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

PRELIMINARY TESTING OF THE GMA
GPB ENGINEERING PROCEDURE

P0662 Rev A
September 6, 2000

PREPARED	R. Stephenson, GMA Engineer	Date
APPROVED	G. Asher, GMA REE	Date
APPROVED	D. Ross, Quality Assurance	Date
APPROVED	B. Muhlfelder, Hardware Manager	Date

TABLE OF CONTENTS

1. SCOPE

The purpose of this procedure is to show basic workability of the SM GMA. Simple tests will be done to insure that the GMA valves open and close, and that there are no major leaks. During these tests, all gas connections to the GMA (VCR's, Gamahs, etc) will be fitted with "connector savers" to remove the chance of wear or damage. By the same logic, all electrical connections to the solenoids and pressure sensors will be made through "connector savers". For this reason, the mate/demate cycles of the electronic connectors will not be monitored. The number of open/close cycles for the solenoid valves will, however, be recorded.

All work on the GMA will be done in Room 132 under the laminar flow hood or a similarly clean environment.

For this test, either the old regulator jumper line must be installed, or the gamah connectors must be plugged where the jumper connects.

2. TEST INFORMATION

- Proper care should be taken in handling components, and their cleanliness must be preserved.
- Temperature: Room temperature
- Humidity: not critical

2.1 Cleanliness

2.1.1 Normal lab environment when components are double bagged.

2.1.2 Class 10 clean room, or a clean hood in class 1000 or 10,000 clean room when valves are open to atmosphere.

2.2 ESD precautions

None required.

2.3 Use of Connector Savers

Connector savers will but used on all gas and electrical connections.

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

QA Notified_____ ONR Notified _____

2.4 Personnel, QA, and Documentation

The Test Director (TD) shall be Rick Stephenson or an alternate that he shall designate. The TD has overall responsibility for the implementation of this procedure and shall sign off the completed procedure and relevant sections within it. The GMA REE shall also sign off the completed "As-Built" procedure.

Integration Engineers and other personnel. All engineers and technicians participating in this procedure shall work under the direction of the TD who shall determine personnel that are qualified to participate in this procedure. Participants in this procedure are to be R. Stephenson and G. Asher.

The test 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 D. Ross shall be present during the procedure (if deemed necessary) and shall review any discrepancies noted and approve their disposition. Upon completion of this procedure, the QA Manager, D. Ross or her designate, shall certify their 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. If a re-test of any or all of the hardware is necessary, the TD will determine the appropriate changes in the procedure, with the QA Manager's approval.

2.5 Red-line Authority

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

DOCUMENTS AND EQUIPMENT

3.1 Applicable Documents

Document number	Rev	Description
25110	B	GMA Assembly
25111	A	Caging Component Assembly
25112	B	Spinup Component Assembly
25113	C	Regulator Component Assembly
26211-101	B	Solenoid Valve Assembly
P0499	–	Probe Fastener Staking
P0585	–	GMA Leak Test

3.2 Test Equipment

Equipment	Model and Serial Number	Calibration
Solenoid Control Box		P0621
Pressure sensor readout		
Epoxy	2143D	
Nitrogen		
Helium		
Leak Detector		

3.3 Flight Parts

Description	Model and Serial Number	Comments
Flight GMA	25110	
Pallet Harness	26202	

4 FLOW VERIFICATION TEST OF SPINUP VALVES

This test will simply show that each solenoid valve functions. This entails opening and closing on command, and stopping gas flow when closed.

Started on: _____

4.1 Place GMA in Clean room and prepare all tools and necessary GSE.

4.2 Install connector savers to all gas ports on the GMA, and all solenoid electronic connectors.

4.3 Attach Nitrogen tank to spinup exhaust line SD2A and set the regulator to 15-20 psig.

4.4 Hold a small beaker of alcohol so that the end of a spinup line is submerged in it.

4.5 With Nitrogen supply on, manipulate the valves to verify flow (and stoppage of flow) with each valve, by watching for bubbles of air in the alcohol beaker.

4.6 Monitor pressure sensor readings during test to make sure they are functioning correctly. Record results in Table 1.

4.7 Repeat for each spinup line.

5 WORKABILITY TEST OF REGULATOR ASSEMBLY

This test will simply show that each solenoid valve functions. This entails opening and closing on command, and stopping gas flow when closed.

Started on: _____

5.1 Make sure that GMA is in clean room and connector savers are installed (should have been done in previous test).

5.2 Attach leak detector to SD2A and close off other outlet. Attach nitrogen supply to SD1.

5.3 Make sure each solenoid in the regulator assembly and the manual valves to SD1 are closed, and the path through the spinup assembly manifold (not to a spinup line) is open.

5.4 Start leak detector and draw a vacuum in the manifold.

5.5 Open one solenoid at a time in the regulator assembly and watch for a pressure spike on the leak detector. Then close the valve and fill it from behind with nitrogen by manipulating solenoids and manual valves.

5.6 In this fashion, make sure that all solenoids function.

5.7 Monitor pressure sensor readings during test to make sure they are functioning correctly. Record results in Table 1.

5.8 Finally, open all solenoids and HPM1 to draw a vacuum on the entire assembly. This is a way to check for gross leaks in the assembly.

6 FLOW VERIFICATION TEST OF CAGING VALVES

Started on: _____

6.1 Make sure that GMA is in clean room and connector savers are installed (should have been done in previous test).

6.2 Attach Nitrogen tank to CD2.

6.3 Hold a small beaker of alcohol so that the end of a caging line is submerged in it.

6.4 With Nitrogen supply on, manipulate the valves to verify flow (and stoppage of flow) with each valve, by watching for bubbles of air in the alcohol beaker.

6.5 Monitor pressure sensor readings during test to make sure they are functioning correctly. Record results in Table 1.

6.6 Repeat for each caging line.

7 LEAK CHECK

Note: P0585 will not be performed exactly as written, due to the jumper assembly not being connected. Connections will have to be made to the gamah fittings (using connector savers, of

course) where the jumper normally connects. Alternately, the old jumper line could be installed for the purposes of this test. Also, the patch panel will be used instead of the ECU to control valves.

Started on: _____

7.1 Perform procedure P0585 with the above modifications.

8 STAKING

Started on: _____

8.1 Upon successful completion of all tests, loosen one screw at a time of each bottom cap.

8.2 Place a small drop of epoxy under the head of the screw and retighten to 30-35 in-lbs.

8.3 Repeat for all bottom cap screws.

8.4 Loosen one solenoid fastening screw at a time.

8.5 Place a small drop of epoxy under the head of the screw and retighten to 20-25 in-lbs.

9 TABLES

9.1 Pressure sensor readings

PRESSURE SENSOR	FUNCTIONAL (YES/NO)	NOTES
CP1		
CP2		
CP3		
CP4		
SP1		
SP2		
SP3		

SP3A		
SP4		
SP5		
SP6		
SP7		
SP8		
SP9		

9.2 Solenoid cycles

	Mark each open or close with an X (close) or and O (open).												
SV1													
SV2													
SV3													
SV4													
SV5													
SV6													
SV7													
SV8													
SV9													
SV10													
SV11													
SV12													
SV13													
SV14													
SV15													
SV16													
SV17													
SV18													
SV19													
SV20													
SV21													
SV22													
SV23													
SV24													
CV1													
CV1A													
CV2													
CV2A													
CV3													
CV3A													
CV4													
CV5													

10 PROCEDURE COMPLETION

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

_____ date: _____
Test Engineer

Discrepancies if any:

Approved: _____ date: _____
GMA REE

Approved: _____ date: _____
QA Representative

Approved: _____ date: _____
QA Manager

11 DATA BASE ENTRY

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

- Name, number and revision of this procedure
- Date of successful completion of procedure.

- Part numbers and serial numbers of Caging Units and their components