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

INITIAL INSPECTION OF SIA AFTER VACUUM CAN REMOVAL

P0720 Rev -

July 27, 2000

PREPARED	_____	_____
	R. Brumley, Gyroscope RE	Date
APPROVED	_____	_____
	C. Gray, Gyroscope Verification	Date
APPROVED	_____	_____
	K. Bower, Gyroscope Verification	Date
APPROVED	_____	_____
D. Ross, Quality Assurance and Safety		Date
APPROVED	_____	_____
	G. Keiser, Chief Scientist and Chair Cleanliness Control Committee	Date
APPROVED	_____	_____
	B. Muhlfelder, Technical Manager	Date

1. SCOPE

This procedure specifies the process used to inspect the SIA/Probe C assembly after the vacuum can has been removed. Some of the inspection points are used to satisfy specific Discrepancy Reports (DRs). If these DRs have already been closed, then those sections may be omitted.

2. REFERENCES

2.1 Plans and Procedures

P0023 GPB Clean Room Procedures

P0057 GPB Magnetic Control Plan

P0059 Probe Contamination Control Plan

P0108 Science Mission Quality Plan

P0147 Relativity Mission Contamination Control Plan, Master

P0327 Gravity Probe B Relativity Mission System Safety Program Plan

P0476 ESD/EOS Risk Mitigation Procedure

3. GENERAL REQUIREMENTS

3.1 Environmental Requirements

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

3.1.1 Room Cleanliness

The Class 10 clean room where this integration takes place shall be maintained at the cleanliness levels per Federal Stanford 209D. All personnel in the clean room shall wear certified Class 10 cloth garments.

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 parts shall be maintained at level 100 cleanliness per GP-B Contamination Control Plan (P0059). A portable particle counter shall be set up on a table downstream of the local work area, and monitored to ensure that particulate counts are consistent with the 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 all parts of their bodies downstream of the probe, defined by the direction of HEPA airflow.

3.1.3 Magnetic Contamination

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, Science Mission (P0057). Take all necessary precautions to keep tools and handling equipment free of particulate contamination.

Only nonmagnetic materials are allowed to touch the cold end of the probe.

3.1.4 Electrostatic Discharge (ESD)

ESD wrist straps shall be worn by all personnel per P0476.. Note that per the previous section (Magnetic Contamination) the steel alligator clips which connect to most wrist straps can not be connected to the cold end of the probe. The Precision Manipulator (PM) is in electrical contact with the probe, and may be used as a grounding site for ESD wrist straps.

3.2 Test Personnel

3.2.1 Test Director

The test director for this procedure shall be Robert Brumley, or his appointed replacement.

3.2.2 Personnel

The following personnel are qualified to perform this procedure

- Paul Bayer
- Chris Gray
- Ken Bower
- Bruce Clarke
- Robert Brumley

See section 3.4 for details on the requirements for Quality Assurance notification and witnessing of this procedure.

3.2.3 Minimum Personnel

No activity shall be performed on the science mission probe without at least two people in the room, i.e. at least one person to perform the procedure and one person to observe the procedure.

3.3 Safety

3.3.1 Hardware Safety -- General

Great care should be taken in the handling of the gyroscope and its hardware to avoid damage to them.

3.3.2 Electrostatic Discharge

Grounded wrist straps shall be worn when making connections to the readout cable. Also, it is important to adhere to use the multimeter specified in Section 4 so as to avoid any possibility of damaging the pickup loop. Also, the ionizer bars shall be operating upstream from the work area.

3.3.3 Personnel Safety

All operations shall take place according to Stanford University safety guidelines. Any person observing a situation which they deem unsafe shall report the fact immediately to the test director. The Quality Assurance representative shall be responsible for monitoring that all activities are performed in a safe manner.

3.4 Quality Assurance

Stanford QA must be notified at least one hour before beginning this procedure.

ONR QA must be notified at least one hour before beginning this procedure.

D. Ross (or her designate) must be present to monitor the completion of this procedure.

This procedure shall be conducted on a formal basis to its latest approved and released version. The QA Program Engineer shall be notified of the start of this procedure. A Quality Assurance representative designated by D. Ross shall review any discrepancy noted during test. Redlines shall be approved by the QA representative. The QA representative will nominally be Russ Leese. Upon completion of this procedure, the QA Program Engineer, D. Ross or R. Leese, shall certify his of her concurrence that the effort was performed and accomplished in accordance with the prescribed instructions by signing and dating the appropriate approval line at the end of the procedure.

3.5 Red-Line Authority

Authority to red-line (make minor chances during execution) this procedure is given to the qualified personnel listed in section 3.2.2. All redlines must be approved by the QA representative. Additionally, approval by the Technical Manager shall be required if, in the judgement of the test director or the QA representative, experiment functionality may be affected.

4. REQUIRED EQUIPMENT

Flight Hardware

- Probe C / SIA Assembly

Non-Flight Hardware

The following GSE hardware is required to complete this procedure

Item	Calibration Required
Digital Camera	NO
Video Camera	NO
Probe C - SIA ICD	NO

5. INITIAL CONDITIONS

5.1 Verify Probe is on the Precision Manipulator in the Class 10 room, the vacuum can is off, and the probe is horizontal. _____

5.2 Verify that the SIA is situated in front of the HEPA flow such that work is being performed downwind. _____

6. OPERATIONS

6.1 Procedure Initialization

Start Date: _____ Start Time: _____

Test Engineer: _____ (print)

QA Representative: _____ (print)

The following parts of section 6 may be performed in any order.

6.2 Initial Overview Inspection

6.2.1 Visually inspect the SIA as a whole. Rotate the probe about its Z axis to view the SIA from all angles. Take extensive pictures and video using the digital camera and video recorder.

Notes:

6.3 Epoxy Staking Points

Check the following epoxy staking points. The purpose of this inspection is to assess whether there will be any problems breaking the epoxy staking to remove the staked component. This part of the inspection can only be performed by an individual who has, by experimentation and practice, become expert at making this assessment. These individuals are C. Gray and K. Bower. Take close-up pictures of the epoxy staking on the SQUID lid screws and caging nuts.

	OK?
Gyro #4 SQUID Lid	
Gyro #4 Suspension Cables	
Gyro #4 UV Cables	
Gyro #4 Ground Plane Cable	
Gyro #4 Caging Nuts	
Gyro #2 SQUID Lid	

Additional Notes:

6.4 Detailed Contamination Inspection

Now focus the inspection on particulate contamination. Use a monochromatic light to make particles easier to see. Wherever possible, document any particulate contamination with digital pictures or video.

Notes:

6.5 Quartz (Cracks)

Inspect the SIA for any defects in the quartz (such as cracks). Again, a monochromatic light may be helpful to highlight any defects. Be sure to document any cracks using a camera. This part of the inspection should be performed slowly and methodically by Ken Bower, Paul Bayer, or Chris Gray.

Notes:

6.6 Gyroscope Wires

Inspect the integrity of the following wires.

	OK?
Gyro #1 Suspension Lines (6)	
Gyro #1 UV Fiber Optics (2)	
Gyro #1 UV Bias Connections (2)	
Gyro #1 Readout Cable (1)	
Gyro #1 Ground Plane Connection (1)	
Gyro #1 GRT Wires (4)	
Gyro #1 Heater Wires (2)	
Gyro #2 Suspension Lines (6)	
Gyro #2 UV Fiber Optics (2)	
Gyro #2 UV Bias Connections (2)	
Gyro #2 Readout Cable (1)	
Gyro #2 Ground Plane Connection (1)	
Gyro #2 GRT Wires (4)	
Gyro #2 Heater Wires (2)	
Gyro #3 Suspension Lines (6)	
Gyro #3 UV Fiber Optics (2)	
Gyro #3 UV Bias Connections (2)	
Gyro #3 Readout Cable (1)	
Gyro #3 Ground Plane Connection (1)	
Gyro #3 GRT Wires (4)	
Gyro #3 Heater Wires (2)	

Gyro #4 Suspension Lines (6)	
Gyro #4 UV Fiber Optics (2)	
Gyro #4 UV Bias Connections (2)	
Gyro #4 Readout Cable (1)	
Gyro #4 Ground Plane Connection (1)	
Gyro #4 GRT Wires (4)	
Gyro #4 Heater Wires (2)	

Additional Notes:

6.7 Instrumentation Wires

Now examine the instrumentation wire assemblies. Look carefully to be sure no wires are broken, kinked, or otherwise in danger of being compromised. Notes:

6.8 Caging Lines

Now focus on the caging lines. Examine them for kinks or any obvious defects (e.g. cracks in the solder). Record observations below.

6.9 Suspension Cable Short Diagnosis (DR279)

Now examine Gyro #4's suspension lines, focusing on C42, C43, and C44. These cables had a short between the inner shield and probe ground in Payload Test 1. Comment on any observable factors which might have contributed to the anomaly.

6.10 Gyro #2 UV Anomaly Inspection (DR319)

Measure the continuity (top hat to bottom) of Gyro #2's UV bias connections. The top hat connections are found on BG34 pins 3 and 4. The SIA-side connections can be found by tracing the cables from Gyro #2. Record the resistances below:

BG34 - 3: _____

BG34 - 4: _____

6.11 Heater Wire Anomaly (DR324)

During RT Test #3, the heaters H-5P and H-6P were found to be shorted. It is believed the cause of the failure has been localized to a connector saver. However, top to bottom resistance should be measured if it is possible to easily access the bottom heater connections (i.e. no break in configuration). The bottom connections can be found on the Probe C - SIA ICD. All top hat connection pinouts refer to the I-5 connector.

Pin 51 - bottom Resistance: _____

Pin 52 - bottom Resistance: _____

Pin 53 - bottom Resistance: _____

Pin 54 - bottom Resistance: _____

6.12 Vacuum Can

Now focus on the inside of the vacuum can. Note any particulate contamination in the space below.

7. UPDATE DISCREPANCY REPORTS

Update DR288 with the results from Section 6.8: _____

Update DR279 with the results from Section 6.9: _____

Update DR319 with the results from Section 6.10: _____

Update DR324 with the results from Section 6.11: _____

8. PROCEDURE COMPLETION

Record completion of this procedure in the traveler, as appropriate.

Record any abnormalities or deviations from this procedure in the D-Log. If the QA representative decides it is appropriate, open a Discrepancy Report to document the event.

This test has been completed according to the procedure contained herein. All redlines used have been integrated into this document.

Test Director:	_____ (sign) _____ (print)	(date and stamp)
(optional) Test Engineer:	_____ (sign) _____ (print)	(date and stamp)
(optional) Test Engineer:	_____ (sign) _____ (print)	(date and stamp)
QA Representative:	_____ (sign) _____ (print)	(date and stamp)