Statement of Work

For

Gamma Large Area Space Telescope (GLAST)
Large Area Telescope (LAT)
Crate Power Supply (CPS) Circuit Card Assembly

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1 INTRODUCTION

This document is the Statement of Work (SOW) for assembly and inspection of the Gamma-ray Large Area Space Telescope (GLAST) Large Area Telescope (LAT) Crate Power Supply (CPS) Circuit Card Assembly (CCA); hereinafter referred to as the CPS CCA.

1.1 PURPOSE

This document describes the tasks to be performed by the Supplier to receive materials for, assemble, inspect, and deliver the CPS CCAs.

1.2 SCOPE

This SOW covers receipt of parts and materials, planning, assembly, inspection, and delivery of CPS CCAs.

1.3 ACRONYMS AND DEFINITIONS

CCA  Circuit Card Assembly  
DAQ  Data Acquisition  
CPS  LAT Crate Power Supply Board  
GLAST Gamma-ray Large Area Space Telescope  
LAT Large Area Telescope instrument of the GLAST mission  
SLAC Stanford Linear Accelerator Center  
SOW Statement of Work

2 APPLICABLE DOCUMENTS

The following documents form a part of this SOW to the extent specified herein.

2.1 GLAST LAT PROGRAM DOCUMENTS

LAT-DS-01669 Circuit Card Assembly, CPS  
LAT-DS-01670 Printed Wiring Board, CPS  
LAT-DS-02870 PWB, Fab, Loading, and Assembly  
LAT-TD-02356 Bill of Materials, CPS  
LAT-DS-02140 3U Front Panel  
LAT-DS-02401 Heat Sink

2.2 STANDARDS DOCUMENTS

NASA STD 8739.4 Crimping, Interconnecting Cables, Harnesses, and Wiring  
IPC/EIA J-STD-001C Requirements for Soldered Electrical and Electronic Assemblies

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2.3 ABSTRACT

A total of 9 flight CPS CCAs are being procured for the GLAST LAT: 2 flight “first” articles and, after approval of the first two, 7 additional flight production units. The CPS CCAs will then be integrated with other LAT equipment and tested further as part of the integrated instrument. During this integration and test effort, it may be necessary to repair a CPS CCA that has failed or has been damaged. Buyer may elect to have faulty CPS CCAs reworked by the Supplier.

3 REQUIREMENTS

The supplier shall develop a manufacturing plan for the assembly of the CPS CCAs. These plans shall be reviewed and approved by the Buyer prior to start of assembly operations. The plans shall be flow charts and/or bullet charts showing all major steps and shall address at least the following areas:

1. Receiving inspection
2. Materials and parts traceability plan and capabilities
3. SMT and other assembly operations
4. In-process and final inspection plans
5. Packaging and shipping

3.1 PROGRAM MANAGEMENT

Supplier shall provide the program management necessary to ensure that the requirements and product assurance provisions of this SOW are satisfied, and that the flight CPS CCAs are delivered in accordance with the delivery schedule to be negotiated.

3.2 MANUFACTURING ENGINEERING

A manufacturing engineer who is knowledgeable of surface-mount and through-hole solder assembly processes shall be assigned to provide appropriate engineering support to this effort. The assigned manufacturing engineer shall work with Buyer engineering personnel to ensure CCA specific assembly procedures are properly documented and that assembly operators are trained on those procedures. The assigned manufacturing engineer shall be the primary technical point of contact for GLAST LAT personnel throughout the CPS CCA production effort.
3.3 MATERIAL MANAGEMENT

Buyer will procure the electronic and mechanical parts required to build the CPS CCAs and deliver them to the Supplier. Supplier shall provide the shop services, approved supplies and materials, including but not limited to, solder and solder paste, flux, cleaning solvents and solutions, tapes, and adhesives required to assemble the CPS CCAs in accordance with the drawings listed in section 2. Supplier shall perform receiving inspection on each receipt of Buyer-Furnished CPS CCA parts and materials shipped to Supplier’s address. The Supplier shall manage CPS CCA materials as described in the following paragraphs:

3.3.1 MATERIAL RECEIVING

Supplier shall perform receiving inspection on each shipment of parts and materials received from the Buyer. Receiving inspection shall consist of part identification, inspection for visible damage to packaging and/or contents, and recording of received quantity in accordance with the CPS CCA Bill of Materials, see section 2.1. All discrepancies shall be documented using Supplier’s internal process for documenting receiving-inspection discrepancies. Additionally, Supplier shall report receiving-inspection discrepancies to the buyer within 24 hours of their discovery.

3.3.2 MATERIAL STOCKING AND STORAGE

Supplier shall ensure that Buyer-furnished CPS CCA materials will not be inadvertently used on other Supplier products. Once shipping seals have been broken, CPS CCA parts and materials shall be stored in an environmentally-controlled area. Supplier shall also possess documented procedures for the control and monitoring of the environment and shelf life of perishable materials and pre-mixed and frozen materials.

3.3.3 MATERIAL ISSUE

Supplier shall issue material to assembly in a manner that ensures traceability of the parts and materials used in an assembly from the assembly serial number to the individual piece-part and material production lot and/or date code. Several components used in the CPS CCA are serialized. Supplier shall record on the traveler for each CPS CCA the serial numbers and locations of the components installed.

3.4 ASSEMBLY

Supplier shall perform one level of assembly, CPS CCA, in accordance with Buyer-approved Supplier procedures, but in two steps. Supplier shall assemble CPS CCAs in accordance with the CCA specification in section 2.1. See Figure 1, Sequence of Assembly and Test for CPS CCAs.

Figure 1. Sequence of Assembly and Test for CPS CCAs,

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Supplier shall maintain current documentation detailing all processes and procedures planned for use in assembling the CPS CCAs. Buyer will review and approve this documentation prior to the start of assembly to assess adequacy for GLAST LAT Program requirements. Changes to process and/or procedure documentation applicable to CPS CCAs manufacture or in-process test shall be submitted to Buyer for approval prior to their implementation.

### 3.4.1 ASSEMBLY OF CPCI CONNECTORS

Prior to assembly of flight boards, vendor is to assemble supplied PCI connectors on two CPS PCB’s in order to verify that the connector solder joints meet IPC standards. The two samples are to be shipped to SLAC for examination.

### 3.4.2 FLIGHT ASSEMBLY

Supplier shall assemble the CPS CCAs in accordance with this SOW, the assembly drawings listed in section 2.1 and the workmanship standards specified in Sections 2.2 and 3.4.6. All work shall be performed using shop travelers or work orders that detail and document the operations to be performed and inspections required to verify that assembly operations comply with applicable engineering drawings, work instructions, and process procedures. Shop travelers shall also provide spaces for recording operator identification, the date operations are performed, and identification marks or stamps for inspectors.

### 3.4.3 ASSEMBLY FACILITIES

The CPS CCAs, shall be assembled in a clean, environmentally-controlled facility. The facility shall have defined operating ranges and monitoring capabilities for temperature and relative humidity. Additionally, the facility shall comply with the ESD control requirements specified in ANSI/ESD 20.20-1999.

### 3.4.4 ELECTRICAL PERFORMANCE TESTING

CPS CCA electrical performance testing will be performed by Buyer at Buyer;’s facility. Supplier will ship CPS CCAs as required to Buyer for electrical performance testing and Buyer will ship CPS CCAs back to the Supplier subsequent to testing. In the event rework is deemed necessary, Buyer may elect to perform the rework at the Buyer’s facility for minor rework. Otherwise, the CPS CCAs will be shipped back to the Supplier for the rework to be performed.
3.4.5 ASSEMBLY EQUIPMENT AND TOOLING

Supplier shall provide sufficient personnel, assembly equipment, and tooling to support the production capacity needed to meet the agreed upon delivery schedule.

3.4.6 WORKMANSHIP STANDARDS

The assembly workmanship standards are IPC/EIA J-STD-001C, IPC J-STD-001 CS and NASA STD 8739.4, as applicable. Individual operator certification to NASA STD 8739.4 is not required. The Supplier’s internal workmanship standards may be utilized in place of the NASA Workmanship Standards provided approval is obtained in writing from the Buyer’s Quality Assurance Group.

3.4.7 INSPECTION

Supplier manufacturing personnel shall perform in-process inspections as defined in Suppliers inspection plan. As a minimum the following mandatory Inspection Points (MIPs) shall be performed by the Buyer’s source inspector:

- 100% pre-conformal coat inspection
- 100% post-conformal coat inspection
- Final inspection and End Item Data Package review and acceptance

MIPs shall be documented in the Supplier’s traveler and shall be stamped by Buyer’s inspector upon completion of inspection.

3.4.8 INSPECTION DOCUMENTATION

Inspection results shall be documented either on the shop traveler or work order, or on a separate inspection sheet or log book. Documentation shall identify the specific item being inspected (part number and serial number, minimum), indicate the date of the inspection, the identification of the person who performed the inspection, and the disposition of the part following the inspection. Digital photographs are the preferred method of illustrating material and workmanship defects, wherever possible. Inspection results and photographs of defects shall be included in the End Item Data Package (EIDP) for each delivered CPS CCA.

3.4.9 FINISHED PRODUCT PHOTOGRAPHS

Supplier shall take digital photographs of each CPS CCA as follows:

- Minimum resolution, 2 megapixels
- 8-inch by 10 inch photograph of both sides of each CCA
- ¾ view of each CPS CCA with labeling showing
3.5 SHIPPING

The Supplier shall ensure that all certifications, test data, test reports, inspection reports and other required documentation per Section 4.8 are included with each CPS CCA shipped to Buyer. Supplier shall also furnish a Packing List/Shipping Documents with each shipment showing the following information:

- P.O. Number
- Part Number
- Serial number
- Item description
- Qty ordered
- Qty shipped
- Date of shipment
- Any handling constraints or cautions

3.5.1 PREPARATION FOR SHIPMENT

Buyer will provide shipping containers and Shockwatch Clip™ shock monitors for the completed GASU Assemblies. Supplier shall prepare each completed GASU Assembly for shipping as follows:

6. Install ESD-safe protective covers on all connectors.

7. Clean unit of all handling residue using isopropyl alcohol and lint-free wipes.

8. Attach a Buyer provided shock monitor to the unit adjacent to the CCA serial number.

9. Wrap unit in sealed, ESD-safe materials. A zip-lock or vacuum-sealed, ESD-safe bag is also acceptable.

10. Place the wrapped, sealed unit in the Buyer-supplied shipping container along with the End Item Data Package and secure the lid.

11. Place the shipping container in a foam-lined box and seal the box with strapping tape. Affix a label to the box which contains shipped-from and shipped-to addresses along with the part number and serial number of the unit contained within.

12. Affix Buyer-supplied GLAST FLIGHT HARDWARE label, and shipping invoice to the box, and ship via 2nd-day air to the following address:

   GLAST LAT Shipping and Receiving, Building 33
   Attn: Albert Conceicao

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4 PRODUCT ASSURANCE REQUIREMENTS

4.1 PRE-AWARD SURVEY OF PROSPECTIVE SUPPLIER

When deemed necessary by the Buyer, a pre-award survey will be conducted of any prospective Supplier’s technical, quality assurance, production or financial capability. Evaluation of documented quality assurance program/system(s) applicable to materials being produced or services to be performed by the prospective Supplier may include but not be limited to inspection, test and manufacturing controls, calibration of measuring, manufacturing and test equipment, controls over special processes, material storage and handling, and drawing change control.

4.2 QUALITY MANAGEMENT SYSTEM REQUIREMENTS

Supplier shall define and implement a quality system based on ISO 9001 (1994 or 2000 revision) that properly encompasses products and services to be provided. Third party registration is NOT required. The Supplier’s quality manual shall be made available to the Buyer for review.

The Supplier shall require, in writing, subcontractors of all tiers to comply with all applicable quality program/system requirements.

4.3 GENERAL QUALITY ASSURANCE REQUIREMENTS

4.3.1 PROHIBITED PRACTICES

Unauthorized Repairs/Rework: Rework of workmanship defects that are outside of documented process statistical performance parameters shall not be performed without approval from the Buyer for each specific defect. Repairs of material defects caused by either fabrication or processing during assembly shall not be performed without written approval from the Buyer’s Quality Assurance Group for each specific defect.

Changes in Approved Drawings, Processes, Materials or Procedures: Supplier shall not change any drawing, material, or procedure without prior Buyer written approval during performance under any contract or purchase order incorporating this SOW.

Re-Submittal of Rejected Items: Items initially rejected and subsequently resubmitted to Buyer shall be clearly identified on the manufacturing document as resubmitted items. New lot control identification numbers are to be provided. Rejected items shall not be used by SLAC without Material Review Board approval.

Notification of Facility Change: Supplier shall not use or relocate any production, manufacturing, and/or processing facilities during performance of the work specified in the Procurement Documents from those production, manufacturing, or process facilities approved by Buyer without promptly notifying Buyer.

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Substitution of Parts or Materials: The parts and materials called out on the assembly drawings shall be used in the assembly of the CPS CCAs. Supplier shall make no substitutions in those parts and materials without prior written approval from the Buyer.

Changes to Software: Software used to verify electrical performance shall be under formal configuration control. Supplier shall not make changes to the software without prior written Buyer approval.

4.3.2 RESPONSIBILITY FOR CONFORMANCE

Neither surveillance, inspection, and/or tests made by Buyer, or Buyer representatives at either Supplier or Buyer facilities, nor Supplier’s compliance with all applicable Quality Assurance requirements, shall relieve Supplier of the responsibility to furnish items that conform to the requirements of this SOW.

4.3.3 BUYER SURVEYS, SURVEILLANCE, AUDITS, AND INSPECTION

Buyer has the right to conduct surveys, audits, and surveillance of Supplier’s facilities with prior coordination with Supplier to determine their capability to comply and to verify continuing compliance with the requirements of this SOW and associated procurement documents. This includes but is not limited to: adhesive mix records, mate/demate logs, equipment calibration and/or service logs, and torque logs.

The Buyer will assign a Buyer employee to provide QA oversight throughout the assembly production. The Buyer’s inspector may elect to perform in-process verifications, visual inspections, packaging & handling verifications, and/or review test results following any process, inspection or test step. The vendor is to provide the Buyer’s employee a desk, computer and phone line and use of any inspection equipment to perform his/her task.

As a minimum, the Mandatory Inspection Points (MIPs) specified in paragraph 3.4.8 shall be performed by the Buyer’s Source Inspector. The MIPs shall be documented in the Buyer’s traveler and stamped by the Buyer’s Source Inspector upon completion of the inspection/witness/acceptance activity.

4.4 NON-CONFORMING MATERIAL

The Buyer grants no Material Review Board authority to Supplier or its sub-tier suppliers. Repair is not allowed under this clause. Supplier shall ensure that parts, materials, and CPS CCAs which do not conform to requirements are identified and controlled to prevent their unintended use or delivery. The controls and related responsibilities for dealing with nonconforming parts, materials, and CPS CCAs shall be defined by the Supplier in a documented procedure. Supplier’s documented procedure shall define the responsibility for review and authority for the disposition of nonconforming product and the process for approving personnel making these decisions. The cost of reworking workmanship defects shall be covered by the Supplier.
A discrepancy/nonconformance/failure at any portion of the buyer performed electrical test or any nonconformance detected during the Mandatory Inspection Points will be documented as a nonconformance by the Buyer.

4.4.1 DEFINITIONS

Nonconformance: A condition of any article, material or service in which one or more characteristics do not conform to requirements specified in the contract, drawings, specifications, or other approved product description. This includes failures, discrepancies, defects, anomalies, and malfunctions.

Rework: Used when an article can be made to conform to drawing requirements. Detailed instructions must be included or referenced. Rework is considered routine when it is covered in a released procedure document that is performed on conditions specified in the assembly procedure or organization quality assurance documentation. Non-routine rework requiring engineering analysis and direction shall not be performed without written Buyer approval.

Repair: Used when the nonconforming article, material or service can be corrected to a usable condition, although its condition may not be identical with drawing/specification requirements. Repairs shall not be performed without written Buyer approval.

4.4.2 NONCONFORMANCE PRELIMINARY REVIEW

The preliminary review process shall be initiated with the identification and documentation of a nonconformance. A preliminary review shall be the initial step performed by Supplier to determine if the nonconformance needs to be reported to the Buyer as specified in 4.4.3, and to determine if the nonconformance is minor and can be reworked to a condition that completely conforms to the drawing or specification requirements. Note: preliminary review does not negate the requirement to identify, segregate, document, report, and disposition nonconformances.

4.4.3 NONCONFORMANCE REPORTING

Supplier shall report nonconformances to the Buyer’s on-site Mission Assurance Representative/Quality Engineer any time one of the following conditions exists:

- A nonconformance that cannot be removed by documented routine rework is detected during an in-process inspection,
- A failure of any portion of the specified electrical test,
- Any time a nonconformance is detected during final inspection.

When Buyer notification is required, notification shall be within 24 hours of discovery of the nonconformance.
4.4.4 DATA REQUIREMENTS

Nonconformance reports shall include a detailed description of the nonconformance, the location of the nonconformance (by drawing reference point, hardware reference point, clock location, etc.), the part number, serial number and quantity of affected hardware, an exact callout of the violation by drawing or specification requirement (including sub-paragraph or illustration number). It shall also list what type of inspection revealed the discrepant condition, and what, if any, subsequent actions were taken prior to disclosure. Dimensional violations shall include “should be” and “is” dimensions, and tool(s) calibration traceability numbers. Nonconformance reports shall also document the root cause of the nonconformance and corrective action taken to prevent the root cause from recurring.

4.5 MATERIAL REVIEW BOARD

Supplier shall provide management, quality assurance and engineering support to the GLAST LAT Material Review Board (MRB) as required. The GLAST LAT MRB is chaired by the GLAST LAT Product Assurance Manager (or his designee) and consists of end-item responsible engineers and specialty engineers, as appropriate. At a minimum, Supplier participation shall include the engineer responsible for the product described herein and a Quality Assurance representative.

All nonconformances requiring Buyer notification identified during production of CPS CCAs shall be documented on a Non-Conformance Report and submitted to the GLAST LAT MRB for review and disposition. All work on the defective item shall cease until the MRB review is complete and work instructions for returning the item to compliance have been established.

4.6 INSPECTION RECORDS

Supplier shall maintain records of all inspections, nonconformances and tests performed on items delivered to Buyer. These records shall be submitted to the Buyer as a deliverable. Period of retention is 5 years from close of order, unless specified on the Procurement Document.

4.7 IDENTIFICATION AND TRACEABILITY

Buyer will provide bar-code labels printed with a series of SLAC tracking numbers. Supplier shall affix one of these labels to each completed CPS CCA after completion of conformal coating.

All parts and materials shall be traceable to a specific component/part number and lot number/lot date code. An as-built parts list shall be provided.

4.8 DELIVERABLES AND DOCUMENTATION

The following items and documentation shall be delivered in accordance with a Purchase Order incorporating this SOW:

1. Two sample CPS PCB’s with PCI connectors assembled (soldered).

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2. 9 flight CPS CCAs (2 first-articles plus 7 production)

3. End-Item Data Package for each CPS CCA containing the following:
   a. Certificate of Compliance for each CPS CCA
   b. Copies of shop travelers and shop orders for the identified CPS CCA
   c. Non-conformance Reports applicable to the end item
   d. As-built drawing and parts list as applicable and as-built configuration record
   e. In-process and final test reports as applicable
   f. End item acceptance (or qualification) test data, including environmental test reports
   g. Inspection reports as applicable
   h. Mate/demate log for flight connectors
   i. Digital equipment photographs on CD ROM

5 PROGRAM REVIEWS

5.1 TECHNICAL INTERCHANGE MEETINGS (TIMS)

The Buyer and Supplier will schedule TIM(s) to occur after a Manufacturing plan has been submitted by the Supplier and prior to start of work. The purpose of this meeting is to verify that requirements have been clearly provided to the Supplier and are understood, that plans and procedures are documented and approved, and that tools and equipment are in place. TIM(s) would include Buyer responsible engineer, manufacturing engineer, quality engineer and Supplier responsible engineer.