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

P0360
13 Feb 1998
Removing SIA from Pr-B

REMOVING THE SIA FROM PROBE-B

GTU-2 "AS BUILT" PROCEDURE

13 February 1998

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PREPARED _____
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1. SCOPE

This procedure describes the method used for de-integrating and removing the Science Instrument Assembly (SIA) from Probe-B. This procedure takes place in the HEPL Class 10 cleanroom. It assumes that the Probe is mounted horizontally on the Precision Manipulator (PM), with the Probe Vacuum Shell off, and the Birdcage end facing the observation window. It also assumes that the SQUIDS, Caging Assemblies, and the Gyros have been removed from the SIA.

2. REFERENCES

P0377	Removal of SQUIDS from SIA/Probe
P0378	Removal of Gyros from SIA

3. GENERAL REQUIREMENTS

3.1 Environmental Requirements

3.1.1. Cleanliness

This procedure takes place in the Class 10 Cleanroom in the HEPL building. Personnel working in the Class 10 cleanroom shall wear certified Class 10 cloth garments.

3.1.2. Magnetic Contamination

Parts to be handled are in Zones 1 through 4. Take all necessary precautions to keep tooling and handling free of magnetic contamination.

3.2 Integration Personnel

3.2.1 Integration and Test Director

The Integration and Test Director (ITD) for this procedure shall be Dr. Doron Bardas. He has overall responsibility for the implementation of this procedure and shall sign off the completed procedure.

3.2.2 Integration Engineers

All engineers and technicians participating in this procedure shall work under the direction of the ITD who shall determine whether this person is qualified to participate in this procedure. Nominally, the personnel participating in this procedure are D. Bardas and J. Efraín Alcorta.

3.3 Safety

3.3.1. General

The responsible engineer shall ensure that all personnel are aware of the specific personnel and hardware safety concerns indicated in the safety requirements, cautions and warnings in the procedure.

3.3.2. Special Precautions in Cleanroom

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.

3.4. Quality Assurance

Upon completion of this procedure, the QA representative will certify his/her concurrence that the effort was performed and accomplished in accordance with the prescribed instructions by signing and dating his/her approval line at the end of the procedure.

4. REQUIRED EQUIPMENT

Flight Prototype Hardware
Probe-B and GTU-2 SIA
Reference P0175 for part numbers

GSE
Precision Manipulator
Oriel Optical Table
X-Y Cart for holding Quartz Block
Approved non-magnetic tools
Fiberlite Model 190, Dolan-Jenner Industries
Be Cu wrenches, 1/4, 9/32
M190 Cubis delrin tweezers
Allen wrenches, various
Cleanroom storage bags
Cleanroom vacuum

5. OPERATIONS

This procedure takes place in the HEPL Class 10 cleanroom. It assumes that the Probe is mounted horizontally on the Precision Manipulator (PM), with the Probe Vacuum Shell off, and the Birdcage end facing the observation window. This procedure assumes that the SQUIDS, Caging Assemblies, and the Gyros have been removed from the SIA.

Record Start Date and Time 2/10/98, 14:40
There should be at least 2 people on this task.

5.1 Disconnect Telescope Cables From Probe

The probe should be at a height of optimum working convenience for removing hardware (approximately 4 ft), with the optical table under the SIA, for convenient access to tools.

5.1.1 Rotate the probe, if necessary, to position the Quartz Block Support (QBS) access holes between +X and +Y to face workers at approximately a 45 degree angle toward the ceiling and away from the HEPA wall. Use the wrench on the Probe Collar to rotate probe.

5.1.2 Through the second access hole on the +X side (see Figure 1), disconnect the telescope thermal grounds.

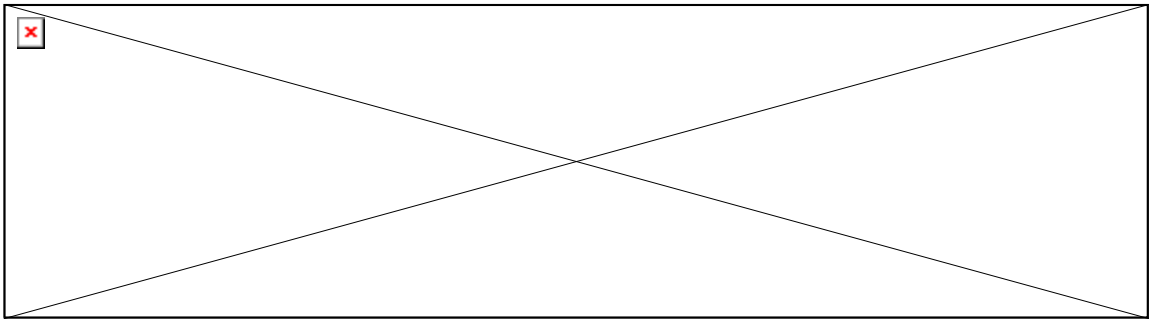

Figure 1. Schematic showing Access Holes in QBS (not to scale)

5.1.3 Individually remove all pins from Terminal Block 4 (TB4) by doing the following:
1) Prepare the pin insertion/extraction tool, so that the extraction sleeve is on the tool base
2) insert the tool sleeve until it bottoms out in the terminal block;
3) grab the pin and sleeve together with long nose BeCu pliers and pull them out carefully;
4) remove the pin off the sleeve.
Repeat until all pins are off TB4.

5.1.4 Use the cleanroom vacuum to suck up any particles which may have fallen into the probe while de-integrating.

5.1.5 Use the Fiberlite to shine into Terminal Block 5 (TB5), to distinguish between the wires which go to the telescope detector (upward towards the corrector plate) and those which go to the QBA (downward toward the Quartz Block). We will remove only those which go upward to the detector package.

5.1.6 Individually remove the telescope pins from TB5 using the same procedure described in 5.1.3.

NOTE: Because the telescope wires will not be used in the future, Doron decided to cut the wires at TB5.

5.2 Preparation and Removal of Spider From Birdcage

5.2.1 Remove the stockade from the spider, by removing the screws which hold the stockade to the spider.

5.2.2 Remove brackets on spider which hold down wires to the spider.

5.2.3 Install the L-splint on the birdcage on the extrusion between -X and +Y. Wrap 3M cleanroom tape around the splint and extrusion to hold the splint to the extrusion. Use in at least 3 places for adequate support.

5.2.4 Remove the rail for the readout cables between +X and -Y with a 3/16 BeCu torque wrench.

5.2.5 Remove the caging lines clips between +X and -Y, using an Allen wrench.

5.2.6 Transfer the GRTs taped on the QBS by taping to the Quartz Block.

5.2.7 Remove the clasps from the spider.

5.2.8 Remove the 4 Phillips screws which hold the spider to the extrusion between +X and -Y.

5.2.9 Use the cleanroom vacuum to suck up any particles which may have fallen into the probe while de-integrating.

5.2.10 Rotate the probe so that -X is facing the workers.

5.2.11 Remove the rail for the readout cables between -X and +Y with a 3/16 BeCu torque wrench.

5.2.12 Twist off the plastic inlet tube from the -X side birdcage end.

5.2.13 Remove the plastic tube from the exhaust end.

5.2.14 Remove terminal blocks TB1 and TB3 one at a time from the spider, using an Allen wrench. Tie wrap the terminal block to the L-splint. It takes two people to hold and tie wrap the block onto the splint. It does not matter which order you do these two terminal blocks.

5.2.15 Remove TB2 wires from the extrusion between -X and +Y**.**

5.2.16 Remove the 4 Phillips screws which hold the spider to the extrusion between -X and +Y.

5.2.17 Use the cleanroom vacuum to suck up any particles which may have fallen into the probe while de-integrating.

5.2.18 Rotate the probe as necessary to remove all screws holding the spider to the birdcage.

CAUTION: Raise the probe if necessary so that the splint won't hit the table while rotating.

5.2.19 Remove the spider.

5.3 Rotate Probe to Vertical

Record Start Date and Time 2/11/98, 9:45
There should be at least 2 people on this task.

5.3.1 Raise the probe sufficiently to clear off the optical table. Move the table to the far northeast corner of the room.

5.3.2 Cover the probe Top Hat with a cleanroom bag, and tape onto probe.

5.3.3 Raise the probe while horizontal to a height of approximately 6 feet.

5.3.4 Rotate the probe about the Z-axis such that the X-X axis is aligned with the Precision Manipulator (perpendicular to the HEPA wall).

5.3.5 Rotate the probe to vertical, using the torque wrench on the probe yoke ring. Use the Protracto level to verify vertical to within 0.1 degree.

5.3.6 Adjust the probe height with the PM motor so that X-Y cart fits directly underneath probe (to approximately 3 feet from floor).

5.4 Clamp Quartz Block in X-Y Cart

5.4.1 Position the X-Y cart so that the vise clamps are along the X-X axis of the probe.

5.4.2 Adjust the clamps so that it just envelopes the Quartz Block.

5.4.3 With one person on the PM motor, and another on the X-Y cart, slowly lower the probe until the bottom of the QB is approximately 1/4 inch from the pad in the center of the X-Y cart between the clamps. Adjust the clamps so that it almost touches the QB.

5.4.4 Manually raise the jack of the clamps until the QB is seated on the pad in the cart.

5.4.5 Tighten the clamps until it securely holds the QB without oversqueezing.

5.5 Remove Bolts Holding QB to Probe

5.5.1 In each quadrant, remove bolts 1,3, and 5, using the appropriate allen wrench. Allow the shims in each quadrant to hang. Put all bolts in a single cleanroom box.

NOTE: the -Y quadrant has only 4 bolts, remove the first and third bolts first.

5.5.2 Remove bolts 2 and 4 from each quadrant. Remove the shims from each quadrant, then remove the indium washers. Place all shims and indium washers in separate cleanroom bags.

5.6 Separate SIA From Probe

5.6.1 Use the manual knob on the X-Y cart jack to lower the QB approximately 1/2 inch. This will separate the SIA from the probe.

5.6.2 With one person on the PM motor, and the other looking through the access holes for interference, raise the probe slowly (1amp setting). Check clearances at corrector plate.

5.6.3 With probe raised approximately 6 inches, gather the corrector plate wires into a small cleanroom bag and tie wrap the bag around the wires. Place the bag inside the probe through the access hole.

5.6.4 Continue raising the probe slowly. Stop occasionally to check clearances. Adjust QB as necessary.

5.6.5 When the probe clears the top of the telescope, move the SIA in X-Y cart away from the probe.

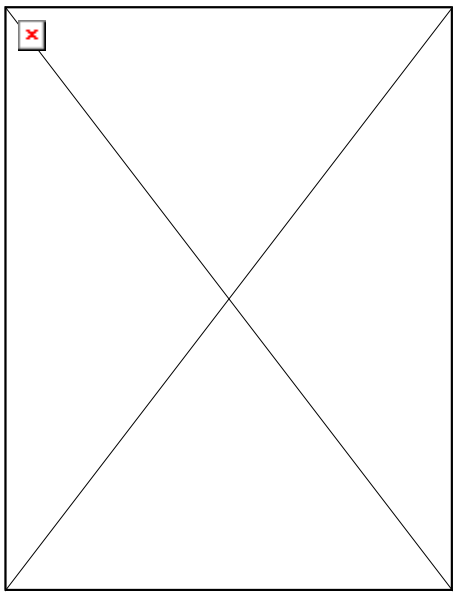

Figure 2. Schematic of Probe and SIA separated (not to scale)

5.7 Remove Remaining Instrumentation Cables

5.7.1 Use cleanroom pliers to remove the GRT aft carrier from the QB. Label and store the GRT and cable in a cleanroom bag.

5.7.2 Repeat 5.7.1 for GRT on flange, and the GRT forward (near telescope).

5.7.3 Use cleanroom pliers to remove the Silicon Diode aft carrier from the QB. Label and store the SD and cable in a cleanroom bag.

5.7.4 Repeat for the Silicon Diode forward carrier.

5.7.5 Remove the 4 routing loops on the -X side of the QB.

5.8 Place SIA on Optical Table

5.8.1 Prepare the Optical Table so that it is clear, with foam padding along the length of the QB.

5.8.2 With one person supporting the SIA, the other person loosens the X-Y cart clamps which support the QB.

5.8.3 Use two people to carry the SIA to the table, and place gently on the foam pad. Place additional foam underneath the telesope end to provide a level support.

5.8.4 Ensure that the SIA is secure and will not move freely.

6. PROCEDURE COMPLETION

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

Integration Engineer _____ Date _____

Integration and Test Director _____ Date _____

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

Quality Assurance _____ Date _____

7. DATA BASE ENTRY

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

1) Name, number and revision of this procedure

2) Date of successful completion of procedure.