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

TEST OF GMA SPINUP ASSEMBLY PRESSURE SENSOR CALIBRATION

GP-B SCIENCE PROCEDURE

P0828 Rev –

14 March, 2001

PREPARED _____ _____
R. Stephenson, GMA Engineer Date

APPROVED _____ _____
C. Gray, GMA REE Date

APPROVED _____ _____
B. Farley Electronics Engineer Date

APPROVED _____ _____
D. Ross, Quality Assurance Date

APPROVED _____ _____
B. Muhlfelder, Hardware Manager Date

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A SCOPE

This procedure tests the pressure calibration scripts derived from data collected in P0807 Rev –. It will be run first on the ECU Engineering Unit (ECU/EU) and later on the ECU Flight Unit (ECU/FU) to show that the pressure sensors are properly calibrated. This data will be crucial in setting the metering valves to produce the correct flow rates for spinup. The data from the ECU will be compared to two known and calibrated pressure gauges. Hopefully the readings will be within 5% of each other.

B SAFETY

No safety concerns.

C. QUALITY ASSURANCE

C.1 QA Notification

This assembly will be conducted on a formal basis to approved and released procedures. **The QA program office and ONR representative shall be notified 24 hours prior to of the start of this procedure**. A Quality Assurance Representative, designated by D. Ross 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, D. Ross or her designate, will certify her 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.

C.2 Red-line Authority

Authority to redline (make minor changes during execution) this procedure is given solely to the Test Engineer or his designate and shall be approved by the QA Representative.

C.3 Discrepancies

Discrepancies will be recorded in a D-log or as a DR per Quality Plan P0108.

D TEST PERSONNEL

The Test Engineer shall be Rick Stephenson or an alternate that he shall designate. The Engineer has overall responsibility for the implementation of this procedure and shall sign off the completed procedure and relevant sections within it.

E REQUIREMENTS

E.1. Electrostatic Discharge Requirements

N/A

E.2. Lifting Operation Requirements

N/A

E.3. Hardware/Software Requirements

ECU Engineering Unit

ECU Flight Unit

Interface cables from ECU to GMA (Engineering)

Interface cables from ECU to GMA (Flight, with built in resistors)

GMA Assembly 25110 Rev D

Potentiometer Assembly and Wiring Breakouts (for use with ECU/EU)

Appropriate CSTOL calibrations for use with both Flight and Engineering ECU's

Leak detector, Alcatel, internally calibrated

Caging GSE Box with Pressure Sensor S/N_____ Calibration Due _____

(optional)Baratron Gauge S/N_____ Calibration Due _____

Clean Nitrogen supply for back filling.

E.4. Instrument Pretest Requirements

N/A

E.5. Configuration Requirements

N/A

E.6. Optional Non-flight Configurations

N/A

E.7. Verification/ Success Criteria

Pressure values from ECU should be within 8% of measured values from calibrated GSE gauge. See section G7.

E.8. Constraints and Restrictions

N/A

F. REFERENCE DOCUMENTS

F.1. Drawings

25110 rev D GMA Assembly

F.2. Supporting documentation

N/A

F.3. Additional Procedures

N/A

G. OPERATIONS

G.1. Verify Appropriate QA Notification

QA Notified_____ ONR Notified_____

G.2. Verify Configuration Requirements

N/A

G.3 Calibration Check of the GMA Spinup Sensors With the ECU EU

Started on: _____

3.1 Verify connector saver valves are installed on all GMA gas ports and are closed.

3.2 Connect leak detector and nitrogen supply to caging GSE box.

3.3 Purge nitrogen gas for 5 minutes at 10 psig and do a particle check. Requirement is less than 3 particles at 0.5 um or greater. (initial here if passes)_____

3.4 Connect Caging GSE box to Ballast Bottle Port on the GMA Assembly.

3.5 If necessary, connect Baratron gauge to SD2B.

3.6 Connect the Potentiometer Assembly to the GMA Assembly using the pigtails per D**iagram 1**.

3.7 Connect the ECU/EU to the pigtails and initialize the ECU. Make sure to load the appropriate CSTOL script for Engineering ECU calibrations.

3.8 Close HPM1 and HPM2. Open HPM3, Ballast Manual Valve, and connector saver valves at SD2B and Ballast Port. Close the Metering valve on the caging box and the manual valves on the caging box.

3.9 Close all GMA solenoid valves.

3.10 Open all Spinup solenoid valves (SV1-SV24).

3.11 Evacuate this area of the GMA with the leak detector and check for leaks at the connections.

3.12 Record the pressure from the Transducer in the caging GSE box and the Baratron (if available) in Table 1.

3.13 Close SV1, 2, 3 and 4.

3.14 Introduce Nitrogen by opening the metering valve on the caging box a little bit and allowing the pressure to rise to about 1.5 psia. Allow to stabilize.

3.15 Record the pressure and the values returned by SP5-SP9 in Table 1.

3.16 Slowly raise the pressure to about 3.5 psia. Allow to stabilize.

3.17 Record the pressure and the values returned by SP5-SP9 in Table 1.

3.18 Slowly raise the pressure to about 4.9 psia. Allow to stabilize.

3.19 Record the pressure and the values returned by SP5-SP9 in Table 1.. Also record the value of SP4.

3.20 Slowly raise the pressure to about 10 psia. Allow to stabilize.

3.21 Record the pressure and the values returned by SP4 in Table 1..

3.22 Slowly raise the pressure to about 15 psia. Allow to stabilize.

3.23 Record the pressure and the values returned by SP4, SP3A, and SP3B in Table 1..

G.4 Establish Final Configuration

4.1 Close all GMA solenoid valves and all manual valves.

4.2 Disconnect Caging GSE box.

4.3 Connect Caging GSE box to SD1.

4.4 Open SV1-4 and HPM1 and HPM2 and fill this space with approximately 1 atm. of nitrogen.

4.5 Close all solenoid valves and disconnect all GSE.

G.5 Calibration Check of the GMA Spinup Sensors With the ECU FU

Started on: _____

5.1 Verify connector saver valves are installed on all GMA gas ports and are closed.

5.2 Connect leak detector and nitrogen supply to caging GSE box.

5.3 Purge nitrogen gas for 5 minutes at 10 psig and do a particle check. Requirement is less than 3 particles at 0.5 um or greater. (initial here if passes)_____

5.4 Connect Caging GSE box to Ballast Bottle Port on the GMA Assembly.

5.5 If necessary, connect Baratron gauge to SD2B.

5.6 Connect the ECU to the GMA and initialize the ECU. Make sure to load the appropriate CSTOL script for Flight ECU calibrations.

5.7 Close HPM1 and HPM2. Open HPM3, Ballast Manual Valve, and connector saver valves at SD2B and Ballast Port. Close the Metering valve on the caging box and the manual valves on the caging box.

5.8 Close all GMA solenoid valves.

5.9 Open all Spinup solenoid valves (SV1-SV24).

5.10 Evacuate this area of the GMA with the leak detector and check for leaks at the connections.

5.11 Record the pressure from the Transducer in the caging GSE box and the Baratron (if available) in Table 2.

5.12 Close SV1, 2, 3 and 4.

5.13 Introduce Nitrogen by opening the metering valve on the caging box a little bit and allowing the pressure to rise to about 1.5 psia. Allow to stabilize.

5.14 Record the pressure and the values returned by SP5-SP9 in Table 2.

5.15 Slowly raise the pressure to about 3.5 psia. Allow to stabilize.

5.16 Record the pressure and the values returned by SP5-SP9 in Table 2.

5.17 Slowly raise the pressure to about 4.9 psia. Allow to stabilize.

5.18 Record the pressure and the values returned by SP5-SP9 in Table 2. Also record the value of SP4.

5.19 Slowly raise the pressure to about 10 psia. Allow to stabilize.

5.20 Record the pressure and the values returned by SP4 in Table 2.

5.21 Slowly raise the pressure to about 15 psia. Allow to stabilize.

5.22 Record the pressure and the values returned by SP4, SP3A, and SP3B in Table 2.

G.6 Establish Final Configuration

6.1 Close all GMA solenoid valves and all manual valves.

6.2 Disconnect Caging GSE box.

6.3 Connect Caging GSE box to SD1.

6.4 Open SV1-4 and HPM1 and HPM2 and fill this space with approximately 1 atm. of nitrogen.

6.5 Close all solenoid valves and disconnect all GSE.

G.7 Tables

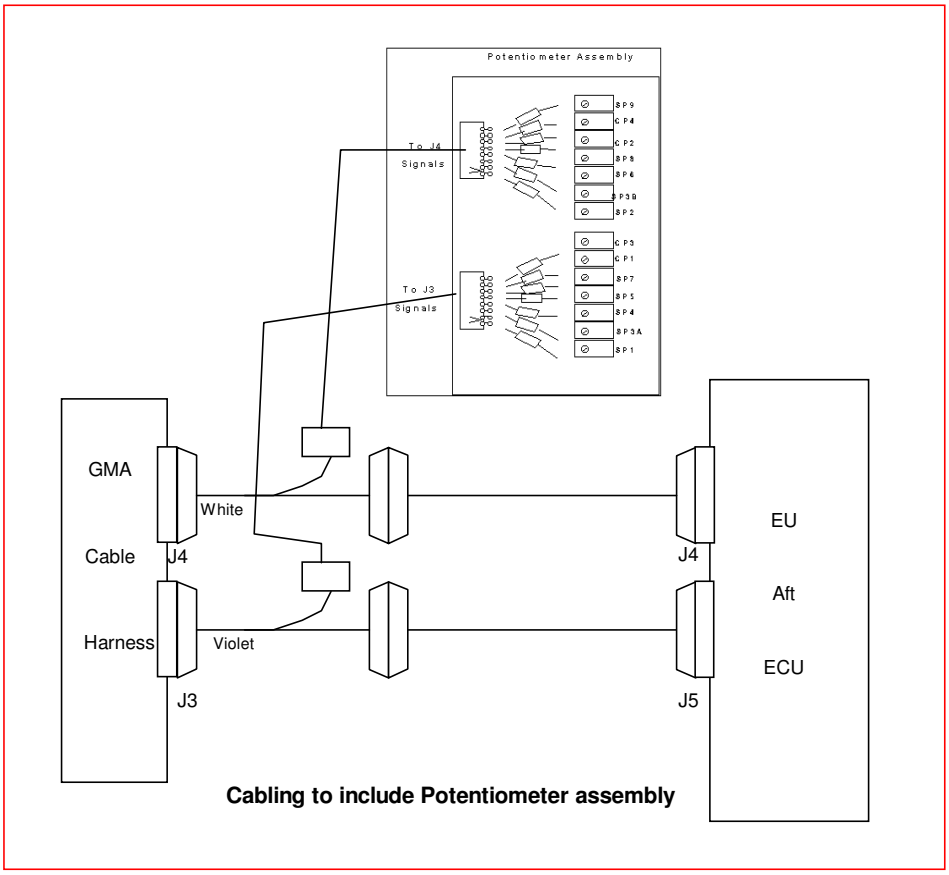
Table 1 ECU/EU Data

			Zero			Low			Middle			High			
Pressure monitor	Gauge S/N	Max P psia	GSE press.	ECU press	% diff.	GSE press.	ECU press	% diff.	GSE press.	ECU press	% diff.	GSE press.	ECU press	% diff.	Time
SP5	986293	5													
SP6	929292	5													
SP7	986296	5													
SP8	986298	5													
SP9	986289	5													
SP4	986294	15													
SP3A	986284	100													
SP3B	986288	100													
			Test engineer:						**Date:**						

Table 1 ECU/FU Data

			Zero			Low			Middle			High			
Pressure monitor	Gauge S/N	Max P psia	GSE press.	ECU press	% diff.	GSE press.	ECU press	% diff.	GSE press.	ECU press	% diff.	GSE press.	ECU press	% diff.	Time
SP5	986293	5													
SP6	929292	5													
SP7	986296	5													
SP8	986298	5													
SP9	986289	5													
SP4	986294	15													
SP3A	986284	100													
SP3B	986288	100													
			Test engineer:						**Date:**						

G.8 Diagram 1



Cabling to include Potentiometer assembly

H PROCEDURE COMPLETION

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

_____ date: _____
GMA Engineer

Mark here ☐ to indicate that all sensors were within acceptable range of known values per section E7.

Discrepancies if any:

Approved: _____ date: _____
C. Gray, GMA REE

Approved: _____ date: _____
QA Representative

Approved: _____ date: _____
D. Ross, QA