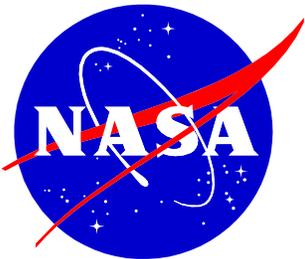


**CONTRACT  
DELIVERABLES  
REQUIREMENTS LIST (CDRL)  
FOR CONTRACT NAS5-00147**

**FOR  
THE GLAST PROJECT**

**LARGE AREA TELESCOPE INSTRUMENT**

**March 27, 2002**



**GODDARD SPACE FLIGHT CENTER  
GREENBELT, MARYLAND**

CONTRACT  
DELIVERABLES  
REQUIREMENTS LIST (CDRL)  
FOR CONTRACT NAS5-00147

FOR  
THE GLAST PROJECT

LARGE AREA TELESCOPE INSTRUMENT

MARCH 27, 2002

NASA Goddard Space Flight Center  
Greenbelt, Maryland

**CHANGE RECORD PAGE**

**DOCUMENT TITLE:** GLAST Project Contract Deliverable Requirements List (CDRL) for contract NAS5-00147 for the Large Area Telescope (LAT) Instrument

**DOCUMENT DATE:** March 27, 2002

| ISSUE    | DATE     | PAGES AFFECTED | DESCRIPTION                                 |
|----------|----------|----------------|---|
|          | 10/00    | All            | Phase A/B contract version.                 |
| Original | 03/27/02 | All            | CCR # 433-0060. Phase C/D contract version. |
| CH-01    | 03/02/04 | ii and 22-29.  | CCR # 433-0235.                             |

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## Part A. INTRODUCTION, DEFINITIONS, AND DISTRIBUTION INSTRUCTIONS

1.0 INTRODUCTION

This document defines the requirements for deliverables to be provided by the GLAST LAT Contractor. Part A includes the introduction, definitions, and instructions for mailing and/or distribution. Part B presents the CDRL item by item, with due dates, quantity, and a distribution key. Part C provides a description of each item and describes use, and preparation information. Except where specifically indicated to the contrary, the formats and drawing standards used shall be those normally used by the GLAST LAT Contractor and/or by its subcontractors.

This document includes that subset of CDRLs that pertains to areas discussed in the following GLAST documents:

- (a) Statement of Work for the GLAST LAT.
- (b) Mission Assurance Requirements (MAR) for the GLAST LAT.

## 2.0 DEFINITION OF DUE DATES/MATURITY

The following definitions apply to the "DUE DATE, MATURITY" column in Part B:

### (a) DUE DATE

- Proposal: Items that are provided with the proposal and subject to negotiation prior to contract go-ahead.
- PDR, CDR, etc.: Preliminary Design Review, Critical Design Review, etc. Documentation received 10 working days prior to review, unless otherwise stated.
- As Generated: After each initial edition, revision, addition, etc. Items that are critical to schedule, performance, or interface shall be transmitted to GSFC by facsimile, express mail, or electronically within 3 working days of generation.
- Quarterly: with quarterly status reports
- Monthly: at a certain time every month
- Weekly: with weekly status reports
- T: Launch Date
- DACM: X days after contract modification (i.e., basic contract definitization)

### (b) MATURITY

- Preliminary: The initial submission of an item. To be completed as is practicable at the time of preparation.
- Final: The complete thorough submission of an item for approval or information; if submitted with proposal it is subject to contract negotiation. This does not preclude updating at a later date. Any updates shall require the same "approval" process as was required for the previous submissions.
- Current: The best up-to-date information available at the time.

Other entries in the "DUE DATE, MATURITY" column are self explanatory.

## 3.0 MAILING AND/OR DISTRIBUTION

The following definitions apply to the "Quantity (QTY)" column in Part B:

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcdl> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

- "E": submission is preferably by electronic means
- Number: submission of hardcopies of the specified number; distributed according to DIST code described below, with extra copies to the TO, or Review Team, if required.

The following definitions apply to the "Distribution (DIST)" column in Part B:

- "A": Copies to the contracting officer, technical officer, configuration management office, GLAST Project Office, and the GLAST Library
- "B": Copies to the contracting officer, technical officer, and the GLAST Library
- "C": Copies to the contracting officer, technical officer, and resource analyst
- "D": Copies to the technical officer only

Note: Copies of all Series 3XX documents will also be distributed to the GLAST Systems Assurance Manager.

#### 4.0 DEFINITION OF CATEGORIES

The following definitions apply to "Submission Category (CAT)" column in Part B:

- A: Approval -- Documents in this category require written GSFC approval prior to use. Requirements for resubmission shall be as specified in letter(s) of disapproval.
- I: Information -- Documents in this category require receipt by GSFC for the purpose of determining current program status, progress, and future planning requirements. When Government evaluations reveal inadequacies, the contractor will be directed to correct the documents.

Part B. GLAST DOCUMENTATION LISTING

Note that the following notes apply to CDRL series 0XX through 2XX. The Safety and Mission Assurance CDRLs (3XX series) have a slightly different format, where the information is contained on each data item description page and on the summary chart for the 3XX deliverables).

0.0 PLANS AND REPORTS(0XX SERIES)

| SUB NO. | DOCUMENT  | DUE DATE, MATURITY              | QTY    | DIST   | CAT    |
|---------|---|---------------------------------|--------|--------|--------|
| 001     | Management Plan   | With Proposal<br>90 DACM, Final | E      | A      | I<br>A |
| 002     | Configuration Management Plan<br>Update   | With Proposal<br>60 DACM, Final | E      | A      | I<br>A |
| 003     | GLAST LAT Software Management Plan  | 90 DACM, Prelim<br>SWPDR, Final | E<br>E | A<br>A | I<br>A |
| 004     | Small Business and Small<br>Disadvantaged Business Concerns<br>Subcontracting Reports | Quarterly, Final                | E      | A      | A      |
| 005     | GLAST LAT Calibration Plan  | PDR, Final                      | E      | A      | A      |
| 006     | Configuration Change Requests (CCR)<br>Class I  | As Generated, Final             | E      | A      | A      |
| 007     | Weekly Status Reports   | Weekly, Current                 | E      | B      | I      |
| 008     | Quarterly Status Reports  | Quarterly, Final                | E      | A      | I      |

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcd> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

|     |  |                              |      |   |   |
|-----|--|------------------------------|------|---|---|
| 009 | Monthly and Quarterly Financial Management Report<br>(NASA Form 533M/533Q) | Monthly and Quarterly, Final | E    | C | I |
| 010 | End of Phase A/B Report and Presentation                                   | End of Phase A/B             | 15   | A | I |
| 011 | Subsystem Peer Review Reports  | As Generated, Final          | Eor5 | A | I |
| 012 | Suborbital Flight Test Report  | 120 days after flight        | E    | A | I |

1.0 MATH MODELS AND ANALYSES (1XX SERIES)

| SUB NO. | DOCUMENT                                  | DUE DATE, MATURITY   | QTY | DIST | CAT |
|---------|---|--|-----|------|-----|
| 101     | GLAST LAT Structural Math Model           | PDR, Preliminary   | E   | D    | I   |
| 102     | LAT Thermal Math Model                    | CDR, Preliminary<br>1 month post thermal testing, Final            | E   | D    | I   |
| 102-A   | LAT Thermal Math Model For Launch Vehicle | CDR + 12 mths., Preliminary<br>1 month post thermal testing, Final | E   | D    | I   |

CH-01

2.0 MISCELLANEOUS (2XX SERIES)

| SUB<br>NO. | DOCUMENT  | DUE DATE, MATURITY | QTY | DIST | CAT |
|------------|---|--------------------|-----|------|-----|
| 201        | Education and Public Outreach Material As Generated |                    | N/A | N/A  | N/A |
| 202        | Signed Agreements with Non-U.S.<br>Partners         | PDR, Final         | E   | A    | I   |

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcd> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**Part C. DATA ITEM DESCRIPTIONS

## DESCRIPTION OF REQUIRED DATA

---

|                  |                     |
|------------------|---------------------|
| 1. <u>Title:</u> | 2. <u>CDRL No.:</u> |
| MANAGEMENT PLAN  | 001                 |

---

3. Use:

Describes how the project is organized and managed. Describes what work is to be performed and where it will be performed. It provides the management structure, its system of operation, responsible lines of communications, and key personnel assignments.

---

4. Preparation Information:

## PROJECT MANAGEMENT

This plan shall address the overall organization, management approach, and structure of the GLAST LAT Project.

Describe how and where the program will operate during all phases of the contract. Delineate how the requirements of the Statement of Work (SOW) will be achieved and include, as a minimum, a description of planned activities for identifiable SOW requirements.

Describe the work to be performed, and what organization will be performing it. Also describe the inter-organizational agreements required, and plans for implementing them.

Describe your concept of the nature of the tasks and related potential problems. Discuss your approach to problem avoidance and/or solution. Address the degree to which your proposed personnel and procedures are proven through similar experience.

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcdl> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

This plan shall address interfaces with the Government. Indicate such things as critical paths, long-lead items and significant milestones.

This plan may include graphical displays such as flow diagrams, WBS, logic networks, etc., to reduce verbal descriptive material.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**  
CDRL NO. 001 (CONTINUED)

This plan shall provide an organizational chart(s) and sufficient supplemental narrative to describe fully the following:

- a. Organization proposed for carrying out the project showing inter- relationships of technical management, business management, and subcontract management, from lower level through intermediate management to top-level management with detailed explanation of:
  - The authority of the GLAST LAT Project Manager relative to other ongoing programs and applicable support organizations within the company structure. Discuss the project manager's control over essential resources and functions necessary to accomplish the work.
  - How and by whom interdepartmental work will be monitored and the authority of the project manager over interdepartmental work.
  - Process to be followed by the project manager in obtaining decisions beyond his/her authority and in resolving priority conflicts for resources and functions not under the project manager's direct control such as personnel, finances, and facilities.
- b. Contractual procedures proposed for the project to effect administrative and engineering changes, describing any differences from existing procedures.

This plan shall describe management techniques to be employed in minimizing project costs and schedule impacts, including controls to be exercised over subcontractors and suppliers. Describe how issues will be surfaced in a timely manner and at the proper levels.

This plan shall discuss and illustrate the proposed GLAST LAT Performance Assurance organizational structure, including staffing plans, reporting channels, authority and responsibilities, and management visibility. State the number and kind of persons who would have to be hired, and plans to obtain them.

This shall be submitted in accordance with Part B of this document.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

## DESCRIPTION OF REQUIRED DATA

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|                               |                     |
|-------------------------------|---------------------|
| 1. <u>Title:</u>              | 2. <u>CDRL No.:</u> |
| CONFIGURATION MANAGEMENT PLAN | 002                 |

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3. Use:

Defines a configuration management system which provides a means of control for all changes affecting form, fit, or function and any impact on performance, cost, or schedule.

---

4. Preparation Information:

The contractor's Configuration Management Plan shall describe the scope, approach, methods, and procedures of the system that he will use to implement the configuration management requirements. The plan shall at least be written to conform to the GLAST Project Configuration Management Plan.

This shall be submitted in accordance with Part B of this document.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01****DESCRIPTION OF REQUIRED DATA**


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|                                    |                     |
|------------------------------------|---------------------|
| 1. <u>Title:</u>                   | 2. <u>CDRL No.:</u> |
| GLAST LAT SOFTWARE MANAGEMENT PLAN | 003                 |

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3. Use:

Provides overview and control for a disciplined approach to the instrument software management.

---

6. Preparation Information:

This shall apply to all of the software provided by the GLAST LAT developer for the GLAST Project, including on-board software used to conduct system testing. Software that is institutional and multiuser, or part of a "generic" capability, shall be identified as to its use on the Project, where it is documented, and how it is managed. It is not controlled by this plan. However, all mission "peculiar" or mission "unique" changes to a basic capability shall fall within the scope of this plan.

This shall be submitted in accordance with Part B of this document.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

## DESCRIPTION OF REQUIRED DATA

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**1. Title:**

SMALL BUSINESS AND SMALL  
DISADVANTAGED BUSINESS  
SUBCONTRACTING REPORTS

**2. CDRL No.:**

004

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**3. Use:**

Provide status of meeting small and small disadvantaged business subcontracting goals.

---

**4. Preparation Information:**

Prepare in accordance with FAR Clause 52.219-9. Show status of all relevant contracts, with justification for the amount towards small/small disadvantaged organizations.

Submit in accordance with Part B of this document.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01****DESCRIPTION OF REQUIRED DATA**


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|                            |                     |
|----------------------------|---------------------|
| 1. <u>Title:</u>           | 2. <u>CDRL No.:</u> |
| GLAST LAT CALIBRATION PLAN | 005                 |

---

3. Use:

Controlling document for definition of calibration requirements, equipment and methods.

---

4. Preparation Information:

This document shall include the rationale for all calibration plans. It shall specify the requirements for calibration of the LAT instrument for each subassembly phase. The prelaunch calibration activities shall be discussed in terms of meeting the science requirements, verification of those requirements, and schedule of all calibration activities. Requirements for calibration equipment and workforce shall be stated. Calibration activities required after integration with the spacecraft, including the required environment for those activities, shall be specified, and needed equipment shall be stated. Post-launch calibration activities shall also be stated in a separate section of the document. This shall include any constraints required on the operation of the spacecraft.

This shall be submitted in accordance with Part B of this document.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

## DESCRIPTION OF REQUIRED DATA

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|  |                     |
|--|---------------------|
| 1. <u>Title:</u>                               | 2. <u>CDRL No.:</u> |
| CONFIGURATION CHANGE REQUESTS (CCR)<br>CLASS I | 006                 |

---

3. Use:

Class I changes are to be used as a vehicle for orderly processing of change requests to appropriate level of approval authority for disposition. Class II changes are to be used as a vehicle for processing of all change requests not classified as Class I to appropriate levels for concurrence.

---

4. Preparation Information:

The developer shall prepare Class I Change Requests for all changes that may impact form, fit, function, cost, schedules or performance. These changes shall be processed according to the procedures outlined in the GLAST Configuration Management Plan and shall be reviewed and approved by appropriate levels of the Configuration Control Board.

These shall be submitted in accordance with Part B of this document.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01****DESCRIPTION OF REQUIRED DATA**


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|                       |                     |
|-----------------------|---------------------|
| 1. <u>Title:</u>      | 2. <u>CDRL No.:</u> |
| WEEKLY STATUS REPORTS | 007                 |

---

3. Use:

Development status evaluation.

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4. Preparation Information:

On one day of each week chosen by the developer, the developer shall email to the Technical Officer a written report indicating the status of the development as of close of business the preceding day, including a summary of progress made. This report shall include, but not necessarily be limited to the following for the week prior to the report: technical progress, including significant accomplishments and milestones reached; problems or issues encountered with proposed corrective actions, if known; and any actual or anticipated slip in schedule.

Note: This weekly report is intended to be timely and informal and should detail the above topics as changes or problems occur.

These shall be submitted in accordance with Part B of this document.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01****DESCRIPTION OF REQUIRED DATA**


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|                          |                     |
|--------------------------|---------------------|
| 1. <u>Title:</u>         | 2. <u>CDRL No.:</u> |
| QUARTERLY STATUS REPORTS | 008                 |

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3. Use:

Quarterly Status Report data shall be used by GSFC system managers to: (1) evaluate contract performance, (2) identify the magnitude and impact of actual and potential project areas causing significant cost, schedule or technical variances, and (3) provide valid, timely project status information to higher authorities.

4. Preparation Information:

The developer shall submit a quarterly status report 15 days after the end of each quarterly reporting period. It shall be submitted by email to the technical officer and the contracting officer. The report shall include system and subsystem status information. It shall include, but not necessarily be limited to: progress since the last quarterly report, including accomplishments vs. plans for the quarter; plans for work for the next quarter; technical and programmatic issues, including any effects on schedule, cost, technical design, or requirements for technical resources (mass, power, volume, data rate), and including mitigation or resolution plans. It shall include technical, programmatic, system assurance and safety, software, and education and public outreach status. It shall also include the current schedule, highlighting the critical path.

These shall be submitted in accordance with Part B of this document.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

## DESCRIPTION OF REQUIRED DATA

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|  |                     |
|--|---------------------|
| 1. <u>Title:</u>   | 2. <u>CDRL No.:</u> |
| MONTHLY AND QUARTERLY FINANCIAL<br>MANAGEMENT REPORT (NASA FORM 533M/533Q) | 009                 |

---

3. Use:

To document, evaluate, and project cost performance in support of the NASA accrued revenue and expenditure accounting system.

---

4. Preparation Information:

The monthly 533M and quarterly 533Q shall be submitted providing the information required on the forms. If 533 forms are not familiar to the developer, other forms may be used, provided they supply the same information.

This shall be submitted in accordance with Part B of this document.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

## DESCRIPTION OF REQUIRED DATA

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|  |                     |
|--|---------------------|
| 1. <u>Title:</u>                         | 2. <u>CDRL No.:</u> |
| End of Phase A/B Report and Presentation | 010                 |

---

3. Use:

To document work accomplished and technical and programmatic characteristics of the LAT instrument.

---

4. Preparation Information:

The presentation may be combined with required review presentations, such as the PDR and the NAR, provided both technical and programmatic (including cost and schedule) aspects of the project are covered. The report shall address only the technical status of the instrument development, giving a complete description of the instrument, and the trade studies currently in process or planned.

This shall be submitted in accordance with Part B of this document.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

## DESCRIPTION OF REQUIRED DATA

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|                               |                     |
|-------------------------------|---------------------|
| 1. <u>Title:</u>              | 2. <u>CDRL No.:</u> |
| Subsystem Peer Review Reports | 011                 |

---

3. Use:  
To keep the Project informed of designs and design issues.

---

4. Preparation Information:

Whatever materials are generated for LAT subsystem internal peer reviews, should be submitted. There is no specific format or requirement, other than what the developer decides to provide at the review.

This shall be submitted in accordance with Part B of this document.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

## DESCRIPTION OF REQUIRED DATA

---

**1. Title:**

Suborbital Flight Test Report

**2. CDRL No.:**

012

---

**3. Use:**

To document the results and resulting plans from the suborbital test flight.

---

**4. Preparation Information:**

This report shall include a description of the goals and requirements of the suborbital test flight, as compared with the actual results. It shall also document how the results will be used in the further optimization of the design of the instrument and its software.

This shall be submitted in accordance with Part B of this document.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01****DESCRIPTION OF REQUIRED DATA**


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|                                 |                     |
|---------------------------------|---------------------|
| 1. <u>Title:</u>                | 2. <u>CDRL No.:</u> |
| GLAST LAT STRUCTURAL MATH MODEL | 101                 |

---

3. Use:

For providing instrument interface information to be utilized in various statics and dynamics observatory analyses.

---

4. Preparation Information:

The deliverable GLAST LAT Structural Math Model shall meet all requirements listed in the GLAST IRD. In addition to these requirements, the math model shall be compared with a modal survey carried out on the structural/thermal model to verify frequency and mode shape predictions of the structural math model. The frequency predictions shall agree with the modal survey results to within 5 percent for the first mode and 10 percent for all other significant modes up to 100 Hz. In addition to the frequency correlation, the mode shape correlations between test and the analytical model shall include a cross-orthogonality check, a mode shape geometric similarity check, and a static deflection check. The final update of the structural model shall include any modifications required to correlate the model to the physical test results. [Note that only the preliminary model is deliverable during the timeframe of this contract.]

This shall be submitted in accordance with Part B of this document.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01****DESCRIPTION OF REQUIRED DATA**

---

**1. Title:**

LAT THERMAL MATH MODEL

**2. CDRL No.:**

102

| CH-01

---

**3. Use:**

To maintain insight into instrument thermal sub-system development and to facilitate Observatory level thermal analyses.

---

**4. Preparation Information:**

A detailed Instrument thermal math model (<10000 nodes) shall be developed and provided for delivery which will be used as the primary tool to simulate LAT thermal performance in both the instrument level thermal analysis as well as the integrated Observatory level thermal analysis. Design hot and cold case thermal models shall be maintained whose parameters bound instrument thermal performance for all design cases. These models shall be capable of being used for off-nominal performance case studies involving both geometric and thermal boundary changes. In addition, the use of proprietary software routines shall be avoided that would preclude their use by other government contracted agents.

| CH-01

Detailed thermal models shall include an adequate level of detail to predict, under worst case hot and cold conditions, all critical temperatures, including those that drive operational and survival temperature limits and heater power. Worst case conditions include variations in season, orbit selection, orbital time, and environmental flux parameters (seasonal and spatial) and a rational combination of the effects of design tolerances, fabrication uncertainties, material differences, and degradation due to aging. Models shall use conservative values for conduction, absorption, emission, MLI effective emittance, and contact resistance that bound predicted hot and cold case thermal performance.

The models usage shall be documented in a User's Manual that shall be delivered along with the models.

| CH-01

**4.1 Geometric Math Model (GMM)**

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcdl> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

Surface geometry models shall be developed for delivery and used to calculate radiation exchange couplings (for both internal as well as external geometry) and orbital absorbed heat loads. The surface model shall comply with the following: CH-01

- a. Surface geometry models (< 3000 surfaces each) shall be developed using the Thermal Synthesizer System (TSS) format. Separate geometric models shall be provided for both external and internal geometry. CH-01
- b. The surface model shall form a completely closed volume. Even the surface area which is used for mechanical attachment to the Spacecraft shall be represented by a surface.
- c. In general, each external and internal (if considered critical for TMM – FEM mapping for STOP analysis) node of the model shall be represented by a surface or set of surfaces in the geometry model. Any surface of special interest (i.e., an aperture or a radiator) shall be modeled separately. CH-01
- d. The local coordinate system shall be rectangular with the same orientation as the Spacecraft coordinate system. For each surface in the model, sufficient information shall be provided to relate each corner of the surface to the coordinate system.
- e. All length dimensions shall be input in millimeters. Time units shall be in seconds.
- f. An instrument-unique numbering system for all TSS/SINDA model identification numbers shall be used. All Instrument components that are physically separate units shall be modeled separately with unique identification numbers within the unique Instrument number allocation. No ID number duplications are allowed. The submodel name "MAIN" shall not be used. CH-01

The following documentation shall be supplied in fulfillment of the requirement of a deliverable TSS surface model: CH-01

1. A table shall be supplied which lists each surface with:
  - a) A brief description.
  - b) The node number in the model.
  - c) The area in mm<sup>2</sup>.
  - d) The surface thermal control coating.
  - e) The beginning-of-life and end-of-life values of solar absorptivity and IR emissivity of the surface materials including thermal blanket outer layers. The values of the thermo-optical properties shall include tolerances for uncertainties and degradation. CH-01
2. A sample run of the TSS surface model of the Instrument shall be supplied assuming the worst EOL hot case with the Instrument operational. The TSS input deck shall be provided on either a 3.5" IBM DOS compatible diskette in ASCII format, or sent to an Internet address specified by the Spacecraft Contractor at the time of delivery, or in other forms agreed-upon with the Spacecraft Contractor. CH-01

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

- |   |       |
|---|-------|
| 3. Description of the model with sufficient references to configurations it represents to establish its pedigree, any special modeling features used, and the rationale for the modeling methodology. | CH-01 |
| 4. Detailed plots of the surface model clearly showing all nodes and node numbers. The coordinate axes shall be clearly marked.   | CH-01 |

|  |       |
|--|-------|
| This model will be updated several times during the design and test phase of the instrument, and the final correlated model will be required after thermal balance testing of the Instrument has been completed. | CH-01 |
|--|-------|

## 4.1.2 Thermal Math Model (TMM)

| CH-01

The deliverable thermal model shall comply with the following:

- |   |       |
|---|-------|
| <ul style="list-style-type: none"> <li>a. The thermal model shall be developed in a Systems Improved Numerical Differencing Analyzer (SINDA) format.</li> <li>b. The model shall be capable of steady-state and transient analysis, with versions for launch, survival and each major operational mode.</li> <li>c. The model shall be as rational as possible and shall not exceed 10000 nodes.</li> <li>d. All length dimensions shall be input in mm. All heat energy data shall be input in watts. Time units shall be in seconds. The Celsius temperature scale shall be used.</li> <li>e. The overall energy balance summation of the thermal model with its boundaries shall be better than <math>\pm 3\%</math> for any set of boundary conditions and internal power dissipations.</li> <li>f. The temperature relationship between each flight temperature sensor and the reduced node thermal model node which contains the flight sensor shall be provided.</li> <li>g. Power distribution and time-lines shall be provided for each expected mode of the mission and for ground testing.</li> <li>h. Each external node of the thermal model shall have a one-to-one correspondence with a surface or group of surfaces from the surface model. Each internal node (if critical for TMM-FEM mapping as well as those with a heat source dissipation) shall have a one-to-one correspondence with a surface or group of surfaces from the surface model.</li> <li>i. Required Deliverable Thermal Model Documentation.</li> </ul> | CH-01 |
|---|-------|

The following information and data shall be supplied in fulfillment of the requirement to document the thermal model:

1. A table shall be provided which lists the node number, a brief description, the mass (kg), the specific heat (J/kg/°C), and the relationship to flight temperature sensors. All tables and lists of data shall have units clearly stated.
2. A detailed description of the internal radiative and conductive networks of thermal couplings.

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<http://glast.gsfc.nasa.gov/project/cm/mcdl> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

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3. Maximum and minimum electrical power consumed and thermal dissipation, if different. Electrical heat dissipation for each node for all operating modes including survival and duty cycle (if applicable). Effects of bus voltage variations should be included.
4. The following information relating to Instrument thermal control heaters shall be supplied.
  - a) Type of control (i.e., on/off ground command, thermostatic or proportional).
  - b) Nodes where heat is dissipated.
  - c) The node used for control.
  - d) Operating temperature limits.
  - e) Rated power at Instrument voltage.
5. A table shall be provided listing the relationship between the external nodes of the reduced node thermal model and the surfaces of the TSS surface model.
6. Description of the model with sufficient references to configurations it represents to establish its pedigree, any special modeling features used, and the rationale for the modeling methodology.
7. Any engineering assumptions made to reduce the model's complexity or to enhance the accuracy shall be stated.
8. Any nodes using adiabatic surfaces or arithmetic nodes (zero mass nodes) shall be noted.
9. A table shall be provided which lists the maximum and minimum temperatures for each node for normal operating conditions, standby mode and survival.
10. A sample run with an appropriate orbital environment shall be supplied to provide a set of reference temperatures that can be compared with the model as it will be used in the Spacecraft model.
11. All calculations necessary to analytically verify that the design satisfies the thermal requirements must be included. Any assumptions that must be made to facilitate the analysis shall be clearly stated. A written report including an abstract and a statement of conclusions and/or recommendations should accompany these calculations.
12. The SINDA input deck used for the sample run shall be provided on either a 3.5" IBM DOS compatible diskette in ASCII format, or sent to an Internet address specified by the GSFC at the time of delivery, or in other forms agreed-upon with the GSFC.

#### 4.1.3 Model Delivery

These models (GMM and TMM) shall be deliverable items to the GSFC GLAST Project Office . These models and their associated documentation shall be delivered 30 days prior to PDR and CDR. The final correlated model shall be delivered 90 days after thermal balance testing of the Instrument has been completed.

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|   |                     |
|---|---------------------|
| 1. <u>Title:</u>                          | 2. <u>CDRL No.:</u> |
| LAT THERMAL MATH MODEL FOR LAUNCH VEHICLE | 102 - A             |

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3. Use:

To maintain insight into instrument thermal sub-system development and to facilitate launch vehicle thermal analyses.

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## 4. Preparation Information:

A reduced instrument thermal model shall be developed for delivery to the spacecraft vendor so that integrated launch vehicle thermal analyses may be performed.

## 4.1 Reduced Node Thermal Model Requirements

A reduced Instrument thermal math model shall be developed and provided for delivery to GSFC GLAST Project Office. This model will be integrated into a reduced Observatory thermal model for use by the Launch Services provider for their launch verification process. This model shall provide similar results to the detailed model in the areas of interface heat flow (both radiation and conduction within +/-5% ) and average internal temperatures (within 5C to 7C) of major instrument components.

The models usage shall be documented in a User's Manual that shall be delivered along with the models.

## 4.2 Reduced Geometric Math Model (GMM)

A surface geometry model shall be developed for delivery and used to calculate radiation exchange couplings and orbital absorbed heat loads. The surface model shall comply with the following:

- a. The surface geometry model shall be developed using the TRASYSII format.

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<http://glast.gsfc.nasa.gov/project/cm/mcdl> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

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- b. The surface geometry model shall have less than 200 surfaces.
- c. The surface model shall form a completely closed volume. Even the surface area which is used for mechanical attachment to the Spacecraft shall be represented by a surface.
- d. In general, each external node of the instrument thermal model shall be represented by a surface or set of surfaces in the geometry model. Any surface of special interest (i.e., an aperture, radiator or other low mass component) shall be modeled separately.
- e. The local coordinate system shall be rectangular with the same orientation as the Spacecraft coordinate system. For each surface in the model, sufficient information shall be provided to relate each corner of the surface to the coordinate system.
- f. All length dimensions shall be input in feet. Time units shall be in hours.
- g. An instrument-unique numbering system for all TRASYII/SINDA model identification numbers shall be used. All Instrument components that are physically separate units shall be modeled separately with unique identification numbers within the unique Instrument number allocation. No ID number duplications are allowed. The submodel name "MAIN" shall not be used.

The following information and data shall be supplied in fulfillment of the requirement of a deliverable TRASYII surface model:

1. A table shall be supplied which lists each surface with:
  - a) A brief description.
  - b) The node number in the model.
  - c) All units in British Units
  - d) The area in ft<sup>2</sup>.
  - e) The surface thermal control coating.
  - f) The beginning-of-life values of solar absorptivity and IR emissivity of the surface materials including thermal blanket outer layers. The values of the thermo-optical properties shall include tolerances for uncertainties and degradation.
2. A sample run of the TRASYII surface model of the Instrument shall be supplied, assuming the worst EOL hot case with the Instrument operational. The TRASYII input deck shall be provided on either a 3.5" IBM DOS compatible diskette in ASCII format, or sent to an Internet address specified by the Spacecraft Contractor at the time of delivery, or in other forms agreed-upon with the Spacecraft Contractor.
3. Description of the model with sufficient references to configurations it represents to establish its pedigree, any special modeling features used, and the rationale for the modeling methodology.
4. Detailed plots of the surface model clearly showing all nodes and node numbers. The coordinate axes shall be clearly marked.

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## 4.3 Reduced Thermal Math Model (TMM)

The deliverable reduced thermal model shall comply with the following:

- a. The thermal model shall be developed in a Systems Improved Numerical Differencing Analyzer (SINDA85) format.
- b. The model shall be capable of steady-state and transient analysis.
- c. The model shall be as rational as possible and shall not exceed 200 nodes.
- d. All length dimensions shall be input in ft. All heat energy data shall be input in BTU/Hr. Time units shall be in hours. The Fahrenheit temperature scale shall be used.
- e. The overall energy balance summation of the thermal model with its boundaries shall be better than  $\pm 5\%$  for any set of boundary conditions and internal power dissipations. Correlation with the detailed instrument model shall be better than 5% at all critical interface areas.
- f. The temperature relationship between each flight temperature sensor and the reduced node thermal model node which contains the flight sensor shall be provided.
- g. Power distribution shall be provided for the launch timeline.
- h. Each external node of the thermal model shall have a one-to-one correspondence with a surface or group of surfaces from the surface model.
- i. Required Deliverable Thermal Model Documentation.

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The following information and data shall be supplied in fulfillment of the requirement to document thermal model:

1. A table shall be provided which lists the node number, a brief description, the mass (lbs), the specific heat (Btu/lb-F), and the relationship to flight temperature sensors. All tables and lists of data shall have units clearly stated.
2. A detailed description of the internal radiative and conductive networks of thermal couplings.
3. Maximum and minimum electrical power consumed and thermal dissipation, if different. Electrical heat dissipation for each node for the launch mode including survival and duty cycle (if applicable). Effects of bus voltage variations should be included.
4. The following information relating to Instrument thermal control heaters shall be supplied.
  - a) Type of control (i.e., on/off ground command, thermostatic or proportional).
  - b) Nodes where heat is dissipated.
  - c) The node used for control.
  - d) Operating temperature limits.
  - e) Rated power at Instrument voltage.

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5. A table shall be provided listing the relationship between the external nodes of the reduced node thermal model and the surfaces of the TRASYSII surface model.
6. Description of the model with sufficient references to configurations it represents to establish its pedigree, any special modeling features used, and the rationale for the modeling methodology.
7. Any engineering assumptions made to reduce the model's complexity or to enhance the accuracy shall be stated.
8. Any nodes using adiabatic surfaces or arithmetic nodes (zero mass nodes) shall be noted.
9. A table shall be provided which lists the maximum and minimum temperatures for each node for normal operating conditions, standby mode and survival.
10. A sample run with an appropriate orbital environment shall be supplied to provide a set of reference temperatures that can be compared with the model as it will be used in the Spacecraft model.
11. All calculations necessary to analytically verify that the design satisfies the thermal requirements must be included. Any assumptions that must be made to facilitate the analysis shall be clearly stated. A written report including an abstract and a statement of conclusions and/or recommendations should accompany these calculations.
12. The SINDA input deck used for the sample run shall be provided on either a 3.5" IBM DOS compatible diskette in ASCII format, or sent to an Internet address specified by the GSFC at the time of delivery, or in other forms agreed-upon with the GSFC.

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#### 4.2.3 Reduced Model Delivery

These models (GMM and TMM) shall be deliverable items to the GSFC GLAST Project Office. These models and their associated documentation shall be delivered 120 days after thermal balance testing of the Instrument has been completed.

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## DESCRIPTION OF REQUIRED DATA

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|   |                     |
|---|---------------------|
| 1. <u>Title:</u>                        | 2. <u>CDRL No.:</u> |
| Education and Public Outreach Materials | 201                 |

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3. Use:

To provide educational materials to areas of the community for disseminating the information learned by activities associated with this contract.

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4. Preparation Information:

These materials shall be developed and disseminated in accordance with the activities specified in the LAT proposal.

This shall be submitted in accordance with Part B of this document.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

## DESCRIPTION OF REQUIRED DATA

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|                                   |                     |
|-----------------------------------|---------------------|
| 1. <u>Title:</u>                  | 2. <u>CDRL No.:</u> |
| Agreements with Non-U.S. Partners | 202                 |

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3. Use:

To document the international arrangements of responsibility and participation.

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4. Preparation Information:

Whatever agreements are put in place, at the developers choice, and consistent with the Implementing Arrangement between NASA and DOE for the GLAST Project, shall be signed by both parties. At a minimum, it shall include the division of responsibilities of each participation country.

This shall be submitted in accordance with Part B of this document.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01****Safety and Mission Assurance Documentation (3XX SERIES)**

| <b>CDRL NO.</b> | <b>DESCRIPTION</b>   | <b>Due Date, Maturity</b>  | <b>Qty</b> | <b>Dist</b> | <b>Cat</b> |
|-----------------|--|--|------------|-------------|------------|
| 301             | Performance Assurance Implementation Plan (PAIP)                                     | 90 DACM, Final<br>As Generated, Revisions  | E          | A           | A          |
| 302             | Electronic Copies of Requirements Documents  | At Time of Draft Release for Review, Preliminary<br>At Time of Major Revision Release for Review, Current  | E          | B           | I          |
| 303             | System Safety Program Plan (May incorporate into PAIP)                               | 90 DACM, Final<br>As Generated, Revisions  | E          | A           | A          |
| 304             | Preliminary Hazard Analysis (PHA)  | PDR, Preliminary<br>CDR, Update  | E          | B           | A          |
| 305             | Safety Noncompliance Reports   | As Generated, Final  | E          | B           | A          |
| 306             | Technical Reviews  | GSFC Chaired/Co-Chaired Review Technical Material -<br>7 work days prior to review, final<br>Minutes & Action Items for Technical Review -<br>10 work days following review, final<br>Responses to Government Action Items or Requests for<br>Information/Action - Per Schedule Established at/for Review, Final | E          | B           | I<br>A     |
| 307             | Instrument Performance Verification Plan   | 20 Work Days Prior to PDR, Preliminary<br>20 Work Days Prior to CDR, Final<br>As Generated, Updates  | E          | A           | I          |
| 308             | Parts Control Plan (PCP) (May incorporate into PAIP)                                 | 90 DACM, Final<br>As Generated, Revisions  | E          | A           | A          |
| 309             | Parts Control Board (PCB) Reports  | 5 Work Days After PCB Meeting, Final   | E          | B           | I          |
| 310             | Parts Identification List (PIL) Program Parts List (PPL)/ As Built Parts List (ABPL) | 30 Days Prior to PDR, Initial<br>As Generated and at CDR, Revisions<br>60 Days Prior to Hardware Shipment, Final (As Built Parts List)   | E          | A           | A          |
| 311             | Alert/Advisory Disposition and Preparation   | Responses - 25 Calendar Days After Receipt of<br>Alert/Advisory from GSFC, Final<br>Preparation - Within 60 Days of Problem's Discovery  | E          | B           | I          |
| 312             | Materials, Processes and Lubrication Assurance Plan (May incorporate into PAIP)      | 90 DACM, Final<br>As Generated, Revisions  | E          | A           | A          |

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| CDRL NO. | DESCRIPTION  | Due Date, Maturity  | Qty | Dist             | Cat         |
|----------|--|---|-----|------------------|-------------|
| 313      | Materials Usage Agreement  | 30 Days Prior to PDR, Preliminary<br>30 Days Prior to CDR, Updates<br>30 Days Prior to Hardware Acceptance, Updates   | E   | A                | A           |
| 314      | Polymeric Materials and Composites Usage List                          | 30 Days Prior to PDR, Preliminary<br>30 Days Prior to CDR, Updates<br>30 Days Prior to Hardware Acceptance, Updates   | E   | A                | I           |
| 315      | Inorganic Materials and Composites Usage List                          | 30 Days Prior to PDR, Preliminary<br>30 Days Prior to CDR, Updates<br>30 Days Prior to Hardware Acceptance, Updates   | E   | A                | I           |
| 316      | Lubrication Usage List   | 30 Days Prior to PDR, Preliminary<br>30 Days Prior to CDR, Updates<br>30 Days Prior to Hardware Acceptance, Updates   | E   | A                | I           |
| 317      | Material Process Utilization List                                      | List - 30 Days Prior to PDR, Preliminary<br>30 Days Prior to CDR, Updates<br>30 Days Prior to Hardware Acceptance, Updates<br>Copy of Process - Upon Request, Final | E   | A<br>A<br>A<br>B | I           |
| 318      | Failure Mode and Effects Analysis (FMEA) and Critical Items List (CIL) | 30 Days Prior to PDR, Preliminary<br>30 Days Prior to CDR, Final<br>As Generated, Updates   | E   | A                | I           |
| 319      | Limited Life Items   | 30 Days Prior to PDR, Preliminary<br>30 Days Prior to CDR, Update<br>As Generated, Updates  | E   | A                | I           |
| 320      | Quality Manual   | 90 DACM, Final<br>As Generated, Revisions   | E   | B                | I           |
| 321      | Nonconformance Reports (NCR's)   | Within 24 Hours of Occurrence, Preliminary<br>At Completion of Analysis & Assignment of Corrective Action, Current<br>Within 3 Work Days of Closure, Final          | E   | B<br>B<br>A      | I<br>I<br>A |
| 322      | Contamination Control Plan   | 30 Days Prior to PDR, Preliminary<br>30 Days Prior to CDR, Final  | E   | A                | I           |
| 323      | Risk Management Plan (May incorporate into PAIP)                       | 90 DACM, Final<br>Revisions, As Generated   | E   | A                | A           |
| 324      | Information Needed to Prepare Probabilistic Risk Analysis (PRA)        | As required by the Government Prior to PDR, Initial<br>As required by the Government Prior to CDR, Final<br>As required by the Government, Updates                  | E   | B                | I           |

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| CDRL NO. | DESCRIPTION   | Due Date, Maturity   | Qty | Dist | Cat |
|----------|---|--|-----|------|-----|
| 325      | Information Needed to Prepare Fault Tree Analysis (FTA)                             | As required by the Government Prior to PDR, Initial<br>As required by the Government Prior to CDR, Final<br>As required by the Government, Updates | E   | B    | I   |
| 326      | Information Needed to Prepare Risk Assessment                                       | As required by the Government 30 Days After A Request, Final   | E   | B    | I   |
| 327      | Operations and Support Hazard Analysis (O&SHA)                                      | 30 Days Prior to the CDR, Initial<br>120 Prior to Launch, Update   | E   | B    | A   |
| 328      | Hazard Control Verification Log   | In Support of Spacecraft Contractor's MSPSP Schedule<br>As Generated to Document Hazard Analyses, Initial<br>As Warranted by Analyses, Updates     | E   | B    | A   |
| 329      | Safety Assessment Report (SAR)  | In Support of Spacecraft Contractor's MSPSP Schedule   | E   | B    | A   |
| 330      | Ground Operations Plan (GOP) Inputs (to Spacecraft Contractor)                      | In Support of Spacecraft Contractor's GOP Schedule   | E   | B    | A   |
| 331      | Performance Verification Procedure  | 30 Days Prior to the Start of Testing  | E   | B    | A   |
| 332      | Verification Reports  | 72 Hours After Testing, Preliminary<br>30 Days After Verification Activity, Final  | E   | B    | I   |
| 332      | Instrument Performance Verification Report  | At CDR, Preliminary<br>30 Days Following On-Orbit Check Out, Final   | E   | B    | I   |
| 333      | Printed Wiring Board (PWB) Coupons  | As Received From Manufacturer By Developer, Final  | E   | B    | A   |
| 334      | Parts Stress Analysis   | 30 Work Days Prior to CDR, Final<br>As Generated, Updates  | E   | B    | I   |
| 335      | <b>Software Specification and Requirements Documentation (SSRD)</b>                 | 30 Work Days Prior to CDR, Final<br>As Generated, Updates  | E   | B    | I   |
| 336      | Software Performance Validation Matrix  | 90 Days After CDR, Initial<br>As Generated, Updates  | E   | B    | I   |
| 337      | Functional Configuration Audit (FCA) and Physical Configuration Audit (PCA) Results | Prior to End Item Delivery/Acceptance, Final   | E   | B    | I   |
| 338      | Software Testing Procedures   | 30 Days Prior to TTR, Preliminary<br>15 Days Prior to Test Activity, Final   | E   | B    | I   |
| 338      | Software Test Reports   | 15 Days After Test Completion, Preliminary<br>30 Days After On-Orbit Check-out, Final  | E   | B    | I   |
| 339      | Input for Software Metrics  | 10 Work Days Prior to Each LAT Quarterly Review Or<br>As Otherwise Agreed Upon With Project Management   | E   | B    | I   |

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**PERFORMANCE ASSURANCE IMPLEMENTATION PLAN**

|   |                  |
|---|------------------|
| Title:<br>Performance Assurance Implementation Plan   | CDRL No.:<br>301 |
| Reference:<br>MAR Section 1.1   |                  |
| Use:<br>Detail the developer's system safety and mission assurance program for their GLAST instrument.  |                  |
| Related Documents<br>None   |                  |
| Place/time/purpose of delivery:<br>Delivery is due to GSFC 90 days after contract signing for approval. Any subsequent revisions to PAIP must be submitted to GSFC for approval.  |                  |
| Preparation Information:<br>The Performance Assurance Implementation Plan will include the details of the developer's plans for implementing the following program: <ul style="list-style-type: none"> <li>a) System Safety (May be a separate document.)</li> <li>b) Technical Review</li> <li>c) Design Validation</li> <li>d) Electronic Packaging and Processes</li> <li>e) Parts (May be a separate document.)</li> <li>f) Materials, Processes, and Lubrication (May be a separate document.)</li> <li>g) Reliability</li> <li>h) Quality Assurance</li> <li>i) Contamination Control</li> <li>j) Software Assurance</li> <li>k) Ground Data Systems Assurance</li> <li>l) Risk Management</li> </ul> |                  |

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**ELECTRONIC COPIES OF REQUIREMENTS DOCUMENTS**

|   |                          |
|---|--------------------------|
| <p>Title:<br/>Electronic Copies of Requirements Documents</p>   | <p>CDRL No.:<br/>302</p> |
| <p>Reference:<br/><br/>MAR Sections 1.10</p>  |                          |
| <p>Use:<br/>Developer-prepared requirements documents will be analyzed using the Automated Requirement Measurement (ARM) Tool that was developed at GSFC for use as an early life cycle aid to identify areas of a requirements specification document that can be improved.</p>  |                          |
| <p>Related Documents:<br/><br/>None</p>   |                          |
| <p>Place/Time/Purpose of Delivery:<br/><br/>All developer-prepared requirements documents (e.g., LAT specifications, management plans, the instrument performance verification plan, the PAIP and its associated documentation such as the Risk Management Plan and System Safety Program Plan) will be delivered electronically to the GSFC Project Office for analysis/review. Documents will be delivered at the time of major draft releases, prior to their formal acceptance.</p> |                          |
| <p>Preparation Information:<br/><br/>The documentation will be delivered to GSFC using a format and media negotiated between the developer and the GSFC Project Office. (Note: This same tool will be used to analysis GSFC-developed requirements documents.) A GSFC document analysis report will be delivered to the developer for their consideration prior to the document's formal release.</p>   |                          |

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**SYSTEM SAFETY PROGRAM PLAN**

|  |                          |
|--|--------------------------|
| <p>Title:<br/>System Safety Program Plan</p>   | <p>CDRL No.:<br/>303</p> |
| <p>Reference:<br/><br/>MAR Section 2.2</p>   |                          |
| <p>Use:<br/><br/>This plan describes in detail the tasks and activities of system safety management and engineering required to identify, evaluate, and eliminate and control hazards, or reduce the associated risk to a level acceptable to Range Safety throughout the system life cycle. The approved plan shall account for all contractually required tasks and responsibilities on an item-by-item basis.</p> |                          |
| <p>Related Documents:<br/>EWR 127-1</p>  |                          |
| <p>Place/Time/Purpose of Delivery:<br/><br/>Deliver to GSFC with, or as part of, the Performance Assurance Implementation Plan for approval. Any subsequent revisions must be approved by GSFC.</p>  |                          |
| <p>Preparation Information:<br/><br/>Refer to Appendix 1B of EWR 127-1 for preparation directions.</p>   |                          |

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**PRELIMINARY HAZARD ANALYSIS (PHA)**

|  |                          |
|--|--------------------------|
| <p>Title:<br/>Preliminary Hazard Analysis (PHA)</p>  | <p>CDRL No.:<br/>304</p> |
| <p>Reference:<br/><br/>MAR Section 2.2</p>   |                          |
| <p>Use:<br/><br/>Used to identify safety critical areas, provide an initial assessment of hazards, and identify requisite hazard controls and follow-on actions. The analysis will result in an initial risk assessment of the system.</p> |                          |
| <p>Related Documents:<br/>EWR 127-1</p>  |                          |
| <p>Place/Time/Purpose of Delivery:<br/><br/>The first delivery will be at the PDR for GSFC approval. An update will be due at CDR for GSFC approval.</p>   |                          |
| <p>Preparation Information:<br/><br/>Refer to Appendix 1B of EWR 127-1 for guidance on the performance of a PHA.</p>   |                          |

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**SAFETY NONCOMPLIANCE REPORTS**

|  |                          |
|--|--------------------------|
| <p>Title:<br/>Safety Noncompliance Reports</p>   | <p>CDRL No.:<br/>305</p> |
| <p>Reference:<br/>MAR Section 2.2</p>  |                          |
| <p>Use:<br/>Used to document the inability to meet program requirements, or the ability to meet equivalent though not exact, program requirements.</p> |                          |
| <p>Related Documents:<br/>EWR 127-1</p>  |                          |
| <p>Place/Time/Purpose of Delivery:<br/>As required for GSFC approval.</p>  |                          |
| <p>Preparation Information:<br/>Refer to Appendix 1C of EWR 127-1 for preparation directions.</p>  |                          |

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**Technical reviews**

|   |                          |
|---|--------------------------|
| <p>Title:<br/>Technical Reviews</p>   | <p>CDRL No.:<br/>306</p> |
| <p>Reference:<br/><br/>MAR Section 3</p>  |                          |
| <p>Use:<br/><br/>Provide review material and hand-outs for technical reviews which review team members will need to read prior to the review.<br/>Provide review minutes and action items after technical reviews.</p>  |                          |
| <p>Related Documents:<br/>None</p>  |                          |
| <p>Place/Time/Purpose of Delivery:<br/><br/>Provide review materials/hand-outs 7 work days prior to each GSFC- chaired/co-chaired technical review for information. This will include the such reviews listed in LAT MAR Section 3.<br/>Provide minutes and action items from each technical review (peer or GSFC-chaired/co-chaired) within 10 work days following each review for GSFC review.<br/>Provide responses to Government action items/requests for information (per the schedule established at/for the review) for GSFC approval.</p>  |                          |
| <p>Preparation Information:<br/><br/>Prior to each GSFC-chaired/co-chaired technical review, provide an electronic or hard copy of technical review material including vu-graphs. Documentation may be made available via a website. Material shall include risk and safety status as of the date of the particular technical review.</p> <p>Following each peer review, provide meeting minutes and action items. Material may be provided via hard copy, electronic copy, or website.</p> <p>Following each GSFC-chaired/co-chaired technical review, provide meeting minutes, as needed or as agreed upon with the GLAST Project Office, to supplement/complement the GSFC chair's/co-chair's minutes. This may include splinter meeting minutes. Additionally, after each GSFC-chaired/co-chaired technical review, provide any pertinent action items authored by the developer and/or their collaborators during the meeting or as a result of the meeting.</p> <p>Provide responses to Government actions items/requests for information/action via the format requested at each review: electronic, hard copy or web-based.</p> |                          |

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**INSTRUMENT PERFORMANCE VERIFICATION PLAN**

|   |                  |
|---|------------------|
| Title:<br>Instrument Performance Verification Plan  | CDRL No.:<br>307 |
| Reference:<br><br>MAR Section 4.2.1   |                  |
| Use:<br><br>Provides the overall approach for accomplishing the verification program. Defines the specific tests, analyses, calibrations, alignments, etc. that will demonstrate that the hardware complies with the mission requirements.  |                  |
| Related Documents<br><br>None   |                  |
| Place/Time/Purpose of Delivery:<br><br>Provide a preliminary draft 20 work days prior to the PDR for GSFC review. The final draft will be due 20 work days prior to the CDR for GSFC approval. Updates will be provided as required for GSFC approval.  |                  |
| Preparation Information:<br><br><p>Describes the approach (test, analysis, etc.) that will be utilized to verify that the hardware/software complies with mission requirements. If verification relies on tests or analyses at other level of assemblies, describe the relationships.</p> <p>A section of the plan will be an Instrument Performance Verification Matrix summarizing the flow-down of system specification requirements that stipulates how each requirement will be verified, and summarizes compliance/non-compliance with requirements. It will show each specification requirement, the reference source (to the specific paragraph or line item), the method of compliance, applicable procedure references, report reference numbers, etc. The Instrument Performance Verification Matrix may be made a separate document.</p> <p>The Instrument Performance Verification Plan will include a section describing the environmental verification program. This will include level of assembly, configuration of item, objectives, facilities, instrumentation, safety considerations, contamination control, test phases and profiles, appropriate functional operations, personnel responsibilities, and requirements for procedures and reports. For each analysis activity, include objectives, a description of the mathematical model, assumptions on which the model will be based, required output, criteria for assessing the acceptability of the results, interaction with related test activity, and requirements for reports. Provide for an operational methodology for controlling, documenting, and approving activities not part of an approved procedure. Plan controls that prevent accidents that could damage or contaminate hardware or facilities, or cause personal injury. The controls will include real-time decision-making mechanisms for continuation or suspension of testing after malfunction, and a method for determining retest requirements, including the assessment of the validity of previous tests. Include a test matrix that summarizes all tests to be performed on each component, each subsystem, and the payload. Include tests on engineering models performed to satisfy qualification requirements. Define pass/fail criteria. The Environmental Test Plan section will include an Environmental Test Matrix which summarizes all environmental tests that will be performed showing the test and the level of assembly. Tests on development/engineering models performed to satisfy qualification requirements will be included in this matrix. The Environmental Verification Plan may be made a separate document rather than be a part of the Instrument Performance Verification Plan</p> <p>As an adjunct to the environmental verification program, an Environmental Test Tracking Matrix summarizing all tests performed and showing the test and the level of assembly will be maintained.</p> <p>The Instrument Performance Verification Plan will include an Environmental Verification Specification section that stipulates the specific environmental parameters used in each test or analysis required by the verification plan. Contains the specific test and analytical parameters associated with each of the tests and analyses required by the Verification Plan. Payload peculiarities and interactions with the launch vehicle will be considered when defining quantitative environmental parameters under which the hardware elements must meet their performance requirements. The Environmental Verification Specification may be a separate document or it may be included as part of the Instrument Performance Verification Plan.</p> |                  |

CHECK THE GLAST PROJECT WEBSITE AT

<http://glast.gsfc.nasa.gov/project/cm/mcd> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

**PARTS CONTROL PLAN (PCP)**

|   |                  |
|---|------------------|
| Title:<br>Parts Control Plan (PCP)  | CDRL No.:<br>308 |
| Reference:<br><br>MAR Sections 6.1, 6.2.1, 6.2.2, 6.2.3, & 6.2.6  |                  |
| Use:<br><br>Description of developer's approach and methodology for implementation of the Parts Control Program.  |                  |
| Related Documents<br><br>Parts Identification List (PIL)  |                  |
| Place/Time/Purpose of Delivery:<br><br>The PCP will be developed and delivered for GSFC review with, or incorporated into, the developer's Performance Assurance Implementation Plan. It will be delivered for GSFC approval. Any subsequent revisions must be delivered to GSFC for approval.  |                  |
| Preparation Information:<br><br>The PCP will be prepared and will address all EEE parts program requirements. The PCP will contain, as a minimum, detailed discussions of the following:  |                  |
| <ul style="list-style-type: none"> <li>a. The developer's plan or approach for conforming to the EEE parts requirements.</li> <li>b. The developer's parts control organization, identifying key individuals, and specific responsibilities.</li> <li>c. Detailed Parts Control Board (PCB) procedures, to include PCB membership, designation of Chairperson, responsibilities, review and approval procedures, meeting schedules and method of notification, meeting minutes, etc.</li> <li>d. Parts tracking methods and approach, including tools to be used such as databases, reports, PIL, etc. Describe system for identifying and tracking parts approval status.</li> <li>e. Parts procurement, processing and testing methodology and strategies. Identify internal operating procedures to be used for incoming inspections, screening, qualification testing, derating, testing of parts pulled from stores, Destructive Physical Analysis, radiation assessments, etc.</li> </ul> |                  |

**PARTS CONTROL BOARD (PCB) REPORTS**

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcd/> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

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|   |                  |
|---|------------------|
| Title:<br>Parts Control Board Reports   | CDRL No.:<br>309 |
| Reference:<br><br>MAR Sections 6.2.1.1  |                  |
| Use:<br><br>Document all PCB meeting minutes  |                  |
| Related Documents<br><br>Parts Control Plan (PCP)   |                  |
| Place/Time/Purpose of Delivery:<br><br>PCB reports will be submitted to GSFC for review within five work days after each PCB meeting.   |                  |
| Preparation Information:<br><br>Actions and recommendations from reviews and discussions of all issues effecting EEE parts (e.g., alert findings, DPA results, failure analysis results, qualification basis, screening requirements, etc.) shall be recorded in the PCB reports. |                  |

**PARTS IDENTIFICATION LIST (PIL)/PROGRAM PARTS LIST (PPL)/AS BUILT PROGRAM PARTS LIST (ABPL)**

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcd/> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

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|   |                  |
|---|------------------|
| Title:<br>Parts Identification List (PIL)/Program Parts List (PPL)/As Built Parts List (ABPL)   | CDRL No.:<br>310 |
| Reference:<br>MAR Sections 6.3 & 6.3.2  |                  |
| Use:<br>Listing of all EEE parts intended for use in spaceflight hardware   |                  |
| Related Documents<br>Parts Control Plan (PCP)   |                  |
| Place/Time/Purpose of Delivery:<br>The initial parts list delivery will be due to GSFC for approval 30 days prior to the PDR. Subsequent revisions (with all changes clearly noted on a hard copy) will be delivered to GSFC in a timely manner for approval with an updated revision due 30 days prior to the CDR and as mandated by list changes.. The As Built Parts List [ABPL] will be developed from this document/database and will be submitted to GSFC for review 60 days prior to delivery of the end item to the spacecraft contractor and/or the Government.  |                  |
| Preparation Information:<br><p>The PIL/PPL/ABPL will be prepared and maintained throughout the life of the project. The PIL/PPL/ABPL will be compiled by instrument or instrument component and will include the following information, as a minimum:</p> <ul style="list-style-type: none"> <li>a. Part name</li> <li>b. Part number</li> <li>c. Manufacturer</li> <li>d. Manufacturer's generic part number</li> <li>e. Procurement specification</li> </ul> <p>Any format may be used provided the required information is included. All submissions to GSFC will be provided in an electronic spreadsheet format. A hard copy will accompany the electronic version. Any changes from the last revision shall be clearly noted on the hard copy. (That is, updates to PIL will identify changes from the previous submission.)</p> <p>Note: The As-Built Parts List (ABPL) will include the following information in addition to the above list:</p> <ul style="list-style-type: none"> <li>a. Lot date code</li> <li>b. Quantities</li> <li>c. Parts use location to the sub-assembly level</li> </ul> |                  |

**ALERT/ADVISORY DISPOSITION AND PREPARATION**

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcd> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

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|   |                  |
|---|------------------|
| Title:<br>Alert/Advisory Disposition and Preparation  | CDRL No.:<br>311 |
| Reference:<br><br>MAR Sections 6.4  |                  |
| Use:<br><br>Review and the disposition of GIDEP Alerts and NASA Alerts and Advisories which are provided to the Developer by GSFC or another source.<br>Prepare, or assist GSFC in preparing, Alerts/Advisories based on part anomalies/concerns resulting from the Developer's own experience.   |                  |
| Related Documents<br><br>Parts Control Plan (PCP)   |                  |
| Place/Time/Purpose of Delivery:<br><br>Respond to GSFC within 25 calendar days of receipt of Alert/Advisory. Alert/advisory impacts, if any, should be discussed at technical reviews and PCB meetings. This information will be provided for GSFC information; however, GSFC must concur with the developer that all flight hardware is flightworthy.<br>Developer-prepared alerts/advisories will be prepared within 60 days in coordination with GSFC, as needed.                                  |                  |
| Preparation Information:<br><br>Developer will provide an impact statement to GSFC for each Alert or Advisory reviewed. When a negative impact exists, the developer will provide a narrative plan of action and an implementation date within the 25 calendar days listed above.<br><br>The developer will notify GSFC within 2 workdays of discovering a suspect part/lot. Information will be shared with GSFC so that GSFC can assist the developer in preparing an Alert/Advisory, if necessary. |                  |

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

**MATERIALS, PROCESSES AND LUBRICATION ASSURANCE PLAN**

|  |                  |
|--|------------------|
| Title:<br>Materials, Processes and Lubrication Assurance Plan  | CDRL No.:<br>312 |
| Reference:<br>MAR Section 7.1  |                  |
| Use:<br>Documents the developer's materials engineering and assurance program  |                  |
| Related Documents:<br>None   |                  |
| Place/Time/Purpose of Delivery:<br>A Plan will be developed and delivered for GSFC review with, or incorporated into, the developer's Performance Assurance Implementation Plan. The Plan will be delivered to GSFC for approval. Any subsequent changes/revisions must be delivered to GSFC for approval.   |                  |
| Preparation Information:<br>The Materials, Processes and Lubrication Assurance Plan will contain: <ul style="list-style-type: none"> <li>a. Table of contents.</li> <li>b. Organization of materials group, project management group and connecting organization.</li> <li>c. Authority and methods of material and lubrication assurance control of hardware drawing signatures</li> <li>d. Failure analysis participation</li> <li>e. Materials review board participation</li> <li>f. Technical skill mix and laboratory capabilities</li> <li>g. The responsibility of materials and lubrication engineering in the design, drawing and process control in the engineering, fabrication and testing control system utilized by the developer.</li> <li>h. Limited shelf-life materials control program.</li> </ul> |                  |

**MATERIALS USAGE AGREEMENT**

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcd> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

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|  |                  |
|--|------------------|
| Title:<br>Materials Usage Agreement  | CDRL No.:<br>313 |
| Reference:<br><br>MAR Sections 7.2.1, 7.2.2, 7.2.2.1, 7.2.5.2 and 7.2.6  |                  |
| Use:<br><br>For usage evaluation and approval of non-compliant materials or lubrication usage.   |                  |
| Related Documents:<br><br>GSFC -SPEC-522, GSFC-HDBK-527, NHB 1700.7, GMI 1700.3, NASA-STD-6001   |                  |
| Place/Time/Purpose of Delivery:<br><br>Provide to the GSFC Project Office, with the materials usage lists, 30 days prior to the PDR for GSFC approval. Additionally, updates, as required, must be provided to GSFC 30 days before the CDR for approval and 30 days before hardware acceptance for approval.   |                  |
| Preparation Information:<br><br>A Materials Usage Agreement (MUA) will be provided, for each non-compliant off-the-shelf-hardware material usage, non-compliant polymeric material outgassing, flammability or toxicity usage and non-compliant inorganic material stress corrosion cracking usage.<br><br>The MUA will be provided on a Material Usage Agreement form, a contractor's equivalent form, or the contractor's electronically transmitted form. The GSFC MUA form is Figure 7-1 in this document.<br><br>The MUA form requires the minimum following information: MSFC 527 material rating, usage agreement number, page number, drawing numbers, part or drawing name, assembly, material name and specification, manufacturer and trade name, use thickness, weight, exposed area, pressure, temperature, exposed media, application, rationale for safe and successful flight, originator's name, project manager's name and date.<br><br>The off-the-shelf-hardware usage must identify the measures to be used to ensure the acceptability of the hardware such as hermetic sealing, material changes to known compliant materials, vacuum bake-out to the error budget requirements listed in the contamination control plan. |                  |

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**POLYMERIC MATERIALS AND COMPOSITES USAGE LIST**

|  |                  |
|--|------------------|
| Title:<br>Polymeric Materials and Composites Usage List  | CDRL No.:<br>314 |
| Reference:<br>MAR Section 7.2.5  |                  |
| Use:<br>For usage evaluation and approval of all polymeric and composite materials applications.   |                  |
| Related Documents:<br>NASA RP-1124, ASTM E 595, MSFC-HDBK-527, NHB 1700.7, EWR 127.1, GMI 1700.3, NASA-STD-6001  |                  |
| Place/Time/Purpose of Delivery:<br>Provide to the GSFC Project Office 30 days before PDR for review. Additionally, the current list must be provided to GSFC 30 days before the CDR for approval and 30 days before hardware acceptance for approval.  |                  |
| Preparation Information:<br><br><p>The developer will provide the information requested via the GSFC polymeric materials and composites usage list form, an equivalent developer's form, or an equivalent electronic format. The GSFC form is Figure 7-3 of this document.</p> <p>The polymeric materials and composites usage list form requires, as a minimum, the following information: spacecraft, subsystem or instrument name, GSFC technical officer, contractor, address, prepared by, phone number, date of preparation, GSFC materials evaluator, evaluator's phone number, date received, date evaluated, item number (1), material identification (2), mix formula (3), cure (4), amount code, expected environment (5), outgassing values and reason for selection (6). (Notes 1 through 6 are listed below.)</p> <ol style="list-style-type: none"> <li>1. List all polymeric materials and composites applications utilized in the system except lubricants which should be listed on polymeric and composite materials usage list.</li> <li>2. Give the name of the material, identifying number and manufacturer. For example: Epoxy, Epon 828, E. V. Roberts and Associates</li> <li>3. Provide proportions and name of resin, hardener (catalyst), filler, etc. For example: 828/V140/Silflake 135 as 5/5/38 by weight</li> <li>4. Provide cure cycle details. For example: 8 hours. at room temperature plus 2 hours. at 150C</li> <li>5. Provide the details of the environment that the material will experience as a finished spacecraft component, both in ground test and in space. List all materials with the same environment in a group. For example: Thermal vacuum-20C/+60C, 2 weeks, 10E-5 torr, ultraviolet radiation (UV); Storage: Up to 1 year at room temperature; Space: -10C/+20C, 2 years, 150 mile altitude, UV, electron, proton, atomic oxygen</li> <li>6. Provide any special reason why the materials was selected. If for a particular property, please give the property. For example: Cost, availability, room temperature curing, or low thermal expansion.</li> </ol> |                  |

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01****INORGANIC MATERIALS AND COMPOSITES USAGE LIST**

|  |                  |
|--|------------------|
| Title:<br>Inorganic Materials and Composites Usage List  | CDRL No.:<br>315 |
| Reference:<br><br>MAR Section 7.2.6  |                  |
| Use:<br>For usage evaluation and approval of all metal, ceramic, and metal/ceramic composite material applications.  |                  |
| Related Documents:<br>MSFC-HDBK-527, NHB 1700.7, MSFC-SPEC-522   |                  |
| Place/Time/Purpose of Delivery:<br>Provide to the GSFC Project Office 30 days before PDR for review. Additionally, the current list must be provided to GSFC 30 days before the CDR for approval and 30 days before hardware acceptance for approval.  |                  |
| Preparation Information:<br><br>The hardware provider will provide the information requested via the GSFC inorganic materials and composites usage list form, an equivalent developer's form, or an equivalent electronic format. The GSFC form is Figure 7-4 of this document.<br><br>The inorganic materials and composite usage list form requires, as a minimum, the following information: spacecraft, subsystem or instrument name, GSFC technical officer, contractor, contractor address, prepared by, phone number, date of preparation, GSFC materials evaluator, evaluator's phone number, date received, item number, materials identification (1), condition (2), application or usage (3), expected environment (4), stress corrosion cracking table number, MUA number and NDE method. (Notes 1 through 4 are listed below.) List all inorganic materials (metals, ceramics, glasses, liquids and metal/ceramic composites) except bearing and lubrication materials which should be listed on Form 18-59C.<br><br><ol style="list-style-type: none"> <li>1. Give materials name and identifying number manufacturer. For example: Aluminum 6061-T6; Electroless nickel plate, Enplate Ni 410, Enthone, Inc.; Fused silica, Corning 7940, Corning Glass Works</li> <li>2. Give details of the finished condition of the material, heat treatment designation (hardness or strength), surface finish and coating, cold worked state, welding, brazing, etc. For example: Heat treated to Rockwell C 60 hardness, gold electroplated, brazed; surface coated with vapor deposited aluminum and magnesium fluoride; cold worked to full hard condition, TIG welded and electroless nickel plated.</li> <li>3. Give details of where on the spacecraft the material will be used (component) and its function. For example: Electronics box structure in attitude control system, not hermetically sealed.</li> <li>4. Give the details of the environment that the material will experience as a finished spacecraft component, both during ground testing and in space. Exclude vibration environment. List all materials with the same environment in a group. For example: Thermal vacuum - -20C/+60C, 2 weeks, 10E-5 torr, Ultraviolet radiation (UV); Storage - Up to 1 year at room temperature; Space - -10C/+20C, 2 years, 150 miles altitude, UV, electron, proton, Atomic Oxygen.</li> </ol> |                  |

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## LUBRICATION USAGE LIST

|  |                  |
|--|------------------|
| Title:<br>Lubrication Usage List   | CDRL No.:<br>316 |
| Reference:<br><br>MAR Section 7.2.7  |                  |
| Use:<br><br>For evaluation and approval of all lubricant usage and applications.   |                  |
| Related Documents:<br><br>None   |                  |
| Place/Time/Purpose of Delivery:<br><br>Provide to the GSFC Project Office 30 days before PDR for review. Additionally, the current list must be provided to GSFC 30 days before the CDR for approval and 30 days before hardware acceptance for approval.  |                  |
| Preparation Information:<br><br>The hardware developer will provide the information requested via the GSFC lubricant usage list form, an equivalent developer's form, or an equivalent electronic format. The GSFC form is Figure 7-5 of this document.<br><br>The lubricant usage list form requires, as the minimum, the following information: spacecraft, subsystem or instrument name, GSFC technical officer, contractor, contractor address, prepared by, phone number, date of preparation, GSFC materials evaluator, evaluator's phone number, date received, item number, component type, size, material (1); component manufacturer and manufacturer identification; proposed lubrication system and amount of lubrication; type and number of wear cycles (2); speed, temperature and atmosphere of operation (3); type and magnitude of loads (4) and other details (5). (Notes 1 through 5 are listed below.)  |                  |
| <ol style="list-style-type: none"> <li>1. Ball bearing (BB), Sleeve bearing (SB), Gear (G), Sliding surfaces (SS), or Sliding electrical contacts (SEC). Give generic identification of materials used for the component. For example: 440C steel, PTFE.</li> <li>2. Continuous unidirectional rotation (CUR), continuous oscillation (CO), intermittent rotation (IR), intermittent oscillation (IO), small angle (less than 30°) oscillation (SAM), large angle (greater than 30°) oscillation (LAM), continuous sliding (CS), or intermittent sliding (IS). State the number of wear cycles: 1 to 1E2 ("A"), 1E2 to 1E4 ("B"), 1E4 to 1E6 ("C"), or greater than 1E6 ("D").</li> <li>3. State speed: as revolution per min. (RPM), oscillations per min. (OPM), variable speed (VS), or sliding speed in cm. per minute (CPM). State operational temperature range atmosphere as: vacuum, air, gas sealed or unsealed and pressure.</li> <li>4. Type of loads: axial, radial, tangential (gear load). Give magnitude of load.</li> <li>5. For ball bearings, give type and material of ball cage, number of shields, and type of ball groove surface finishes. For gears, give surface treatment and hardness. For sleeve bearings, give the bore diameter and width. Provide the torque and torque margins.</li> </ol> |                  |

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**MATERIAL PROCESS UTILIZATION LIST**

|  |                  |
|--|------------------|
| Title:<br>Material Process Utilization List  | CDRL No.:<br>317 |
| Reference:<br>MAR Section 7.3  |                  |
| Use:<br>For usage evaluation and approval of all material processes that are used to fabricate, clean, store, integrate, and test the space flight hardware.   |                  |
| Related Documents:<br>None   |                  |
| Place/Time/Purpose of Delivery:<br>Provide to the GSFC Project Office 30 days before PDR for review. Additionally, the current list must be provided to GSFC 30 days before the CDR for approval and 30 days before hardware acceptance for approval. A copy of any process will be submitted to the GSFC Project Office upon request.   |                  |
| Preparation Information:<br><p>The developer will provide the information requested via the GSFC material process utilization list form, an equivalent developer's form, or an equivalent electronic format. The GSFC form is Figure 7-6 of this document.</p> <p>The material process utilization list requires, as a minimum, the following information: spacecraft, subsystem or instrument name, GSFC technical officer, contractor, address, prepared by, phone number, date of preparation, GSFC materials evaluator, evaluator's phone number, date received, date evaluated, item number, process type (1), contractor specification number (2), Military, ASTM, Federal or other specification number, description of material processed, (3) and spacecraft/instrument application (4). (Notes 1 through 4 are listed below.)</p> <ol style="list-style-type: none"> <li>1. Give the generic name of the process. For example: anodizing (sulfuric acid)</li> <li>2. If the process is proprietary, please state so.</li> <li>3. Identify the type and condition of the material subjected to the process. For example: 6061-T6</li> <li>4. Identify the component or structure for which the materials are being processed. For example: Antenna dish.</li> </ol> <p>All welding and brazing of all flight hardware, including repairs, shall be performed by certified operators in accordance with the requirements of the appropriate industry or government standards. A copy of the procedure qualification record (PQR) and a current copy of the operator qualification test record shall be provided along with the Materials Process Utilization List.</p> |                  |

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**FAILURE MODE AND EFFECTS ANALYSIS (FMEA) AND CRITICAL ITEMS LIST (CIL)**

|  |                          |
|--|--------------------------|
| <p>Title:<br/>Failure Mode and Effects Analysis (FMEA) and Critical Items List (CIL)</p>   | <p>CDRL No.:<br/>318</p> |
| <p>Reference:<br/><br/>MAR Section 8.2.1</p>   |                          |
| <p>Use:<br/><br/>Reliability analysis to evaluate the design relative to requirements, identify single point failures, and identify hazards.</p>   |                          |
| <p>Related Documents</p> <ul style="list-style-type: none"> <li>a. Procedures for Performing an FMEA, S-302-89-01, February 1990.</li> <li>b. CR 5320.9, Payload and Experiment Failure Mode Effects Analysis and Critical Items List Ground Rules, MSFC.</li> <li>c. MIL-STD 1629A, Procedures for Performing an FMECA, DoD.</li> </ul>   |                          |
| <p>Place/Time/Purpose of Delivery:</p> <p>Provide a preliminary draft to the GSFC Project Office 30 days before PDR for review. Additionally, the final version must be provided to GSFC 30 days before the CDR for review. Updates, as required, will be delivered to GSFC for review. Changes from previous versions should be clearly noted on the updates and final versions.</p>  |                          |
| <p>Preparation Information:</p> <p>The FMEA report will document the study including the approach, methodologies, results, conclusions, and recommendations. The report will include objectives, level of the analysis, ground rules, functional description, functional block diagrams, reliability block diagrams, bounds of equipment analyzed, reference to data sources used, identification of problem areas, single-point failures, recommended corrective action, and work sheets as appropriate for the specific analyses being performed.</p> <p>The CIL will include item identification, cross-reference to FMEA line items, and retention rationale. Appropriate retention rationale may include design features, historical performance, acceptance testing, manufacturing product assurance, elimination of undesirable failure modes, and failure detection methods.</p> |                          |

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**LIMITED-LIFE ITEMS**

|  |                  |
|--|------------------|
| Title:<br>Limited-Life Items   | CDRL No.:<br>319 |
| Reference:<br>MAR Section 8.4  |                  |
| Use:<br>Defines and tracks the selection, use, and wear of limited-life items and their impact on mission operations.  |                  |
| Related Documents<br>None  |                  |
| Place/Time/Purpose of Delivery:<br>Provide to the GSFC Project Office 30 days before PDR for review. Additionally, the current list must be provided to GSFC 30 days before the CDR for approval. Updates must be submitted to GSFC for approval as they are released.   |                  |
| Preparation Information:<br><p>List life-limited items and their impact on mission parameters. Define expected life, required life, duty cycles, and rationale for selecting and using the items. Include selected structures, thermal control surfaces, solar arrays, and electromechanical mechanisms. Atomic oxygen, solar radiation, shelf-life, extreme temperatures, thermal cycling, wear and fatigue are used to identify limited-life thermal control surfaces and structural items. When aging, wear, fatigue and lubricant degradation limit their life; include batteries, compressors, seals, bearings, valves, tape recorders, momentum wheels, gyros, actuators and scan devices. Assign responsibilities and describe managerial and reporting activities.</p> |                  |

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

**QUALITY MANUAL**

|  |                  |
|--|------------------|
| Title:<br>Quality Manual   | CDRL No.:<br>320 |
| Reference:<br><br>MAR Section 9.0  |                  |
| Use:<br><br>Documents the developer's quality management system.   |                  |
| Related Documents:<br><br>ANSI/ASQC Q9001-1994, Section 4.2.1  |                  |
| Place/Time/Purpose of Delivery:<br><br>Provide developer's Quality Manual and any updates to GSFC Project Office for review within 90 days of contract signing. The documentation may be available by electronic copy, by hard copy, or via the web.   |                  |
| Preparation Information:<br><br>Prepare a Quality Manual addressing all applicable requirements (from the 20 total elements) of ANSI/ASQC Q9001-1994. Refer to ISO 10013 for further guidelines on preparation of a quality manual.<br><br>The Quality Manual will comply with Q9001 and it will contain:  |                  |
| <ul style="list-style-type: none"> <li>a. The title, approval page, scope, and the field of application</li> <li>b. Table of contents</li> <li>c. Introductory pages about the organization concerned and the manual itself</li> <li>d. The quality policy and objectives of the organization</li> <li>e. The description of the organization, responsibilities, and authorities including the organization responsible for the EEE parts, materials, reliability, safety and test requirements implementation</li> <li>f. A description of the elements of the quality system, developer policy regarding each element and developer implementation procedure for each Q9001 element or reference(s) to approved quality system procedures. System level procedures will address the implementation of all requirements cited in this document.</li> <li>g. A definitions section, if appropriate</li> <li>h. An appendix for supportive data, if appropriate.</li> </ul> |                  |
| Quality Manual issuance and change will be implemented by a controlled process. The Quality Manual will be maintained/updated by the developer throughout the life of the contract.  |                  |

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**NONCONFORMANCE REPORTS (NCR'S)**

|  |                  |
|--|------------------|
| Title:<br>Nonconformance Reports   | CDRL No.:<br>321 |
| Reference:<br>MAR Section 9.1.2  |                  |
| Use:<br>To report failures promptly for determination of cause and corrective action.  |                  |
| Related Documents:<br>GPG 5340.2, GPG 1710.1, GPG 4520.2, GPG 5100.1, GPG 5900.1, 302-PG-1410.2.1  |                  |
| Place/Time/Purpose of Delivery:<br><ol style="list-style-type: none"> <li>Provide for information to the GSFC Project Office within 24 hours of each occurrence;</li> <li>Provide updates for review to the GSFC Project Office at the completion of analysis and assignment of corrective action;</li> <li>Provide to GSFC Project Office for approval within 3 work days after developer closure.</li> </ol>   |                  |
| Preparation Information:<br><p>Reporting of failures will begin with the first power application at the major component, subsystem, or instrument level or the first operation of a mechanical item. It will continue through formal acceptance by the GSFC Project Office and the post-launch operations, commensurate with developer presence and responsibility at GSFC and launch site operations.</p> <p>All failures at GSFC will be documented via the GSFC NCR/CR database.</p> <p>Non-GSFC developers, need to provide copies of failure, problem, nonconformance, and/or anomaly reports per the delivery schedule listed above. The developer's forms may be used but should include information equivalent to that stored in the GSFC NCR/CR database. The developer will provide the GSFC Project Office with any/all Material Review Board (MRB) and Failure Review Board (FRB) documentation including minutes and reports.</p> |                  |

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

**CONTAMINATION CONTROL PLAN**

|   |                  |
|---|------------------|
| Title:<br>Contamination Control Plan  | CDRL No.:<br>322 |
| Reference:<br><br>MAR Sections 10.1 & 10.2  |                  |
| Use:<br><br>To establish contamination allowances and methods for controlling contamination   |                  |
| Related Documents:<br><br>None  |                  |
| Place/Time/Purpose of Delivery:<br><br>Provide a preliminary draft to the Project Office 30 days before PDR for GSFC review. Provide a final draft to the Project Office 30 days before the CDR for approval.   |                  |
| Preparation Information:<br><br>Data on material properties, design features, test data, system tolerance of degraded performance, and methods to prevent degradation will be provided to permit independent evaluation of contamination hazards. The items should be included in the plan for delivery: The CCP should cover:  |                  |
| <ol style="list-style-type: none"> <li>1. Materials <ol style="list-style-type: none"> <li>a. Outgassing as a function of temperature and time</li> <li>b. The nature of outgassing chemistry</li> <li>c. Areas, weight, location, and view factors of critical surfaces</li> </ol> </li> <li>2. Venting: size, location and relation to external surfaces.</li> <li>3. The thermal vacuum test contamination monitoring plan including vacuum test data, QCM location, temperature and pressure data, system temperature profile, and shroud temperature.</li> <li>4. On orbit spacecraft and instrument performance as affected by contamination deposits including <ol style="list-style-type: none"> <li>a. Contamination effect monitoring</li> <li>b. Methods to prevent and recover from contamination in orbit</li> <li>c. How to evaluate in orbit degradation</li> <li>d. Photopolymerization of outgassing products on critical surfaces</li> <li>e. Space debris risks and protection</li> <li>f. Atomic oxygen erosion and re-deposition</li> </ol> </li> <li>5. Analysis of contamination impact on the satellite's on-orbit performance.</li> <li>6. In orbit contamination impact from other sources such as adjacent instruments.</li> </ol> |                  |

**RISK MANAGEMENT PLAN**

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcdl> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

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|   |                  |
|---|------------------|
| Title:<br>Risk Management Plan  | CDRL No.:<br>323 |
| Reference:<br><br>MAR Section 12.1  |                  |
| Use:<br><br>To document the developer's approach to implementing a risk management program.   |                  |
| Related Documents:<br><br>NPG 7120.5A, Section 4.2<br>Website <a href="http://satc.gsfc.nasa.gov/crm/">http://satc.gsfc.nasa.gov/crm/</a> for Risk Management Plan templates and sample plans   |                  |
| Place/Time/Purpose of Delivery:<br><br>Deliver to GSFC with, or as part of, the Performance Assurance Implementation Plan for approval. Any subsequent revisions must be approved by GSFC.  |                  |
| Preparation Information:<br><br>Section 1. Introduction<br>1.1 Purpose and Scope<br>1.2 Assumptions, Constraints, and Policies<br>1.3 Related Documents and Standards<br>Section 2. Overview of Risk Management Practice<br>2.1 Overview<br>2.2 Process and Data Flows<br>2.3 Project Management Integration (optional)<br>Section 3. Organization<br>3.1 Organizational Chart<br>3.2 Project Communication and Responsibilities<br>3.3 AA Program Responsibilities<br>3.4 Contractor Responsibilities<br>Section 4. Practice Details<br>4.1 Establishing Baselines and Reestablishing Baselines<br>4.2 Identifying Risks<br>4.3 Analyzing Risks<br>4.3.1 Criteria for Evaluating Attributes<br>4.4 Planning Risks<br>4.5 Tracking and Control of Risks<br>4.5.1 Collection of Metrics<br>4.6 Summary of Methods and Tools<br>Section 5. Resources and Schedule of Risk Management Milestones<br>Section 6. Documentation of Risk Information |                  |

**INFORMATION NEEDED TO PREPARE PROBABILISTIC RISK ASSESSMENT (PRA)**

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcd/> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

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|   |                  |
|---|------------------|
| Title:<br>Information Needed to Prepare Probabilistic Risk Assessment (PRA)   | CDRL No.:<br>324 |
| Reference:<br><br>MAR Section 12.2  |                  |
| Use:<br><br>For systems under development, to guide trade-offs between reliability, cost, performance, and other tradable resources. For mature systems, to support decision-making on risk acceptability, and on choices among options for risk reduction. |                  |
| Related Documents:<br><br>None  |                  |
| Place/Time/Purpose of Delivery:<br><br>As required (for information) for the Government to prepare the PRA prior to PDR and CDR plus updates as required.   |                  |
| Preparation Information:<br><br>The developer and their collaborators will provide the information necessary, including parts lists, functional diagrams, and schematics, for the Government to prepare the PRA.  |                  |

**INFORMATION NEEDED TO PREPARE FAULT TREE ANALYSIS**

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcd/> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

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|  |                  |
|--|------------------|
| Title:<br>Information Needed to Prepare Fault Tree Analysis (FTA)  | CDRL No.:<br>325 |
| Reference:<br><br>MAR Section 12.2   |                  |
| Use:<br><br>A top down approach for identifying hardware critical failure modes.   |                  |
| Related Documents<br><br>Nuclear Regulatory Commission publication NUREG-0492, Fault Tree Handbook   |                  |
| Place/Time/Purpose of Delivery:<br><br>As required (for information) for the Government to prepare the FTA prior to PDR and CDR plus updates as required.  |                  |
| Preparation Information:<br><br>The developer and their collaborators will provide the information necessary, including parts lists, functional diagrams, and schematics, for the Government to prepare the FTA. |                  |

**INFORMATION NEEDED TO PREPARE RISK ASSESSMENT**

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcd> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

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|  |                  |
|--|------------------|
| Title:<br>Information Needed to Prepare Risk Assessment  | CDRL No.:<br>326 |
| Reference:<br><br>MAR Section 12.3   |                  |
| Use:<br><br>To determine risks inherent in the project at any one time and identify possible risk mitigation strategies for those risks.   |                  |
| Related Documents<br><br>None  |                  |
| Place/Time/Purpose of Delivery:<br><br>For information, 30 days after a request for information/data from the Government.  |                  |
| Preparation Information:<br><br>The government will provide a notification to the developer of the scope and/or area of focus of the risk assessment 30 days prior to the assessment. The assessment will focus on products (e.g., hardware and/or software) and/or processes (e.g., design, configuration management, manufacturing, coding, testing). The developer and their collaborators will provide access to the information necessary to support the scope of the assessment. |                  |

**OPERATING AND SUPPORT HAZARD ANALYSIS (O&SHA)**

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcd> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

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|  |                  |
|--|------------------|
| Title:<br>Operating and Support Hazard Analysis (O&SHA)  | CDRL No.:<br>327 |
| Reference:<br><br>MAR Section 2.1  |                  |
| Use:<br><br>Evaluates activities for hazards or risks introduced into the system by operational and support procedures and evaluates the adequacy of operational and support procedures used to eliminate, control, or abate identified hazards or risks.  |                  |
| Related Documents:<br>EWR 127-1  |                  |
| Place/Time/Purpose of Delivery:<br><br>The first delivery is due 30 days prior to the CDR. An updated delivery is due to support final MSPSP delivery to the Range which in turn supports the Mission Approval Safety Review (120 days before launch). GSFC will approval all deliveries/versions. |                  |
| Preparation Information:<br><br>Refer to Appendix 1B of EWR 127-1 for guidance on performance of an O&SHA.   |                  |

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## HAZARD CONTROL VERIFICATION LOG

|  |                  |
|--|------------------|
| Title:<br>Hazard Control Verification Log  | CDRL No.:<br>328 |
| Reference:<br>MAR Section 2.1  |                  |
| Use:<br>Used to document the instrument safety assessment such that it reflects how the instrument design demonstrates compliance with the safety requirements.  |                  |
| Related Documents:<br>EWR 127-1  |                  |
| Place/Time/Purpose of Delivery:<br>Initially generated to document results of hazard analyses and updated as analysis results warrant. It will be made available to Range Safety upon request. Delivery shall support the spacecraft contractor's MSPSP submittal schedule. (Note: The final MSPSP will be submitted to Range Safety at least 45 calendar days prior to hardware shipment to Range. Preliminary shipment will be TBD based on negotiation between the spacecraft contractor and the Range.) GSFC will approve all deliveries/versions. |                  |
| Preparation Information:<br>Refer to Appendix 1B.1 of EWR 127-1 for preparation directions.  |                  |

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## SAFETY ASSESSMENT REPORT (SAR)

|  |                  |
|--|------------------|
| Title:<br>Safety Assessment Report (SAR)   | CDRL No.:<br>329 |
| Reference:<br><br>MAR Section 2.1  |                  |
| Use:<br><br>The Safety Assessment Report (SAR) is used to document a comprehensive evaluation of the mishap risk being assumed prior to the testing or operation of a system. The SAR will be provided to the Spacecraft Contractor as an input to their preparation of the Missile System Prelaunch Safety Package (MSPSP), which is one of the media through which missile system prelaunch safety approval is obtained.   |                  |
| Related Documents:<br>EWR 127-1  |                  |
| Place/Time/Purpose of Delivery:<br><br>SAR delivery shall support the spacecraft contractor's MSPSP submittal schedule. (Note: The final MSPSP will be submitted to Range Safety at least 45 calendar days prior to hardware shipment to Range. Preliminary shipment will be TBD based on negotiation between the spacecraft contractor and the Range.) GSFC will approve all deliveries/versions.   |                  |
| Preparation Information:<br><br>The Safety Assessment Report will identify all safety features of the hardware, software, and system design as well as procedural, hardware, and software related hazards that may be present in the system being acquired. This includes specific procedural controls and precautions that should be followed. The safety assessment will summarize the following information: <ol style="list-style-type: none"> <li>1. The safety criteria and methodology used to classify and rank hazards plus any assumptions upon which the criteria or methodologies were based or derived including the definition of acceptable risk as specified by Range Safety</li> <li>2. The results of analyses and tests performed to identify hazards inherent in the system including:             <ul style="list-style-type: none"> <li>• Those hazards that still have a residual risk and the actions that have been taken to reduce the associated risk to a level contractually specified as acceptable</li> <li>• Results of tests conducted to validate safety criteria, requirements, and analyses</li> </ul> </li> <li>3. The results of the safety program efforts including a list of all significant hazards along with specific safety recommendations or precautions required to ensure safety of personnel, property, or the environment. <b>NOTE:</b> The list shall be categorized as to whether or not the risks may be expected under normal or abnormal operating conditions.</li> <li>4. Any hazardous materials generated by or used in the system</li> <li>5. The conclusion, including a signed statement, that all identified hazards have been eliminated or their associated risks controlled to levels contractually specified as acceptable and that the system is ready to test or operate or proceed to the next acquisition phase</li> <li>6. Recommendations applicable to hazards at the interface of Range User systems with other systems, as required</li> </ol> |                  |

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**GROUND OPERATIONS PLAN (GOP) INPUTS**

|   |                          |
|---|--------------------------|
| <p>Title:<br/>Ground Operations Plan (GOP) Inputs (to Spacecraft Contractor)</p>  | <p>CDRL No.:<br/>330</p> |
| <p>Reference:<br/><br/>MAR Section 2.1</p>  |                          |
| <p>Use:<br/><br/>Provides a detailed description of hazardous and safety critical operations for processing aerospace systems and their associated ground support equipment. Along with the MSPSP, the GOP is the medium through which missile system prelaunch safety approval is obtained.</p>  |                          |
| <p>Related Documents:<br/>EWR 127-1</p>   |                          |
| <p>Place/Time/Purpose of Delivery:<br/><br/>The draft GOP is to be provided to Range Safety 45 days prior to the spacecraft PDR and CDR. The final GOP is to be submitted 45 days prior to hardware delivery to the Range. Inputs to this plan need to support this delivery date and must be approved by GSFC prior to its delivery to the spacecraft contractor. GOP inputs may be included in the SAR (DID 329) if so requested by the spacecraft contractor..</p> |                          |
| <p>Preparation Information:<br/><br/>Refer to Appendix 6A of EWR 127-1 for preparation directions.</p>  |                          |

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**PERFORMANCE VERIFICATION PROCEDURE**

|  |                  |
|--|------------------|
| Title:<br>Performance Verification Procedure   | CDRL No.:<br>331 |
| Reference:<br><br>MAR Section 4.2.2  |                  |
| Use:<br><br>Describes how each test activity defined in the Verification Plan will be implemented  |                  |
| Related Documents<br><br>None  |                  |
| Place/Time/Purpose of Delivery:<br><br>30 days prior to the start of the testing for GSFC approval.  |                  |
| Preparation Information:<br><br>Describe the configuration of the tested item and the step-by-step functional and environmental test activity conducted at the unit/component, subsystem/instrument, and payload levels. Give details such as instrumentation monitoring, facility control sequences, test article functions, test parameters, quality control checkpoints, pass/fail criteria, data collection and reporting requirements. Address safety and contamination control provisions. A methodology will be provided for controlling, documenting and approving all activities not part of an approved procedure and establish controls for preventing accidents that could cause personal injury or damage to hardware and facilities. |                  |

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**VERIFICATION REPORTS**

|   |   |                       |   |   |  |
|---|---|-----------------------|---|---|--|
| Title:<br>Verification Reports  | CDRL No.:<br>332  |                       |   |   |  |
| Reference:<br><br>MAR Section 4.2.3   |   |                       |   |   |  |
| Use:<br><br>Summarize compliance with system specification requirements and/or provide a summary of testing and analysis results, including conformance, nonconformance, and trend data.  |   |                       |   |   |  |
| Related Documents<br><br>None   |   |                       |   |   |  |
| Place/Time/Purpose of Delivery:<br><br><table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">Verification Reports:</td> <td>Preliminary - 72 hours after testing for GSFC information<br/>Final - 30 days after verification activity for GSFC information</td> </tr> <tr> <td>Instrument Performance Verification Report:</td> <td>Preliminary - At CDR for GSFC information<br/>Final - 30 days following on-orbit check out for GSFC information</td> </tr> </table>  |   | Verification Reports: | Preliminary - 72 hours after testing for GSFC information<br>Final - 30 days after verification activity for GSFC information | Instrument Performance Verification Report: | Preliminary - At CDR for GSFC information<br>Final - 30 days following on-orbit check out for GSFC information |
| Verification Reports:   | Preliminary - 72 hours after testing for GSFC information<br>Final - 30 days after verification activity for GSFC information |                       |   |   |  |
| Instrument Performance Verification Report:   | Preliminary - At CDR for GSFC information<br>Final - 30 days following on-orbit check out for GSFC information                |                       |   |   |  |
| Preparation Information:<br><br>Verification Report: Provide after each unit/component, subsystem/instrument, and payload verification activity. For each analysis activity the report will describe the degree to which the objectives were accomplished, how well the mathematical model was validated by the test data, and other significant results.<br><br>Instrument Performance Verification Report: Compare hardware/software specifications with the verified values (whether measured or computed). It is recommended that this report be subdivided by subsystem. |   |                       |   |   |  |

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**PRINTED WIRING BOARD (PWB) COUPONS**

|   |  |
|---|--|
| <p>Title:</p> <p align="center">Printed Wiring Board (PWB) Coupons</p>  | <p>CDRL No.:</p> <p align="center">333</p> |
| <p>Reference:</p> <p align="center">MAR Section 5.2</p>   |  |
| <p>Use:</p> <p align="center">For independent evaluation of the quality of PWB's used in the hardware</p>   |  |
| <p>Related Documents:</p> <p align="center">IPC-D-275, GSFC S-312-P003, ANSI/IPC-HF 318, ANSI/IPC-A-600, NASA RP 1161</p>   |  |
| <p>Place/Time/Purpose of Delivery:</p> <p align="center">Provide to the GSFC Project Office for approval as a precondition to board population.</p>   |  |
| <p>Preparation Information:</p> <p>Provide a test coupon for each PWB used in the flight hardware and note the following:</p> <ol style="list-style-type: none"> <li>The coupon will be per the design requirements of GSFC S-312-P-003 and will only be removed from the flight PWB panel after the panel has been through all manufacturing processes.</li> <li>The coupon will be "as produced" by the vendor; that is, it will not have seen any processes not experienced by the PWB panel (including metallographic preparation techniques or thermal excursions).</li> <li>The coupon will be clearly identified with the part number, serial number, vendor identification and date code or production lot number.</li> <li>The paperwork accompanying the coupon will include the part number, serial number, vendor identification and date code or production lot number as well as the flight experiment to which the coupon pertains and the shipper identification and tracking number.</li> <li>A fax will precede the coupon receipt by one day. This fax will be sent to the evaluation lab, and will include the part number, serial number, vendor identification and date code or production lot number as well as the flight experiment to which the coupon pertains and the shipper identification and tracking number.</li> </ol> <p>Two weeks prior to shipping the coupons, the hardware provider will notify the Flight Assurance support contractor or the independent evaluation laboratory of the coupons that they plan to ship for evaluation.</p> <p>Flight PWB will not be assembled prior to notification that the representative coupon has passed laboratory evaluation by the GSFC-approved laboratory.</p> <p>The System Assurance Manager for the project will be provided with a preliminary fax of the coupon test results and the final report.</p> <p>A list of certified laboratories, their addresses and phone and fax numbers will be provided by the GSFC Materials Engineering Branch.</p> |  |

**PARTS STRESS ANALYSIS**

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcd> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

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|  |                  |
|--|------------------|
| Title:<br>Parts Stress Analyses  | CDRL No.:<br>334 |
| Reference:<br><br>MAR Section 8.2.2  |                  |
| Use:<br><br>Provides EEE parts stress analyses for evaluating circuit design and conformance to derating guidelines.   |                  |
| Related Documents<br><br>NASA Parts Selection List   |                  |
| Place/Time/Purpose of Delivery:<br><br>The analysis is due 30 work days before CDR for GSFC review at the developer's facility. Updates as required, with any changes clearly indicated, are to be available at the developer's site for GSFC review.  |                  |
| Preparation Information:<br><br>The stress analysis report will contain the ground rules for the analysis, references to documents and data used, a statement of the results and conclusions, and the analysis worksheets. The worksheets, at a minimum, will include part identification (traceable to circuit diagrams), environmental conditions assumed, rated stress, applied stress, and ratio of applied-to-rated stress. |                  |

**SOFTWARE SPECIFICATION AND REQUIREMENTS DOCUMENTATION (SSRD)**

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcd/> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

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|  |                  |
|--|------------------|
| Title:<br>Software Specification and Requirements Documentation (SSRD)   | CDRL No.:<br>335 |
| Reference:<br><br>None   |                  |
| Use:<br><br>Assures development of software products to contractual requirements (throughout the entire software life cycle) that can be traced, coded, tested, and verified. The SSRD's are developed for the verification of performance and functional requirements.  |                  |
| Related Documents:<br><br>None   |                  |
| Place/Time/Purpose of Delivery:<br><br>The documentation is due 30 work days before CDR for GSFC review at the developer's facility. Updates as required, with any changes clearly indicated, are to be available at the developer's site for GSFC review.   |                  |
| Preparation Information:<br><br>At a minimum, the software specification and requirements documents will: <ul style="list-style-type: none"> <li>a. Detail the functional performance and test requirements of the Computer Software Configuration Items (CSCI's)</li> <li>b. State the performance criteria and test criteria under which the CSCI program will be validated</li> <li>c. Describe the detailed design of the CSCI's</li> <li>d. Provide design descriptions, interfaces, storage definition and data organization for the CSCI's</li> </ul> |                  |

**SOFTWARE PERFORMANCE VERIFICATION MATRIX**

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcd> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

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|   |                  |
|---|------------------|
| Title:<br><br>Software Performance Verification Matrix  | CDRL No.:<br>336 |
| Reference:<br><br>MAR Section 11.2.4  |                  |
| Use:<br><br>Used to aid in the verification of software requirement for the LAT.  |                  |
| Related Documents<br><br>None   |                  |
| Place/time/purpose of delivery:<br><br>The initial delivery will be 90 calendar days after the PDR for GSFC review/information. Subsequently, the matrix will be delivered to GSFC for information as it is updated to reflect changes in requirements and verification.  |                  |
| Preparation Information:<br><br>As a minimum, this matrix will include: <ul style="list-style-type: none"> <li>a. How each specification requirement will be verified</li> <li>b. The references source (to the specific paragraph or line item)</li> <li>c. The method of compliance</li> <li>d. The applicable procedure references</li> <li>e. Verification results</li> <li>f. Report references numbers</li> </ul> |                  |

**FUNCTIONAL CONFIGURATION AUDIT (FCA) AND PHYSICAL CONFIGURATION AUDIT (PCA) RESULTS**

CHECK THE GLAST PROJECT WEBSITE AT  
<http://glast.gsfc.nasa.gov/project/cm/mcd> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

|   |                  |
|---|------------------|
| Title:<br><br>Functional Configuration Audit (FCA) and Physical Configuration Audit (PCA) Results   | CDRL No.:<br>337 |
| Reference:<br><br>MAR Section 11.2.5  |                  |
| Use:<br><br>The FCA will verify that the specified functional and performance characteristics of the software end were achieved. The PCA is a technical/physical examination of the "as built" end items to verify that they conform to the technical documentation.  |                  |
| Related Documents:<br><br>None  |                  |
| Place/Time/Purpose of Delivery:<br><br>FCA and PCA information will be available at the Developer's facility for GSFC review/information prior to end item delivery/acceptance.   |                  |
| Preparation Information:<br><br>FCA information will include a description of the tests run, the number of tests cases run, the number of test cases completed, the results of tests (passed/failed/partial), a list of requirements associated with each test, a listing of deviations and waivers, and the identification of discrepancies outstanding from each test case including the actions to be taken to correct them.<br><br>PCA information will include identification of the baseline for the "to be shipped" end item such as end item identification and listing of supporting documentation (e.g., present version and revision level). This will include such things as the Software Version Description Document. |                  |

**SOFTWARE TESTING PROCEDURES AND TEST REPORTS**

|        |           |
|--------|-----------|
| Title: | CDRL No.: |
|--------|-----------|

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

|  |     |
|--|-----|
| Software Testing Procedures and Test Reports   | 338 |
| <p>Reference:</p> <p>MAR Section 11.2.4</p>  |     |
| <p>Use:</p> <p>Summarize compliance with system specification requirements and/or provide a summary of testing and analysis results including conformance, nonconformance, and trend data.</p>   |     |
| <p>Related Documents</p> <p>None</p>   |     |
| <p>Place/Time/Purpose of Delivery:</p> <p>Test Procedures: Preliminary - 30 calendar days prior to the test readiness review (TRR) for GSFC information<br/>Final - 15 calendar days prior to the test activity for GSFC information</p> <p>Test Reports: Preliminary - 15 calendar days after test completion for GSFC information<br/>Final - 30 calendar days after on-orbit check-out for GSFC information</p>   |     |
| <p>Preparation Information:</p> <p>Test Procedures: Test procedures will specify the actions to be taken to execute the applicable LAT test plan, including the performance of post-test data reduction and analysis. In addition to the specific hardware and software configurations and other operational conditions required for each execution sequence, test procedures will list step-by-step actions to be taken, the individual or workstation position that will perform each action, input data values and sources, and expected results.</p> <p>Test Reports: Test reports will be prepared to document the results of conducted tests. Informal reports may be prepared to give an immediate assessment of success based on observation and quick look analysis or to report intermediate results for test sequences. Formal reports will provide a permanent record of test results. The reports will provide detailed information about test execution, results, and related post-test activities. The reports will list and explain deviations from planned or expected results/activities, identify unresolved items, and note recommendations. Items to be reported include the tests executed, system configuration(s) and operational environment, results observed during execution, post-test data reduction and analyses performed and their results, and any DR's generated during testing activity.</p> |     |

**DRAFT OF S&MA DELIVERABLES ASSOCIATED WITH THE LAT "POST-PDR" MAR (433-MAR-0001) DRAFT DATED 11/23/01**

**INPUT FOR SOFTWARE METRICS**

|  |                          |
|--|--------------------------|
| <p>Title:<br/>Input for Software Metrics</p>   | <p>CDRL No.:<br/>339</p> |
| <p>Reference:<br/><br/>MAR Sections 11.2.6</p>   |                          |
| <p>Use:<br/><br/>The resulting metrics will provide insight into the quality of the developer's software development processes and software products.</p>  |                          |
| <p>Related Documents:<br/><br/>None</p>  |                          |
| <p>Place/Time/Purpose of Delivery:<br/><br/>The developer will provide a copy of their source code, using a format and media that will be negotiated between the developer and the GSFC Project Office. This source code is provided for information and will be analyzed by GSFC's Software Assurance Technology Center, using statistical techniques, to provide software metrics and an associated report for Project and developer usage. A copy of the source code is due to GSFC 10 work days before each LAT Quarterly Review or as otherwise agreed upon with the GLAST Project.</p> |                          |
| <p>Preparation Information:<br/><br/>The source code will be provided to the GSFC Project Office using a format and media that will be negotiated between the GSFC and the developer.</p>  |                          |