STANFORD UNIVERSITY
W.W. HANSEN EXPERIMENTAL PHYSICS LABORATORY
GRAVITY PROBE B, RELATIVITY GYROSCOPE EXPERIMENT
STANFORD, CALIFORNIA 94305-4085

PROBE PREPARATIONS for INTEGRATION WITH QB/T

GPB SCIENCE MISSION PROCEDURE

14 April, 1999

PREPARED _____ _____
D. Bardas, Integration Manager Date

APPROVED _____ _____
D. Bardas, Integration Manager Date

APPROVED _____ _____
B. Taller, Quality Assurance Date

APPROVED _____ _____
S. Buchman, Hardware Manager Date

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1 SCOPE

This document provides procedures for final preparation of the probe prior to integration with the QB/T. It assumes that the probe is on the Precision Manipulator with its vacuum shell off, as described in P0205(SM) and P0376.

This procedure:

- Removes the Stockades
- Installs the L-splint
- Ties down Terminal Blocks TB1 and TB3 on the L-splint
- Removes the Spider.

1.1 Acronyms

The following acronyms are used in this document

- SIA Science Instrument Assembly
- QB/T Quartz Block/Telescope
- ITD Integration and Test Director
- Pr-C Probe C, the Science Mission flight probe
- QBS Quartz Block Support (aluminum support on probe)
- QA Quality Assurance
- TB Terminal Block

2 REFERENCES

- P0059 GPB Contamination Control Plan
- P0057 Stanford Magnetic Control Plan
- P0205 Mounting Probe onto Precision Manipulator
- P0376 Removing Probe Vacuum Shell
- P0419 Operations Manual for the Precision Manipulator

3 GENERAL REQUIREMENTS

ONR representative, and QA to be notified prior to beginning this procedure

3.1 Environmental Requirements

This procedure will be conducted in the Stanford Class 10 Cleanroom in the HEPL facility.

3.1.1. Cleanliness

The Class 10 clean room where this integration takes place shall be maintained at the cleanliness levels per GPB Contamination Control Plan P0059. Certified Class 10 cloth garments shall be worn in the Class 10 clean room.

3.1.2 Particulate Contamination

All parts and tools shall be cleaned at least to the cleanliness levels of the rooms where they are used for assembly or testing. In addition, all flight parts shall be maintained at level 100 cleanliness per GP-B Contamination Control Plan (P0059). Take all necessary precautions to keep tools and handling equipment free of particulate contamination.

To the maximum extent possible, personnel shall keep their bodies and garments downstream of the SIA, relative to the HEPA wall.

3.1.3. Magnetic Contamination

All parts and tools shall be screened per Procedure P0057. All parts and tools shall be cleaned using methods consistent with achieving Mil Spec Level 100 cleanliness. In addition, all parts shall be maintained at level 100 cleanliness per GP-B Magnetic Control Plan, P0057. Take all necessary precautions to keep tools and handling equipment free of particulate contamination. Tools to be cleaned with Ethyl Alcohol prior to use, or when contaminated.

3.1.4. Electrostatic Discharge Control

There are no ESD sensitive items dealt with in this procedure.

3.2 Integration and Test Personnel

3.2.1 Integration and Test Director

The Integration and Test Director (ITD) shall be Dr. Doron Bardas or an alternate that he shall designate. The ITD has overall responsibility for the implementation of this procedure and shall sign off the completed procedure and relevant sections within it.

3.2.2 Integration Engineers and other personnel

All engineers and technicians participating in this procedure shall work under the direction of the ITD who shall determine personnel that are qualified to participate in this procedure. Participants in this procedure are expected to be D. Bardas, G. Asher, C. Gray, with assistance from LMMS at certain times.

3.3 Safety

3.3.1 General

Personnel working in the Class 10 Cleanroom must be cognizant of the base of the Precision Manipulator, and take special care to avoid tripping or bumping into it.

3.3.2 Hardware Safety

Extreme care must be taken to avoid accidentally bumping or scratching the QB/Telescope.

3.3.3 Maximum Number of People in Cleanroom

Under normal operating conditions, there shall be no more than 5 people in the Class 10 Cleanroom. This is to avoid violating legal make up air requirements, and to provide an efficient workspace. Exceptions must be for short periods only, and approved by the ITD.

3.4 Quality Assurance

Integration shall be conducted on a formal basis to approved and released procedures. The QA program office shall be notified of the start of this procedure. A Quality Assurance Representative, designated by B. Taller shall be present during the procedure and shall review any discrepancies noted and approve their disposition. Upon completion of this procedure, the QA Program Engineer, B. Taller or his designate, nominally R. Leese, will certify his concurrence that the effort was performed and accomplished in accordance with the prescribed instructions by signing and dating in the designated place(s) in this document.

Discrepancies will be recorded in a D-log or as a DR per Quality Plan P0108.

3.5 Red-line Authority

3.5.1 Authority to red-line (make minor changes during execution) this procedure is given solely to the ITD or his designate and shall be approved by the QA Representative. Additionally, approval by the Hardware Manager shall be required, if in the judgment of the ITD or QA Representative, experiment functionality may be affected.

3.5.2 Procedure Computerization Special Requirements

Because of cleanliness requirements in the Class 10 room, and to conveniently record data directly into the procedure thus generating the "as-built" document, the procedure will be handled in a paperless fashion until completed. A Laptop computer containing an electronic version of this procedure will be operated by the ITD or QA Representative and data shall be recorded by typing directly into the electronic file.

3.5.3 Following completion of the procedure, a hard copy of the "as-built" procedure shall be printed ***and signed off by all the designated parties***. It shall then be filed, including an electronic copy into the data base.

The electronic editing of this document shall be as follows:

- Data will be inserted into the document using normal font, i.e. non-bold, non-italic
- "Signatures" shall be designated by **BLACK CAPITAL BOLD LETTERS**.
- "Redlines" shall be in ***RED BOLD ITALICS*** to make them distinguishable both on the Laptop screen and on the hard copy printout.

- If available, digital pictures shall be inserted into the document where appropriate.

4 REQUIRED EQUIPMENT

The following equipment shall be in the Class 10 cleanroom.

Flight Hardware

Hardware	Part Number	Quantity
Probe-C Assembly, Without Sunshade	1C34115-102	1

Ground Support Equipment

- Probe Precision Manipulator

Tools and Miscellaneous

- TF Solvent
- Ethyl alcohol
- Methanol
- Ultrajet alcohol drying solution
- BeCu Allen wrenches
- Kapton tape
- Torque Wrench, for PM
- Torque Wrench for Yoke Collar
- Torque Wrench for Spider Bolts
- Torque Wrench for Stockade Bolts
- Torque Wrench for Terminal Block Bolts
- Tie Wraps and tape

5 REMOVE SPIDER AND ITS HARDWARE

5.1 Remove Upper Stockade

5.1.1 Remove the socket head cap screw, shoulder washer, and insulator sheet which bolt the stockade to the spider on the +Y side.

5.1.2 Remove the socket head cap screw, along with the flat washer which bolt the Upper Stockade to the Lower Stockade.

5.1.3 Remove the Upper Stockade and keep together with the bolts.

5.2 Remove Lower Stockade

5.2.1 Remove the Lower Stockade from the Spider by removing the groups of socket head cap screw, shoulder washer, and insulator sheet which hold the Stockade to the Spider

5.2.2 Remove the Lower Stockade and keep together with the bolts.

5.3 Install L-Splint

5.3.1 Install the aluminum L-splint on the Birdcage Extrusion between +Y and –X (E2), with the SQUID cables. Hold securely with three tie wraps, approximately equidistantly spaced.

5.4 Remove Terminal Block TB1

5.4.1 Remove the Instrumentation Support Bracket, which hold down the TB1 and TB3 cables, by removing the two bolts from the Spider.

5.4.2 Remove the two tie-down clamps, including washer and screw, which hold down TB1.

5.4.3 Remove the bushing, screws, and crescent washers that secure TB1 to the Spider.

5.4.4 Carefully rotate the cable, which feeds TB1, 180˚ and tie wrap to the L-splint.

5.5 Remove Terminal Block TB3

5.5.1 Remove the two tie-down clamps, including washer and screw, which hold down TB3

5.5.2 Remove the bushing, screws, and crescent washers that secure TB3 to the Spider.

5.5.3 Carefully rotate the cable, which feeds TB1, 180˚ and tie wrap to the L-splint.

5.6 Remove Spider

5.6.1 Loosen the 16 bolts which hold the spider to the 4 extrusions, without removing them.

5.6.2 Remove the 4 bolts and shouldered washers which hold extrusion E3, on the +X, +Y side to the Spider. Remove the Kapton insulators on E3.

5.6.3 Remove the clamp assembly which holds extrusion E4, on the +X, -Y side to the Spider. Then remove the 2 bolts and shouldered washers which also hold the spider to E4.

5.6.4 Remove the two clamp assemblies holding extrusion E2, on the -X, +Y side to the Spider.

5.6.5 Remove the 4 bolts and shouldered washers which hold extrusion E1, on the -X, -Y side to the spider.

5.6.6 Remove the Spider and keep together with installation hardware.

Take picture

Take picture

6 PROCEDURE COMPLETION

The results obtained in the performance of this procedure are acceptable:

Integration Engineer(s) _____ Date _____

_____ Date _____

_____ Date _____

ITD _____ Date _____

The information obtained under this assembly and test procedure is as represented and the documentation is complete and correct:

QA Representative _____ Date _____

QA Program Engineer_____ Date _____

Copy discrepancies to D-Log and open Discrepancy Reports when required.

7 DATA BASE ENTRY

The following data shall be entered into the GP-B Data Base:

- Name, number and revision of this procedure
- An electronic copy of this document
- A copy of the “as-built” procedure with data and pictures, when completed.