity

GLAST's orbit shall be modeled by the proposal preparation tools with varying fidelity. For example, the simplest model will be a precision-averaged orbit while the most sophisticated will predict GLAST's location as a function of time.

### **5.3.2.2 Library of Previous Results**

The GSSC shall provide a library of previous results from GLAST and earlier gamma-ray missions.

### **5.3.2.3 Selection of Peer Review Panels**

The GSSC shall identify a pool of scientists from which NASA HQ will select the members of the peer review panels.

### **5.3.2.4 Technical Evaluation of Proposals**

The GSSC shall evaluate the technical feasibility of proposals.

### **5.3.2.5 Implementation of Peer Review Policies**

The GSSC shall implement the policies promulgated by NASA HQ regarding the peer review process (e.g., regarding conflict-of-interest).

### **5.3.2.6 Convening the Peer Review**

The GSSC shall convene the peer review panels and shall provide logistical support.

### **5.3.2.7 Supporting NASA HQ in Selecting Guest Investigations**

As requested, the GSSC shall support NASA HQ in selecting the guest investigations and in determining the funding awarded to the selected investigations.

### **5.3.2.8 Administering the Guest Investigation Grants**

The GSSC shall administer the guest investigation grants through the appropriate GSFC grants office.

### **5.3.2.9 Posting the Selected Guest Investigations**

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The GSSC shall post the list of selected guest investigations on its website. In addition to its intrinsic scientific interest, this list will inform investigators of anythe proprietary periods for the selected investigations that are established by the data policy.

### **5.3.2.95.3.2.10 Scheduling the Guest Investigations**

The GSSC shall assist in scheduling the selected GI observations by supporting the establishment and maintenance of the timeline (see §5.4.1). (GSSC0010, GSSC4000, and MSS §3.5.2.3)

## **5.3.3 Supporting the Guest Investigators**

### **5.3.3.1 Providing GIs With Requested Data**

The GSSC shall make any requested data available to a GI within a day after the GSSC receives them. The GIs will extract the data they requested from the GSSC's databases. (GSSC1500, GSSC1510, GSSC1520, and MSS §3.1.2.6)

### **5.3.3.2 Providing GIs With Analysis Software**

The GSSC shall provide GIs with a comprehensive suite of analysis software and related documentation (see §5.5). (GSSC1500 and MSS §3.5.1.4)

### **5.3.3.3 Providing GIs with Assistance**

The GSSC shall assist investigators analyze their data. (MSS §3.5.3.5)

#### 5.3.3.3.1 Helpdesk

The GSSC shall respond to investigator's queries submitted electronically. This will be called the 'helpdesk'.

#### 5.3.3.3.2 Helpdesk Response Time

The GSSC shall respond within 2 business days.

#### 5.3.3.3.3 Monitoring Helpdesk Response Time

The helpdesk system shall monitor and report the response time.

#### 5.3.3.3.4 Logging Helpdesk Queries

These investigator queries and the GSSC responses will be logged. (~~MSS §3.5.3.5~~)

#### 5.3.3.3.5 FAQ

A 'Frequently-Asked-Questions' (FAQ) section of the web-based documentation shall be extracted from the helpdesk queries.

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## 5.4 Mission Support

### 5.4.1 ~~Mission Schedule~~Science Timeline

The GSSC shall plan science observations and create science timelines. (GSSC0010 and GSSC4000)

#### 5.4.1.1 Timeline Tools

##### ~~5.4.1.1.1~~5.4.1.1.1 GLAST Orbit Simulator

The GSSC shall provide a tool to simulate GLAST observations to support timeline planning and to evaluate sky survey techniques for uniform coverage over various time frames, frequency of full sky coverage, and spacecraft feasibility. (GSSC4000)

##### 5.4.1.1.2 Observation Scheduler

The GSSC shall ~~support~~maintain scheduling tools to construct high level yearly and detailed weekly observation plans. (GSSC4000)

#### 5.4.1.2 Planning the ~~Observing~~Science Timeline

The GSSC shall convene and support the Timeline Committee that will plan the observing timeline for the mission. The Timeline Committee will consist of the Project Scientist (or his/her designee), GSSC, LAT and GBM representatives, and mission operation experts (TBR). (GSSC4010 and MSS §3.5.2.3-)

#### 5.4.1.3 Posting the Timeline

The timeline as implemented (for past observations) and as planned (for future observations) shall be posted on the GSSC website. (GSSC1500 and MSS §3.5.3.5)

#### 5.4.1.4 ~~Activity Schedules~~Weekly Science Timeline

The GSSC shall provide the MOC ~~with activity schedules to implement the science timelines to incorporate into the Integrated Observatory Timeline.~~ (SYS0050, GSSC1580, and MSS §3.1.4.2.1.3) The timeline in this set of requirements is the actual series of commands that implement the observing plan on a timescale of 1-2 weeks.

##### ~~5.4.1.4.1 Backup Schedule during Phase 2~~Interface with the MOC

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~~During Phase 2 both a primary and a backup schedule shall be provided. (MSS §3.1.4.2.1.3)~~ The GSSC shall interface with the MOC for the exchange of mission planning products. (GSSC1550)

#### 5.4.1.4.2 Interface with the ISOC

The GSSC shall interface with the ISOC for the exchange of mission planning products. (GSSC1560)

#### 5.4.1.4.3 Interface with the GIOC

The GSSC shall interface with the GIOC for the exchange of mission planning products. (GSSC1570)

#### 5.4.1.4.25.4.1.4.4 Earth Avoidance Observational Constraints

The GSSC shall account for observational constraints when generating the science timeline. (GSSC4020). For example, ~~O~~bserving plans should all include default procedures that avoid having the earth enter the central field-of-view of the LAT. Earth avoidance is stated in (MSS §3.1.4.2.2.2); the constraints will be provided in an operations document.

#### 5.4.1.4.5 Preliminary Science Activity Timeline

The GSSC shall provide the MOC a preliminary science activity timeline one day before the MOC requests TDRSS data downlink contacts. (GSSC1580) Currently TDRSS contacts are requested ~3 weeks in advance.

#### 5.4.1.4.6 Final Science Activity Timeline

The GSSC shall provide the MOC with a final science activity timeline one day before the MOC submits the weekly Absolute Time Sequence (ATS) upload implementing the Integrated Observatory Timeline. (GSSC1580)

#### 5.4.1.4.7 TDRSS Constraint on Final Science Activity Timeline

The Final Science Activity Timeline shall not disrupt a scheduled TDRSS contact. (GSSC4020)

#### 5.4.1.4.8 Response to TOOs and Autonomous Repoints

The GSSC shall respond to changes in the science timeline resulting from TOOs and Autonomous Repoints in the science activity timelines of subsequent weeks. (GSSC9000) Note that the GSSC will not revise the science timeline during the days following such a disruption.

#### 5.4.1.4.9 Content of Science Activity Timelines

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The science activity timelines shall consist of the commands implementing the science timeline for the period of one week and the instrument commands that are to be executed as Absolute Time Commands during this week.

#### 5.4.1.4.10 Receipt of TDRSS Contact Schedule Request

The GSSC shall receive the TDRSS Contact Schedule Request from the MOC. (GSSC1550 and GSSC 1600) This request will assist the GSSC in planning the Final Science Activity Timeline.

#### 5.4.1.4.11 Receipt of Confirmed TDRSS Contact Schedule

The GSSC shall receive Confirmed TDRSS Contact Schedule from the MOC. This request will assist the GSSC in planning the Final Science Activity Timeline.

#### 5.4.1.4.12 Receipt of Integrated Observatory Timeline

The GSSC shall receive the Integrated Observatory Timeline from the MOC. (GSSC1590)

#### 5.4.1.4.13 Receipt of Orbit Data Products

The GSSC shall receive the orbit data products from the MOC. (GSSC1600)

#### 5.4.1.4.14 Receipt of the As-Flown Timeline

The GSSC shall receive the as-flown timeline from the MOC. (GSSC1610)

#### 5.4.1.4.15 Backup Schedule during Phase 2

During Phase 2 both a primary and a backup schedule shall be provided. (MSS §3.1.4.2.1.3)

### **5.4.1.5 Targets of Opportunity**

#### 5.4.1.5.1 Receipt of TOO Requests

The GSSC shall receive TOO requests from the science community. (GSSC4100)

#### 5.4.1.5.2 Support for TOO Decision

The GSSC shall support the Project Scientist or his/her designee in evaluating requests for TOOs. (GSSC4110)

#### 5.4.1.5.3 Implementing/Generating the TOO Order

~~When the Project Scientist or his/her designee declares a TOO, the GSSC shall generate and transmit to the MOC an activity schedule giving celestial sky coordinates and an observing duration for such TOO targets. This schedule shall be forwarded to the MOC a TOO order within 2 hours of receipt of approval of the TOO~~

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~~request from~~ by the Project Scientist or his/her designee. (GSSC4120)~~The posted timeline will be updated (see §5.4.1.3). (MSS §3.5.2.7.2)~~

#### 5.4.1.5.4 Receipt of TOO Order Status

The GSSC shall receive from the MOC information that specifies the status of the TOO order. (GSSC4130)

#### 5.4.1.5.5 TOO Log

The GSSC shall maintain a log for the duration of the mission of all TOO requests and orders, their dispositions and status. (GSSC4140)

#### 5.4.1.5.6 Receipt of TOO Execution Notification

The GSSC shall receive TOO execution notification from the MOC. (GSSC4150)

#### 5.4.1.5.7 Notification to the TOO Requester

The GSSC shall notify the TOO requester of the TOO execution results. (GSSC4160)

### **5.4.1.6 Command Flow**

~~In this subsection “commands” refers both to the commands an IOC may send its instrument (e.g., to change a mode or a flight software parameter) and to flight software updates.~~

#### 5.4.1.6.1 Command Flow Through the SSCAbsolute Time Commands

The GSSC shall receive Absolute Time eCommands (ATCs) from the IOCs and transfer them to the MOC incorporate them into the Science Activity Timeline. (GSSC1560 and GSSC1570) ATCs are uploaded with the weekly Integrated Observatory Timeline. In constructing the Science Activity Timeline, the GSSC will reconcile the implementation of the ATCs with the science observing timeline.

#### 5.4.1.6.2 Real Time Commands and File Loads

The GSSC will receive real time commands and fileloads from the IOCs, evaluate their impact on the science observing timeline, and transfer them to the MOC with scheduling instructions. These are commands that update the instruments’ memory or cannot wait for the next ATS upload. The MOC will upload these commands while it is staffed.

#### ~~5.4.1.6.25.4.1.6.3~~ High Priority Commands Pass-Through

~~The GSSC shall pass high priority commands, as identified by the IOCs, (e.g., those necessary to preserve the instrument in an emergency) to the MOC immediately. For these commands the SSC will send the MOC a revised activity schedule to reflect changes to the timeline resulting from the implementation of these commands, and will update the posted timeline (see §5.4.1.3).~~

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#### 5.4.1.6.35.4.1.6.4 Scheduling Commands Command Integrity

~~The SSC shall schedule the implementation of all but the highest priority commands by appending to the commands a revised activity schedule before transferring the commands to the MOC. The posted timeline will be updated (see §5.4.1.3). The GSSC shall maintain the integrity of LAT and GBM commands and flight software loads received from the IOCs. (GSSC1010)~~

#### 5.4.1.6.5 Command Logging

The GSSC shall maintain a record of all instrument loads and commands sent to the MOC. (GSSC4030)

#### 5.4.1.6.6 Autonomous Data Transfers to and from the MOC

The GSSC shall support autonomous data transfers to and from the MOC. (GSSC7000)

#### 5.4.1.6.7 Support of Automated MOC

The GSSC shall support an automated MOC. (GSSC7010)

### **5.4.2 Public Information**

The GSSC shall post on its public website information related to the GLAST mission and its results for the support of GLAST-related research and for public information. (MSS §3.5.3.5)

### **5.4.3 Notifying the Investigator Community**

The GSSC shall notify the investigator community of important GLAST milestones such as the release of NRAs and the subsequent deadlines, of significant policy changes, and of major advances in the analysis software and techniques. This notification may include e-mail notices, e-mail newsletters, notices posted in the newsletters of appropriate professional organizations (e.g., in the newsletter of the High Energy Astrophysics Division of the AAS), and postings on the GSSC website. (MSS §3.5.3.5)

### **5.4.4 Supporting the Project Scientist**

The GSSC shall support the Project Scientist by convening and providing logistical support for GLAST-related committee meetings and scientific conferences.

### **5.4.5 Supporting the Science Working Group (SWG)**

The GSSC shall support the SWG by reporting to it periodically, and acting on the action items assigned to GSSC members. The GSSC manager and science lead are ex officio members of the SWG.

### **5.4.6 Supporting the Users' Committee**

The GSSC shall support the Users' Committee logistically and scientifically.

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#### **5.4.7 Supporting Pre-Launch Activities**

The GSSC shall support pre-launch interface and system test activities, such as planning, performing, and assessing these tests. (GSSC3000)

#### **5.4.8 Ground Communications**

Beginning with the pre-launch phase and continuing for the duration of the mission, the GSSC shall participate in secure voice communications among the ground elements using a "black phone". (GCOM0050, GCOM0060)

### **5.5 Science Analysis Tools**

#### **5.5.1 Suite of Analysis Tools**

The GSSC shall provide investigators with a suite of science analysis tools to perform Level 2 processing on Level 1 data. A core suite of analysis tools for the LAT data has been defined by the LAT-GSSC Software Working Group ([http://www-glast.slac.stanford.edu/ScienceTools/tool\\_defs/](http://www-glast.slac.stanford.edu/ScienceTools/tool_defs/)). (GSSC0020 and MSS §3.5.1.4)

##### **5.5.1.1 Single Analysis Environment**

The GSSC shall provide a single higher level analysis software environment for use by the scientific community and the instrument teams. (SYS0140 and MSS §3.5.1.4)

##### **5.5.1.2 Software Portability**

The analysis tools shall be portable to standard operating systems. (SYS0150 and MSS §3.5.1.5)

##### **5.5.1.3 Vendor Independence**

The analysis environment shall respect standards that ensure independence of vendor (i.e., users will be not required to purchase a particular software package to use the environment). (SYS0150 and MSS §3.5.1.5)

##### **5.5.1.4 Compatibility with Multi-mission Tools**

The analysis environment shall respect standards that ensure compatibility with existing multi-mission high-energy astrophysics tools. (SYS0150 and MSS §3.5.1.5)

#### **5.5.2 Tool Documentation**

Relevant documentation about the use, applicability and methodology of these tools shall be provided. (GSSC1500)

#### **5.5.3 Tool Delivery**

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These tools and documentation shall be provided through the GSSC's website; some tools will be run on the GSSC's servers, while most tools will be retrieved by investigators over the internet, and run on the investigators' own servers. (GSSC1500 and MSS §3.5.3.5)

#### **5.5.4 File Format**

These tools shall conform to HEASARC standards regarding the use of FITS file formats and keywords (see [http://heasarc.gsfc.nasa.gov/docs/heasarc/ofwg/ofwg\\_recomm.html](http://heasarc.gsfc.nasa.gov/docs/heasarc/ofwg/ofwg_recomm.html) and following links for these standards). This file standard will facilitate the application of multi-mission high energy astrophysics tools to the GLAST data. (SYS0150, GSSC2030, MSS §3.5.1.5 and MSS §3.5.3.4)

#### **5.5.5 Configuration Control**

The science tools shall be maintained under configuration control within the GLAST project software infrastructure.

#### **5.5.6 Tool Development**

The definition, development and acceptance of the tools relevant to a given instrument shall be a joint GSSC-instrument team responsibility. The GSSC and the instrument teams have established software working groups to define the necessary tool suite (see §5.5.1) and to decide whether a software package conforms to the HEASARC standards (see §5.5.4), is scientifically valid, and is capable of running on investigators' computers. The result will be single analysis environment for both the scientific community and the instrument teams (see §5.5.1.1). (SYS0140 and MSS §3.5.1.4)

#### **5.5.7 Instrument Response Functions**

Through the GSSC-IOC software working groups the GSSC shall participate in defining the representation of the instrument response functions (IRFs), determining that they conform to HEASARC standards (see §5.5.4), and ensuring that they can be used by the scientific community unaffiliated with the instrument teams. The instrument teams will be responsible for calibrating their instruments and creating the IRFs.

#### **5.5.8 Data Formats**

The GSSC shall adhere to mission specified data formats and standards. (GSSC0030)

## **5.6 Standard Processing**

### **5.6.1 Standard High Level Data Products**

The GSSC shall perform the production data processing that is necessary to generate standard high-level data products, as defined in §5.6.4. (MSS §3.5.2.6)

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### 5.6.2 Data Processing Rate

The GSSC shall be capable of processing its standard data products at a rate greater than 4 times the rate at which the data are accumulated, permitting rapid reprocessing of the data, should it be necessary.

### 5.6.3 Processing Schedule

The GSSC shall complete processing data and make the results of this processing available within 24 hours of the GSSC's receipt of the data.

### 5.6.4 Web Page Product Generation

The GSSC shall provide, on a regular basis, standard products to be linked to the GSSC's website. (MSS §3.5.2.6 and MSS §3.5.3.5) These include Specifically, the GSSC shall calculate and maintain sky exposure maps (GSSC2070). The GSSC may also provide:

- LAT all-sky maps
- ↳ Expanded LAT maps of special regions such as 3C279/3C273 and the Galactic anti-center
- ↳ Exposure maps for the same regions
- Crab pulse profile and pulse-phase images using LAT and GBM data
- GRB localizations and time profiles for ~10 (~~TBD~~) strong GRBs per year from LAT and GBM data
- Lightcurves for a number of strong sources (e.g., 3C 273).

### 5.6.5 Level 1 Processing Pipeline

The GSSC shall maintain backup Level 1 processing pipelines for LAT (GSSC2050 and GBM (GSSC2060) data, which will be operated only with the concurrence and supervision of the relevant instrument team. Members of the GSSC will be familiar with the methodology and operation of these pipelines. In running the pipelines, the GSSC will handle overlapping Level 0 data. (GSSC2040)

## 5.7 Databases and Archives

In the following “database” refers to a collection of data that the GSSC maintains for use by the GSSC and the community it serves during the GLAST mission, while “archives” refers to a collection of data that the HEASARC maintains in perpetuity as a record of the mission and for the use of the scientific community. The standard architecture of HEASARC archives is a set of “archive” files, in FITS format, with the actual data, and “database tables” (which may be maintained within a database system) describing the data. In some cases the same files will constitute both the GSSC's databases and the HEASARC's archives.

### 5.7.1 Data Transmission

#### 5.7.1.1 Level 0 Data from the MOC

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The GSSC shall receive and archive Level 0 data from the MOC. (GSSC2010)

#### **5.7.1.2 Reports from the MOC**

The GSSC shall receive and archive reports and analyses from the MOC. (GSSC0060)

#### **5.7.1.3 Interface with the ISOC**

The GSSC shall interface with the ISOC for the exchange of data products. (GSSC1560)

#### **5.7.1.4 Interface with the GIOC**

The GSSC shall interface with the GIOC for the exchange of data products. (GSSC1570)

#### **5.7.1.5 Data Transmission Capacity**

##### **5.7.1.5.1 Maximum Volume**

The GSSC shall be capable of receiving, processing, and archiving the Level 0 and Level 1 data resulting from a single downlink of at least 36 hours of observatory data. (SYS2010)

##### **5.7.1.5.2 Average Rate**

The GSSC shall be capable of receiving, processing, and archiving the Level 0 and Level 1 data generated at an orbit-average rate of 1.2 Mbps for LAT, 25.5 kbps for GBM and 51 kbps for observatory housekeeping data. (SYS2020)

#### **5.7.1.6 Data Transfer**

~~The GSSC shall receive data products from communicate with the MOC, LISOC or GIOC other ground system elements as follows: the provider will send the GSSC a manifest of available data files, and then the GSSC shall get (e.g., by FTP) the files from the provider's server. The GSSC will inform the provider that the files have been received satisfactorily after applying error detection techniques; corrupted data will be retransmitted using links and protocols that provide error-free data transmission and delivery. (SYS1010, MSS §3.5.1.11) The data products will be described in the relevant Interface Control Documents.~~

#### **5.7.1.7 Data Integrity**

The GSSC shall maintain the integrity of science data received from the IOCs. (GSSC1020)

#### **5.7.1.8 Burst Data**

The GSSC shall receive GLAST-produced GCN Notices and Circulars from the GCN. (GSSC8000)

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### 5.7.2 The GSSC Databases

The GSSC shall maintain the data products received from the MOC, LISOC or GIOC, as well as data products it creates, in databases. The GSSC will also maintain data from ground tests that are in the format of flight telemetry, as agreed upon with the instrument teams. (GSSC0060, GSSC2000, GSSC2010, GSSC2020, MSS §3.5.2.10 and MSS §3.5.2.11)

### 5.7.3 Location of Databases

The GSSC's databases shall reside on data storage devices physically connected to the HEASARC computer system. (HEA1500, MSS §3.5.2.10, MSS §3.5.2.11, and MSS §3.5.3.4)

### 5.7.4 Access to Databases During Mission

During the mission the GSSC shall make these databases accessible to the scientific community through the GSSC website in accordance with the mission's data policies. (GSSC1500, GSSC1520, MSS §3.1.2.6, MSS §3.5.2.10, and MSS §3.5.3.5)

#### 5.7.4.1 Data Rights Policy Implementation

The GSSC shall implement the data rights policies described in the Project Data Management Plan.

#### 5.7.4.2 Data Extraction Tools

The GSSC shall provide the tools necessary to search and extract data from these databases. The extraction tools are part of the comprehensive suite of analysis software the GSSC will provide the scientific community (see §5.3.3.2, §5.5.1). The resulting data will be supplied in a format conforming to OGIP standards (e.g., as FITS files). The GSSC user interfaces will not require knowledge of the internal file structures, naming conventions, or data structure but will be invoked using commonly accepted parameters for absolute time, elapsed time, position (in a TBD variety of coordinate systems) and energy. (HEA0010, and MSS §3.5.2.10)

#### 5.7.4.3 ~~Delivery of Data to the ASDC~~

~~The GSSC shall provide the Agenzia Spaziale Italiana (ASI) Science Data Center (ASDC) with the data products necessary for the ASDC to mirror selected GSSC databases, along with the software to analyze these data, as described by the NASA/ASI Memorandum of Understanding. The data products that will be given the ASDC include the LAT event summary data, the response functions, the pointing and livetime history, the interstellar emission model, and pulsar ephemerides. The delivery method is TBD.~~

### 5.7.5 Data Archives

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By the time it is disbanded after the end of the GLAST mission, the GSSC shall have transferred responsibility for managing the GLAST archive to the HEASARC. In the HEASARC's preferred format at the time of transfer, these data will constitute the GLAST permanent archives. ([GSSC0070](#), [GSSC1530](#), [GSSC1540](#), [GSSC2030](#), *MSS §3.5.2.10*, *MSS §3.5.2.11*, and *MSS §3.5.3.4*)

#### **5.7.6 Software Archives**

By the end of the mission, the GSSC shall deliver all software and documentation to the HEASARC. The software will have the same functionality whether utilizing data from the GSSC's operational databases or the HEASARC's archives ([GSSC0070](#), [HEA0010](#), *MSS §3.5.2.10* and *MSS §3.5.3.4*)

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## APPENDIX A – TRACEABILITY MATRIX (UP)

Requirement	Mission System Specification Parent Requirement From the GSRD unless otherwise specified
5.1.1	MSS 3.5.1.6
5.1.2	<u>GSSC0040, MSS 3.5.1.8</u>
5.1.3	<u>SYS0190, SYS0200, MSS 3.5.1.10.1, MSS 3.5.1.10.2</u>
5.1.4	<u>SYS0010, MSS 3.5.1.12</u>
<u>5.1.5</u>	<u>SYS0120, GSSC1000</u>
<u>5.1.6</u>	<u>SYS0040</u>
<u>5.1.7</u>	<u>SYS1000</u>
5.2.1	Derived
<del>5.2.2</del>	<del>SYS0090, MSS 3.5.1.2</del>
<del>5.2.23</del>	<del>Derived</del> <u>SYS0500</u>
<del>5.2.34</del>	Derived
<u>5.3</u>	<u>GSSC0050</u>
5.3.1	Derived
5.3.2.1	Derived
<u>5.3.2.1.1</u>	<u>Derived</u>
<u>5.3.2.1.2</u>	<u>Derived</u>
<u>5.3.2.1.3</u>	<u>Derived</u>
5.3.2.2	Derived
5.3.2.3	Derived
5.3.2.4	Derived
5.3.2.5	Derived
5.3.2.6	Derived
5.3.2.7	Derived
5.3.2.8	Derived
5.3.2.9	<del>Derived</del> <u>MSS 3.5.2.3</u>
<u>5.3.2.10</u>	<u>GSSC0010, GSSC4000, MSS 3.5.2.3</u>
5.3.3.1	<u>GSSC1500, GSSC1510, GSSC1520, MSS 3.1.2.6</u>
5.3.3.2	<u>GSSC1500, MSS 3.5.1.4</u>
5.3.3.3	MSS 3.5.3.5
<u>5.3.3.3.1</u>	<u>Derived</u>
<u>5.3.3.3.2</u>	<u>Derived</u>
<u>5.3.3.3.3</u>	<u>Derived</u>
<u>5.3.3.3.4</u>	<u>Derived</u>
<u>5.3.3.3.5</u>	<u>Derived</u>
<u>5.4.1</u>	<u>GSSC0010, GSSC4000</u>
<u>5.4.1.1.1</u>	<u>Derived</u> <u>GSSC4000</u>
<u>5.4.1.1.2</u>	<u>GSSC4000</u>
5.4.1.2	<u>GSSC4010, MSS 3.5.2.3</u>
5.4.1.3	<u>GSSC1500, MSS 3.5.3.5</u>

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Requirement	<del>Mission System Specification</del> Parent Requirement From the GSRD unless otherwise specified
5.4.1.4	<del>SYS0050, GSSC1580, MSS 3.1.4.2.1.3</del>
5.4.1.4.1	<del>MSS 3.1.4.2.1.3</del> GSSC1550
5.4.1.4.2	<del>MSS 3.1.4.2.2</del> GSSC1560
5.4.1.4.3	GSSC1570
5.4.1.4.4	GSSC4020, MSS 3.1.4.2.2.2
5.4.1.4.5	GSSC1580
5.4.1.4.6	GSSC1580
5.4.1.4.7	GSSC4020Derived
5.4.1.4.8	GSSC9000Derived
5.4.1.4.9	Derived
5.4.1.4.10	GSSC1550, GSSC1600Derived
5.4.1.4.11	Derived
5.4.1.4.12	GSSC1590
5.4.1.4.13	GSSC1600
5.4.1.4.14	GSSC1610
5.4.1.4.15	MSS3.1.4.2.1.3
5.4.1.5.1	DerivedGSSC4100
5.4.1.5.2	MSS 3.5.2.7.2GSSC4110
5.4.1.5.3	<del>SYS1030, GSSC4120</del>
5.4.1.5.4	GSSC4130
5.4.1.5.5	GSSC4140
5.4.1.5.6	GSSC4150
5.4.1.5.7	GSSC4160
5.4.1.6.1	GSSC1560, GSSC1570Derived
5.4.1.6.2	Derived
5.4.1.6.3	Derived
5.4.1.6.4	GSSC1010
5.4.1.6.5	GSSC4030
5.4.1.6.6	GSSC7000
5.4.1.6.7	GSSC7010
5.4.2	DerivedMSS 3.5.3.5
5.4.3	DerivedMSS 3.5.3.5
5.4.4	Derived
5.4.5	Derived
5.4.6	Derived
5.4.7	GSSC3000
5.4.8	GCOM0050, GCOM0060
5.5.1	GSSC0020, MSS 3.5.1.4
5.5.1.1	SYS0140, MSS 3.5.1.4
5.5.1.2	SYS0150, MSS 3.5.1.5
5.5.1.3	SYS0150, MSS 3.5.1.5
5.5.1.4	SYS0150, MSS 3.5.1.5
5.5.2	GSSC1500Derived
5.5.3	GSSC1500, MSS 3.5.3.5
5.5.4	SYS0150, GSSC2030, MSS 3.5.1.5, MSS 3.5.3.4

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Requirement	<u>Mission System Specification—Parent Requirement From the GSRD unless otherwise specified</u>
5.5.5	Derived
5.5.6	<u>SYS0140</u> , MSS 3.5.1.4
5.5.7	Derived
<u>5.5.8</u>	<u>GSSC0030</u>
5.6.1	MSS 3.5.2.6
5.6.2	Derived
5.6.3	Derived
5.6.4	<u>GSSC2070</u> , MSS 3.5.2.6, MSS 3.5.3.5
5.6.5	<del>Derived</del> <u>GSSC2050, GSSC2060, GSSC2040</u>
<u>5.7.1.1</u>	<u>GSSC2010</u>
<u>5.7.1.2</u>	<u>GSSC0060</u>
<u>5.7.1.3</u>	<u>GSSC1560</u>
<u>5.7.1.4</u>	<u>GSSC1570</u>
<u>5.7.1.5.1</u>	SYS2010
<u>5.7.1.5.2</u>	SYS2020
<u>5.7.1.6</u>	SYS1010, MSS 3.5.1.11
<u>5.7.1.7</u>	<u>GSSC1020</u>
<u>5.7.1.8</u>	<u>GSSC8000</u>
5.7.2	<u>GSSC0060, GSSC2000, GSSC2020</u> , MSS 3.5.2.10, MSS 3.5.2.11
5.7.3	<u>HEA1500</u> , MSS 3.5.2.10, MSS 3.5.2.11, MSS 3.5.3.4
5.7.4	<u>GSSC1500, GSSC1520</u> , MSS 3.1.2.6, MSS 3.5.2.10, MSS 3.5.3.5
5.7.4.1	Derived
5.7.4.2	<u>HEA0010</u> , MSS 3.5.2.10
<del>5.7.4.3</del>	<del>Derived</del>
5.7.5	<u>GSSC0070, GSSC1530, GSSC1540, GSSC2030</u> , MSS 3.5.2.10, MSS 3.5.2.11, MSS 3.5.3.4
5.7.6	<u>GSSC0070, HEA0010</u> , MSS 3.5.2.10, MSS 3.5.3.4

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## APPENDIX B – TRACEABILITY MATRIX (DOWN)

Flowdown of GSRD requirements into GSSC Functional Requirements.

<u>GSRD Requirement</u>	<u>GSSC Functional Requirement</u>
<u>SYS0010</u>	<u>5.1.4</u>
<u>SYS0040</u>	<u>5.1.6</u>
<u>SYS0050</u>	<u>5.4.1.4</u>
<u>SYS0090</u>	<u>5.2.2</u>
<u>SYS0120</u>	<u>5.1.5</u>
<u>SYS0140</u>	<u>5.5.1.1</u>
<u>SYS0150</u>	<u>5.5.1.2, 5.5.1.3, 5.5.1.4</u>
<u>SYS0190</u>	<u>5.1.3</u>
<u>SYS0200</u>	<u>5.1.3</u>
<u>SYS0500</u>	<u>5.2.23</u>
<u>SYS1000</u>	<u>5.1.7</u>
<u>SYS1010</u>	<u>5.7.1.6</u>
<u>SYS1030</u>	<u>5.4.1.5.3</u>
<u>SYS2010</u>	<u>5.7.1.5.1</u>
<u>SYS2020</u>	<u>5.7.1.5.2</u>
<u>GCOM0050</u>	<u>5.4.8</u>
<u>GCOM0060</u>	<u>5.4.8</u>
<u>GSSC0010</u>	<u>5.3.2.10, 5.4.1</u>
<u>GSSC0020</u>	<u>5.5.1</u>
<u>GSSC0030</u>	<u>5.5.8</u>
<u>GSSC0040</u>	<u>5.1.2</u>
<u>GSSC0050</u>	<u>5.3.1</u>
<u>GSSC0060</u>	<u>5.7.1.2, 5.7.2</u>
<u>GSSC0070</u>	<u>5.7.5, 5.7.6</u>
<u>GSSC1000</u>	<u>5.1.5</u>
<u>GSSC1010</u>	<u>5.4.1.6.4</u>
<u>GSSC1020</u>	<u>5.7.1.7</u>
<u>GSSC1500</u>	<u>5.3.3.1, 5.3.3.2, 5.5.3, 5.7.4</u>
<u>GSSC1510</u>	<u>5.3.3.1</u>
<u>GSSC1520</u>	<u>5.3.3.1, 5.7.4</u>
<u>GSSC1530</u>	<u>5.7.5</u>
<u>GSSC1540</u>	<u>5.7.5</u>
<u>GSSC1550</u>	<u>5.4.1.4.1</u>
<u>GSSC1560</u>	<u>5.4.1.4.2, 5.7.1.3</u>
<u>GSSC1570</u>	<u>5.4.1.4.3, 5.7.1.4</u>
<u>GSSC1580</u>	<u>5.4.1.4, 5.4.1.4.5, 5.4.1.4.6</u>
<u>GSSC1590</u>	<u>5.4.1.4.12</u>
<u>GSSC1600</u>	<u>5.4.1.4.13</u>
<u>GSSC1610</u>	<u>5.4.1.4.14</u>
<u>GSSC2000</u>	<u>5.7.2</u>
<u>GSSC2010</u>	<u>5.7.1.1, 5.7.2</u>

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<u>GSRD Requirement</u>	<u>GSSC Functional Requirement</u>
<u>GSSC2020</u>	<u>5.7.2</u>
<u>GSSC2030</u>	<u>5.7.5</u>
<u>GSSC2040</u>	<u>5.6.5</u>
<u>GSSC2050</u>	<u>5.6.5</u>
<u>GSSC2060</u>	<u>5.6.5</u>
<u>GSSC2070</u>	<u>5.6.4</u>
<u>GSSC3000</u>	<u>5.4.7</u>
<u>GSSC4000</u>	<u>5.3.2.10, 5.4.1, 5.4.1.1</u>
<u>GSSC4010</u>	<u>5.4.1.2</u>
<u>GSSC4020</u>	<u>5.4.1.4.4</u>
<u>GSSC4030</u>	<u>5.4.1.6.5</u>
<u>GSSC4100</u>	<u>5.4.1.5.1</u>
<u>GSSC4110</u>	<u>5.4.1.5.2</u>
<u>GSSC4120</u>	<u>5.4.1.5.3</u>
<u>GSSC4130</u>	<u>5.4.1.5.4</u>
<u>GSSC4140</u>	<u>5.4.1.5.5</u>
<u>GSSC4150</u>	<u>5.4.1.5.6</u>
<u>GSSC4160</u>	<u>5.4.1.5.7</u>
<u>GSSC7000</u>	<u>5.4.1.6.6</u>
<u>GSSC7010</u>	<u>5.4.1.6.7</u>
<u>GSSC8000</u>	<u>5.7.1.8</u>
<u>GSSC9000</u>	<u>5.4.1.4.8</u>
<u>HEA0010</u>	<u>5.7.4.2</u>
<u>HEA1500</u>	<u>5.7.3</u>

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## APPENDIX BC – VERIFICATION MATRIX

The definitions of analysis, demonstration, inspection and test are provided in the Glossary (§3).

Requirement	Verification Method
5.1.1	Inspection
5.1.2	Demonstration
5.1.3	Inspection
5.1.4	Inspection
<u>5.1.5</u>	<u>Demonstration</u>
<u>5.1.6</u>	<u>Inspection</u>
<u>5.1.7</u>	<u>Analysis</u>
5.2.1	Inspection
5.2.2	Inspection
5.2.3	Test
<del>5.2.4</del>	<del>Test</del>
<u>5.3</u>	<u>Demonstration</u>
5.3.1	Demonstration
5.3.2.1	Inspection
<u>5.3.2.1.1</u>	<u>Inspection</u>
<u>5.3.2.1.2</u>	<u>Inspection</u>
<u>5.3.2.1.3</u>	<u>Inspection</u>
5.3.2.2	Inspection
5.3.2.3	Demonstration
5.3.2.4	<del>Inspection</del> <u>Demonstration</u>
5.3.2.5	<del>Demonstration</del> <u>Inspection</u>
5.3.2.6	Demonstration
5.3.2.7	Demonstration
5.3.2.8	<del>Inspection</del> <u>Demonstration</u>
5.3.2.9	<del>Demonstration</del> <u>Inspection</u>
<u>5.3.2.10</u>	<u>Demonstration</u>
5.3.3.1	Analysis
5.3.3.2	Inspection
5.3.3.3	Demonstration
<u>5.3.3.3.1</u>	<u>Inspection</u>
<u>5.3.3.3.2</u>	<u>Demonstration</u>
<u>5.3.3.3.3</u>	<u>Inspection</u>
<u>5.3.3.3.4</u>	<u>Inspection</u>
<u>5.3.3.3.5</u>	<u>Demonstration</u>
<u>5.4.1</u>	<u>Demonstration</u>
<u>5.4.1.1.1</u>	Inspection
<u>5.4.1.1.2</u>	<u>Inspection</u>

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Requirement	Verification Method
5.4.1.2	Demonstration
5.4.1.3	Demonstration
5.4.1.4	Demonstration
5.4.1.4.1	Demonstration
5.4.1.4.2	<u>Analysis Demonstration</u>
<u>5.4.1.4.3</u>	<u>Demonstration</u>
<u>5.4.1.4.4</u>	<u>Analysis</u>
<u>5.4.1.4.5</u>	<u>Test</u>
<u>5.4.1.4.6</u>	<u>Test</u>
<u>5.4.1.4.7</u>	<u>Demonstration</u>
<u>5.4.1.4.8</u>	<u>Demonstration</u>
<u>5.4.1.4.9</u>	<u>Inspection</u>
<u>5.4.1.4.10</u>	<u>Test</u>
<u>5.4.1.4.11</u>	<u>Test</u>
<u>5.4.1.4.12</u>	<u>Test</u>
<u>5.4.1.4.13</u>	<u>Test</u>
<u>5.4.1.4.14</u>	<u>Test</u>
<u>5.4.1.4.15</u>	<u>Demonstration</u>
5.4.1.5.1	Demonstration
5.4.1.5.2	<del>Test</del> <u>Demonstration</u>
<u>5.4.1.5.3</u>	<u>Analysis</u>
<u>5.4.1.5.4</u>	<u>Test</u>
<u>5.4.1.5.5</u>	<u>Test</u>
<u>5.4.1.5.6</u>	<u>Test</u>
<u>5.4.1.5.7</u>	<u>Demonstration</u>
5.4.1.6.1	Test
5.4.1.6.2	Test
5.4.1.6.3	Test
<u>5.4.1.6.4</u>	<u>Test</u>
<u>5.4.1.6.5</u>	<u>Test</u>
<u>5.4.1.6.6</u>	<u>Demonstration</u>
<u>5.4.1.6.7</u>	<u>Demonstration</u>
5.4.2	Demonstration
5.4.3	Demonstration
5.4.4	Demonstration
5.4.5	Demonstration
5.4.6	Demonstration
<u>5.4.7</u>	<u>Demonstration</u>
<u>5.4.8</u>	<u>Test</u>
5.5.1	Inspection
5.5.1.1	Inspection
5.5.1.2	Test
5.5.1.3	Inspection
5.5.1.4	Inspection
5.5.2	Inspection

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Requirement	Verification Method
5.5.3	Test
5.5.4	Inspection
5.5.5	Inspection
5.5.6	Demonstration
5.5.7	Demonstration
<u>5.5.8</u>	<u>Inspection</u>
5.6.1	Test
5.6.2	Test
5.6.3	Test
5.6.4	Inspection
5.6.5	Test
<u>5.7.1.1</u>	Test
<u>5.7.1.2</u>	<u>Test</u>
<u>5.7.1.3</u>	<u>Test</u>
<u>5.7.1.4</u>	<u>Test</u>
<u>5.7.1.5.1</u>	<u>Test</u>
<u>5.7.1.5.2</u>	<u>Analysis</u>
<u>5.7.1.6</u>	<u>Test</u>
<u>5.7.1.7</u>	<u>Test</u>
<u>5.7.1.8</u>	<u>Test</u>
5.7.2	Inspection
5.7.3	Inspection
5.7.4	Demonstration
5.7.4.1	Inspection
5.7.4.2	Inspection
<del>5.7.4.3</del>	<del>Inspection</del>
5.7.5	<del>Inspection</del> <u>Demonstration</u>
5.7.6	<del>Inspection</del> <u>Demonstration</u>

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