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

PROCEDURE FOR POLISHING CAGING ROD

GP-B SCIENCE MISSION PROCEDURE

13 January1999

PREPARED _____
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PREPARED _____
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APPROVED _____
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1. SCOPE

This procedure describes the method used for polishing the spherical surface on the end of the Science Mission Caging Rods, Part Number 22798-101. It assumes the rods are machined to drawing 22798, except for the final polishing.

2. REFERENCES

Drawing Number 22798, Caging Rod

3. GENERAL REQUIREMENTS

3.1 Environmental Requirements

This procedure will be conducted at Hayden Precision Finishing.

3.2 Personnel

John Stamets has overall responsibility for the implementation of this procedure and shall sign off the completed procedure. The polishing shall be done by Joe Hayden, Hayden precision finishing.

3.3 Safety

3.3.1 General

Only experienced personnel under the direction of Joe Hayden shall be allowed to operate the polish machine Safety glasses shall be worn when operating the polishing machine.

3.4 Quality Assurance

Polishing shall be conducted on a formal basis to this approved and released procedure. A Quality Assurance representative shall review and document any discrepancy noted during this procedure, and approve its disposition. Upon completion of each 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.

3.5 Red-line Authority

Authority to red-line (make minor changes during execution) this procedure is given solely to John Stamets and Joe Hayden.

4 REQUIRED EQUIPMENT

Caging Rods, P/N 22798-101 Rev A

Length, L	Lot Date Code

GSE
Single crystal aluminum oxide grinding tool of same radius as caging rod surface
Quartz or Pyrex grinding tool of same radius as caging rod surface minus 1 mm
Polishing pad (1 mm thick)
Polish machine @ Hayden Precision finishing
Aluminum oxide abrasive (6 µm, 3µm, 1µm, 0.3µm particle sizes)
Wide view Microscope, maximum 100 X Magnification
Colloidal silica solution
Spherometer gauge

5. OPERATIONS

5.1 Initial Preparation

5.1.1 Fabricate a convex grinding tool of the same radius as the lens (the Caging Rod surface) to within 0.0005 inch. A spherometer gauge is used as the reference sphere. This tool is the grinding tool, and is nominally made of single crystal aluminum oxide.

5.1.2 Fabricate a convex grinding tool of the same radius as the lens minus the thickness of the intended polishing pad (in this case, 1 mm) to within 0.0005 inch. A spherometer gauge is used as the reference sphere. This tool is the polishing tool, and is nominally made of any metal.

5.2 Grinding

5.2.1 Mount the grinding tool in the polishing Machine.

5.2.2 Mix powdered aluminum oxide abrasive to a paste, using 6 µm particle size first.

5.2.3 Apply paste to the lens/tool interface.

5.2.4 With the tool rotating at 100-200 rpm, rotate lens randomly about tool by hand. The exact tool rotation speed is determined by operator experience.

5.2.5 Visually inspect with the stereo microscope at 12X magnification to ensure there are no scratches and the spherical surface is uniform. Inspection and iteration is determined through operator experience.

5.2.6 With the same grinding tool, repeat steps 5.2.2 through 5.2.5, using a 3 µm particle size for the abrasive.

5.2.7 With the same grinding tool, repeat steps 5.2.2 through 5.2.5, using a 1 µm particle size for the abrasive.

5.3 Polishing

5.3.1 Glue the polishing pad on the polishing tool.

5.3.2 Mount the polishing tool on the polish machine.

5.3.3 Mix powdered aluminum oxide abrasive to a paste, using 1 µm particle size first.

5.3.4 Apply paste to the lens/tool interface.

5.3.5 With the tool rotating at 100-200 rpm, rotate lens randomly about tool by hand. The exact tool rotation speed is determined by operator experience.

5.3.6 Visually inspect with the stereo microscope at 12-25X magnification to ensure there are no scratches and the spherical surface is uniform. Inspection and iteration is determined through operator experience.

5.3.7 With the same grinding tool, repeat steps 5.3.3 through 5.3.6, using a 0.3 µm particle size for the abrasive.

5.3.8 As a final step, apply a colloidal silica solution on the pad, and rotate lens randomly about tool by hand.

5.3.9 Inspect with the microscope at approximately 25X to ensure there are no scratches and the spherical surface is uniform. When completed, the surface finish will be 1.0 µ smoothness.

6 PROCEDURE COMPLETION

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

Responsible Engineer _____ 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:

- Name, number and revision of this procedure