SU/GP-B P0366 –

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

# TRANSFER PROBE FROM PM TO GURNEY PLUS TRANSPORTATION

## GP-B SCIENCE MISSION PROCEDURE

4 February, 1999

PREPARED _____ _____
A. Nakashima, Systems Date

APPROVED _____ _____
D. Bardas, Integration Manager Date

APPROVED _____ _____
J. Janicki, Safety Engineering Date

APPROVED _____ _____
B. Taller, Quality Assurance Date

APPROVED _____ _____

S. Buchman, Hardware Manager Date

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# 1 SCOPE

This procedure describes the method used for transferring the Probe from the Precision Manipulator (PM) to the Gurney. The procedure assumes that the Probe is on the Precision Manipulator in the Class 10 cleanroom. This procedure is applicable whether the probe vacuum shell is on (when the probe is ready for evacuation) or off (for temporary storage of the probe). It also describes the transport of the gurney with probe into the Class 1000 cleanroom or elsewhere in the cleanroom complex.

# 2 REFERENCES

## 2.1 Plans and Procedures

| | |
|---|---|
| P0059 | GPI Contamination Control Plan |
| P0057 | Stanford Magnetic Control Plan |
| P0205 | Mounting Probe onto Precision Manipulator |
| P0419 | Operations Manual for the Precision Manipulator |
| P0409 | Prepare Probe For Class 10 CLEANROOM |

## 2.3 Acronyms

The following acronyms are used in this document

| | |
|---|---|
| $GN_2$ | Gaseous Nitrogen |
| HEPA | High Efficiency Particulate Air |
| HEPL | Hansen Experimental Physics Laboratory |
| PM | Precision Manipulator |
| SIA | Science Instrument Assembly |

# 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 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. Tool should be sprayed with Freon from a pressure can filtered to 0.2 μm prior to use, or when contaminated.

Only approved non-magnetic materials or tools are allowed to touch the cold end of the probe.

## 3.2 Integration and Test Personnel

### 3.2.1 Integration Test Director (ITD)

The test director for this procedure is Doron Bardas or his appointed replacement. The ITD is also responsible in general for the coordination of all integration procedures, and will schedule appropriate time for the performance of this procedure.

### 3.2.2 Integration and Test Director

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

### 3.2.3 Personnel

All engineers and technicians participating in this procedure shall work under the direction of the ITD who shall determine whether the person is qualified to participate in this procedure. Personnel participating in this procedure are nominally D. Bardas, J. Stamets, G. Asher, C. Warren, and LMMS personnel plus any others approved by the ITD.

## 3.3 SAFETY

### 3.3.1 General

**Safety Engineering is to be notified prior to the start of this procedure.**

All participating personnel shall ensure they are aware of the specific and hardware safety concerns indicated in the safety requirements, cautions, and warnings in the procedure. 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 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 be approved by the Integration Manager.

### 3.3.3 Hardware Safety

Extreme care must be taken to avoid accidentally bumping the Probe or damaging connectors. Only flight-approved connectors can mate with Probe C connectors.

## 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, nominally J. Stamets, 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 P. Unterreiner, 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

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 Integration Manager and Hardware Manager shall be required, if in the judgment of the ITD or QA Representative, experiment functionality or probe integrity may be affected.

### 3.6 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.

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

Flight Hardware

| | |
|---|---|
| Probe-C Assembly, Without Sunshade | P/N 1C34115-102 |

Ground Support Equipment

Probe Gurney
Precision Manipulator (PM)
CLEANROOM bagging
Vacuum can or special oversized can

Tools and Miscellaneous

Allen Wrenches, various
Torque Wrenches, various

# 5 TRANSFER PROBE FROM PM TO GURNEY AND STORE

## 5.1 Rotate Probe for transfer to gurney

5.1.1 Make sure that the X-flange (or appropriate substitute) is attached to the probe.

5.1.2 Make sure the spool is attached to the top of the X-flange.

5.1.3 Rotate the probe 180 degrees so that the Top Hat end is facing the observation window.

5.1.4 Raise the probe to a height of approximately 5 feet, for ample clearance the Gurney.

5.1.5 Rotate the probe on its axis so that it is in the orientation determined to be appropriate for the next operations.

5.1.6 Lock the rotation of the probe by tightening the squeeze clamp at STA 200.

## 5.2 Lower the Probe into the gurney

5.2.1 Using the PM lower the probe until the STA200 ring is in its "V" block support on the gurney and the spool is in the half clamp at one end.

5.2.2 Loosen the 4 bolts from the STA200 adapter to the PM adapter.

5.2.3 Use the PM to gently lift the interface at the STA200 adapter block so that the probe rotates sufficiently until the locking pin can be inserted between the Gurney and the STA200 adapter.

5.2.4. Lower the PM to release the probe.

5.2.5 Replace the other half of the spool clamp and bolt.

## 5.3 Bag and Store the Gurney/Probe

*Note: The next step is done only for the case when the probe is temporarily stored.*

*Note that it may be desirous to add the LMMS oversized vacuum can to the probe at this time if future operations requyire protection of the QBS*

5.3.1 In the CL 10 cleanroom bag the QBS up to STA200 as tightly as possible

5.3.2 Attach the LMMS oversize vac can over the bag and secure to STA 200.

5.3.3 Roll the gurney to the storage location. This may be in the CL 10 room or more likely in the CL 1000 room.

5.3.4 One the gurney is in the desired location, prevent movement by raising the gurney off its wheels by lifting it on its jacks.

*Take pictures (if digital, imbed in this document)*

## 6 PROCEDURE COMPLETION

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

Integration Engineer _____ 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 _____

## 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

*Take a picture (if digital, imbed in this document)*

*Take a picture (if digital, imbed in this document)*