Solar Probe Plus

A NASA Mission to Touch the Sun

Integrated Science Investigation of the Sun
Energetic Particles

Preliminary Design Review

05 – 06 NOV 2013

Performance Assurance

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Outline

- Requirements
- Performance Assurance Implementation Plan
- Organization
- Quality Assurance
- EEE Parts Engineering
- Safety
- Summary

SPP PA Requirements and PAIPs

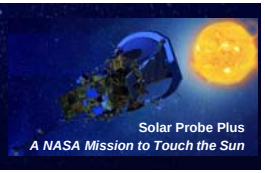
Tailored SMA Requirements negotiated with the SPP project:

- Solar Probe Plus (SPP) Instrument Mission Assurance Requirements Compliance Matrix
- SPP document # 7434-9096 Rev. A
- Iterative process between SPP and ISIS SMA teams utilizing best practices and combined knowledge of the diverse teams at all participating organizations

ISIS Implementation through plans (PAIP) and operating procedures:

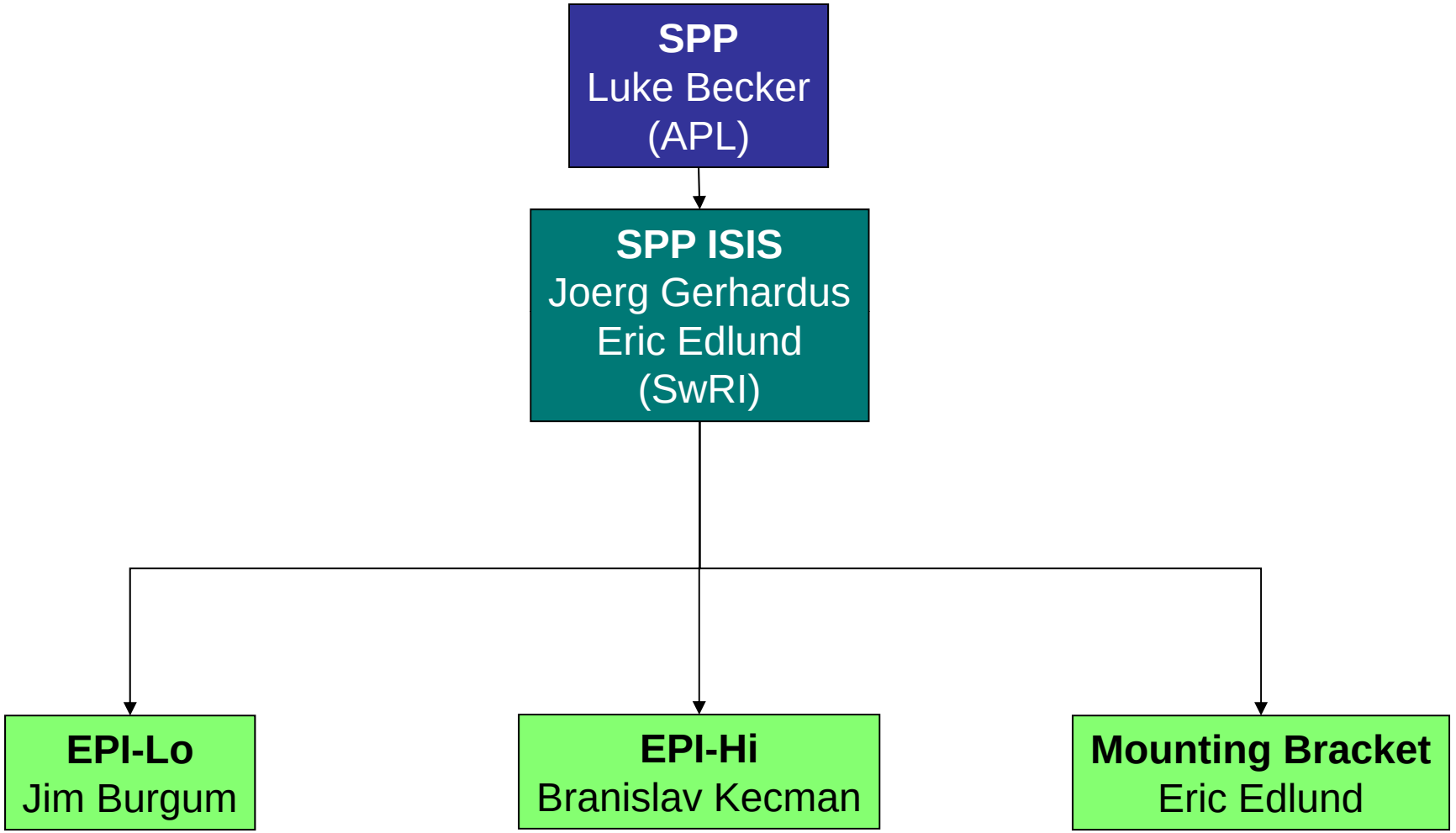
- ISIS: SwRI document 16105-SPP-IMAR-COMPMAT-01 Rev. 0, released 10/07/13
- EPI Lo: Solar Probe Plus (SPP) Performance Assurance Implementation Plan; APL document # 7434-9001 Rev. -, released 10/14/13
- EPI-Hi: Caltech document CIT-SPP-004 Rev. -, released 10/07/2013

Performance Assurance Implementation Plan



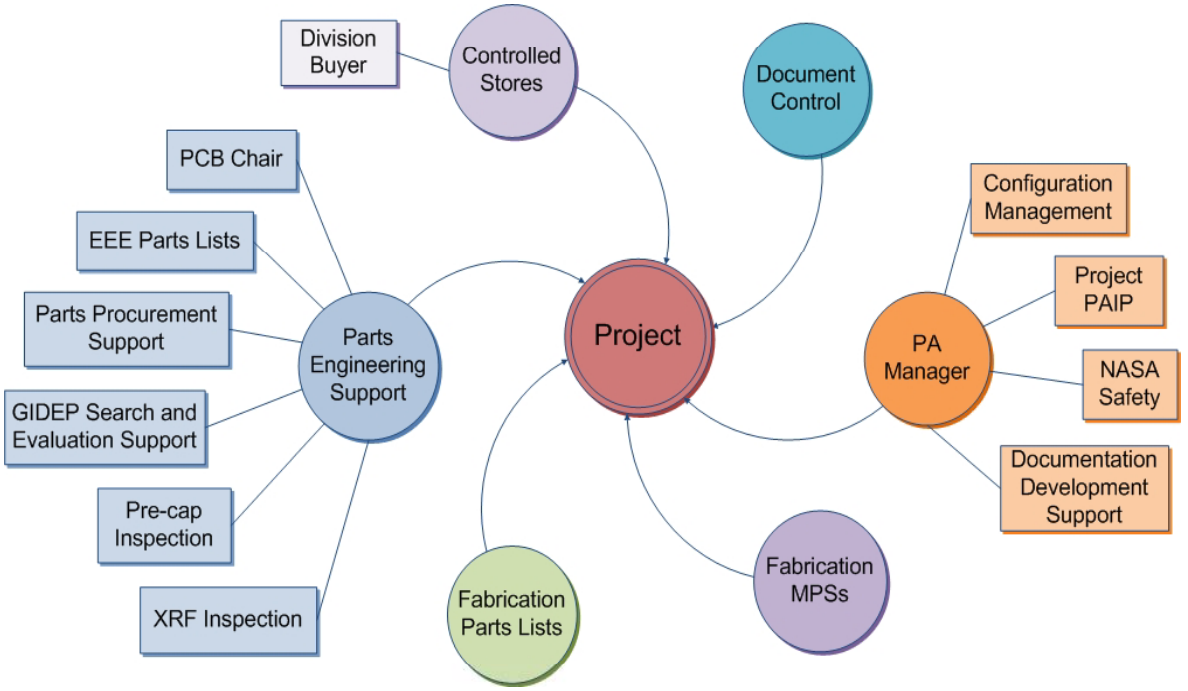
- Deliverables
- General Quality Requirements
  - Procurement
  - QA Surveillance
  - Training and Certification
  - Design and Development Review Process
  - Configuration Management
  - Non Conformance Process and Reporting
- Hardware Quality Requirements
  - Manufacturing, Inspection, Assembly, Test, and Inspection Planning
  - Controlled Stores
  - Fabrication processes
  - Inspection
  - Acceptance Test Verification
  - Handling Packaging, Shipping
- Software Quality Requirements
  - Requirements Analysis
  - Reviews
  - Verification and Validation
- Safety
- Reliability Assurance
- EEE Parts Program

PA Organization Chart

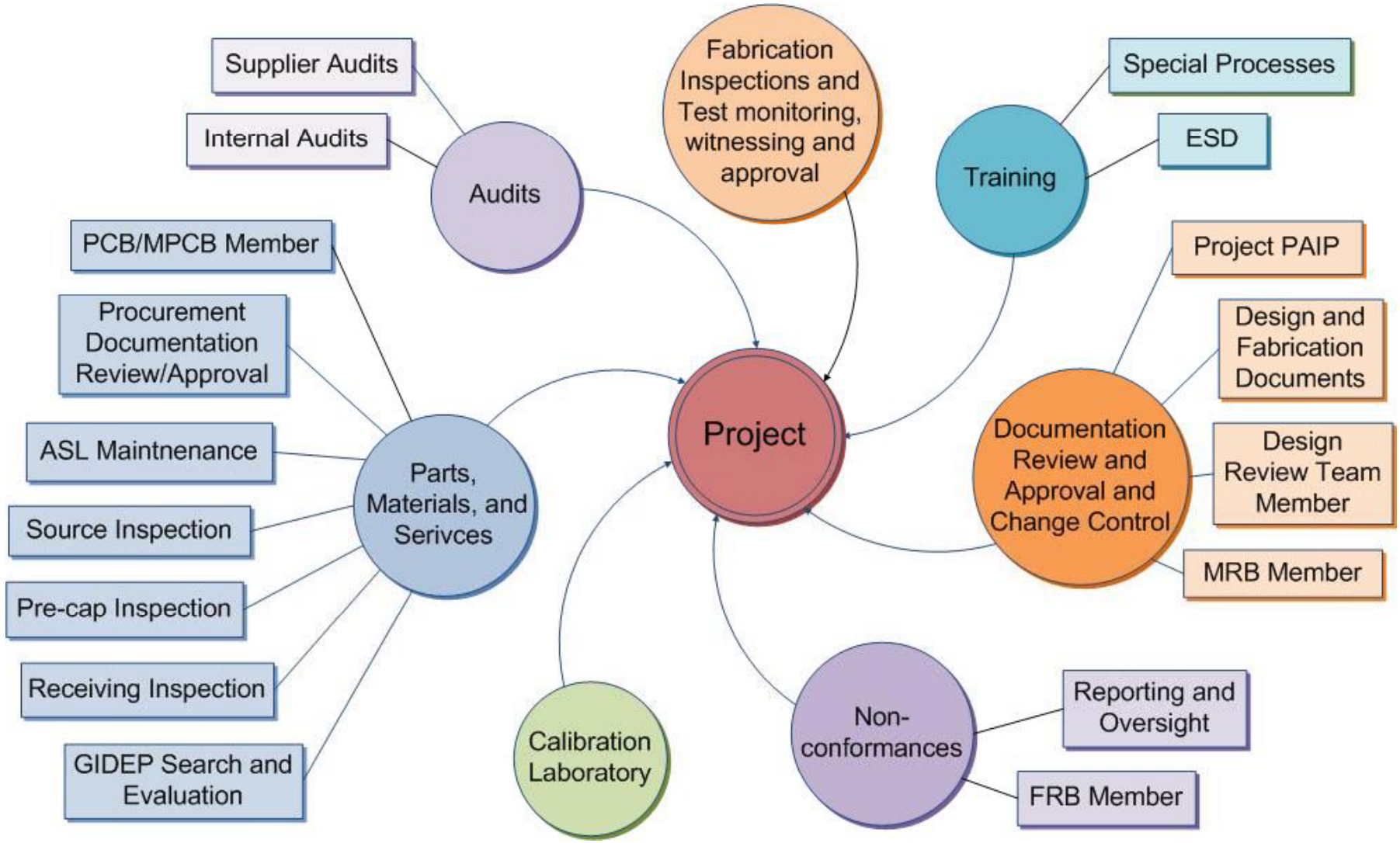


Project Quality Assurance

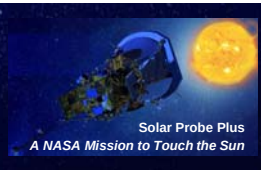
- Project Team PA
  - Reliability engineering
  - Parts acquisition oversight
- Division 15 PA Manager and Staff
  - Coordinate Div 15 Resources
- Independent Project Quality Engineer
  - Oversight & Coordination
  - QA Engineering
  - QA Inspections
- Partner QA
  - Implement local PAIP and support SwRI's SPP ISIS PA Lead



Quality Tasks



Design Assurance

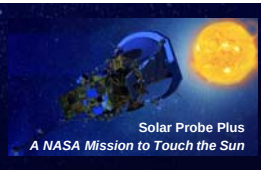


- Hardware designs governed by:
  - Design process and controls
    - Requirements definition
    - System engineering process
    - Design planning
    - Peer reviews and checklist
    - Verification and validation
    - Control of design changes
  - Software designs governed by:
    - Structured software development process
    - Contract reviews, software development folder, planning
    - Review of requirements, and checklist
    - Software design specification, design peer reviews, and checklist
    - Coding standards, configuration control, and code walkthroughs
    - Test plans, test preparations, formal testing, and reporting
    - Independent QA surveillance and reporting

Quality Assurance (1/2)

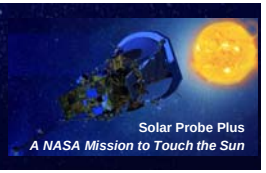
- Procurements per released drawing and indentured parts list
- Periodic GIDEP alert verification performed on EEE parts list
- QA Receiving Inspection of EEE parts for flight hardware
- Flight PWB procurement and coupon testing at GSFC
- SwRI coordinates PCB effort for SPP ISIS with mission-level PCB

Quality Assurance (2/2)



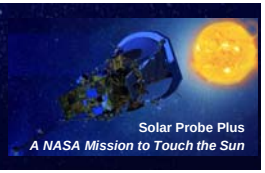
- Non-conformance control:
  - Per organization's established procedures
  - MRB and FRB established
  - All non-conformances will be processed as Anomalies or Problem/Failure reports and reported through SwRI to APL as required
- Workmanship
  - Technicians and inspectors are certified to NASA 8739 standards. Vince Ganley and Connie Ovalles are the in-house Level B certified instructors and are available to support other organizations as needed
- ESD
  - Engineers, operators, and technicians are certified to NASA-STD-8739.7 / ANSI ESD S20.20.

Software Quality Assurance



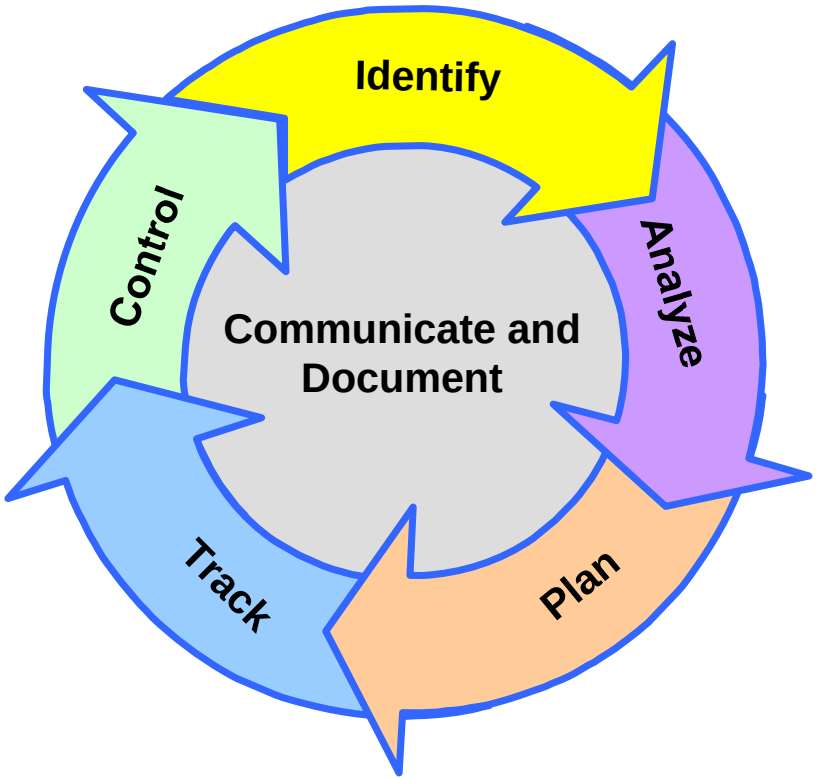
- ISIS SQA follows the AS9100 quality program in monitoring software activities which includes review of project documents, witnessing acceptance testing, tracking action items and defects, and performing surveillances/audits
- QA has approved the ISIS Software Development Plan (SDP), which references the EPI-Hi/Lo SDPs
  - Software Development Plan Solar Probe Plus Project ISIS Instrument Software, Document No. 16105-ISIS-SDP-01, Rev 0 Chg 0, September 2013
- Regular surveillances of EPI-Hi and EPI-Lo software activity will focus on the teams compliance to their SDP and their organization's quality/procedural requirements.
  - On-site surveillances by the SwRI SQA at EPI-Lo and EPI-Hi are planned

EEE Parts Engineering



- Primary role is to support ISIS hardware developers with meeting EEE parts requirements as called out in Solar Probe Plus Parts Control Plan, SPP document 7434-9001 Rev A
  - SwRI has significant experience working with APL & GSFC Parts Engineering Branch
  - Ensure that all parts presented to SPP Parts Control Board are compliant to the PCP
- Provide procurement support where necessary
  - Significant stock available at SwRI
    - This has already been useful to aid in prototyping and EM hardware
      - Avoid long lead times and expensive minimum buys
- Support coordination of common buy activities as requested
  - Allows for 1 consolidated response for the ISIS suite

Safety



- SPP ISIS will provide Safety inputs
  - The NPR-8715.3A process circle summarizes the overall safety program risk management approach
- Safety Hazards Analysis
- Implementation of hazard controls
- Verification

EPI Hi/Lo Hazards and Mitigations

- EPI-Lo:
  - High Voltage
    - 200V bias voltage to the SSDs
    - Fully contained inside the instrument
    - Only operated in high vacuum
    - Safe/arm limiting plug design
  - Ionizing Radiation Sources
    - Planned use of the following sources (radiation datasheets have been provided to SPP):
      - Am-241 foil, 100uCi, Type A2 Capsule
      - Bi-207, 10uCi, MF-1 Disk, 25.4mm OD x 5.08mm AD, 100-200ug/cm2 Acrylic Window
      - Ba-133, 10uCi, MF-1 Disk, 25.4mm OD x 5.08mm AD, 100-200ug/cm2 Acrylic Window
- EPI-Hi:
  - High Voltage
    - 250V bias voltage to each detector within the three telescopes
    - Fully contained inside the instrument
  - Ionizing Radiation Sources
    - Planned use of the following sources:
      - Beta / gamma sources — 106Ru, 207Bi: <0.1 mCi
      - Alpha sources — 228Th, 241Am, 244Cm : <10 mCi
      - alpha source for producing knock-on protons — 210Po : <10 mCi
- General Hazard:
  - Nitrogen purging
    - Controlled flow rates in ventilated areas
    - Conducted by trained personnel
    - Monitoring O_2 levels (where necessary)

Summary

- SPP ISIS Performance Assurance plans and requirements are in place
- PAIPs written in response to the tailored SPP MAR Matrix
- SwRI QA independently verifies that we follow plans