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

# GMA SLEEP PROCEDURE

## GP-B ENGINEERING PROCEDURE

P0930 Rev –

*16 September, 2002*

| | | |
|---|---|---|
| PREPARED | R. Stephenson, GMA Engineer | Date |
| APPROVED | C. Gray, GMA REE | Date |
| APPROVED | D. Meriwether, ECU Engineer | Date |
| APPROVED | D. Ross, Quality Assurance | Date |
| APPROVED | R. Brumley, Hardware Manager | Date |

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**REVISION RECORD**

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## A SCOPE

This procedure puts the GMA into a safe valve state to be used at the end of a test day or at any other time where the GMA needs to be shut down. This sequence insures that all wetted (internal) areas of the GMA are filled with helium.

## B SAFETY

The GMA is a gas pressure vessel. Under normal operations, the GMA requires no safety measures or equipment beyond those required for the use of a supply gas cylinder. Note that the GMA is high value space flight item. The GMA supply tanks are also fracture-critical items.

## C QUALITY ASSURANCE

### C.1 QA Notification

This test 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 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 Director 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 Director shall be Chris Gray or an alternate that he shall designate. The Director 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 Flight or Flight Equivalent Unit (FEU)

Interface cables from ECU to GMA

CSTOL script "gma_sleep.prc"

Flight GMA

GMA Outlet Manifold

Torque wrench 50 inch-lb. or higher Calibration Due_____ Serial number_____

### E.4. Instrument Pretest Requirements

All equipment used must be "in calibration."

### E.5. Configuration Requirements

None

### E.6. Optional Non-flight Configurations

N/A

### E.7. Verification/ Success Criteria

GMA will be pressurized with all solenoid valves closed.

### E.8. Constraints and Restrictions

none

## F REFERENCE DOCUMENTS

### F.1. Drawings

GMA Schematic, Dwg. Number 26273

### F.2. Supporting documentation

S0681 "CSTOL Scripts for GMA Testing"

### F.3. Additional Procedures

none

## G OPERATIONS

### G.1. Verify Appropriate QA Notification

QA Notified_____ ONR Notified_____

## G.2. Verify Configuration Requirements

Verify that the four Spinup outlets as well as the Vent and P1A outlets have a manual valve attached that can be shut off (or are securely capped). These will be designated OMG1, OMG2, OMG3, OMG4, OMP1A, and OMVent for the purposes of this procedure.

Quality _____

## G.3 Putting the GMA into Sleep Mode

**Started on**: _____

Note: Mark off each step of procedure as it is completed.
All GMA solenoids will be operated using the ECU (flight or FEU).

**WARNING**

HELIUM USED IN THE GRAVITY PROBE-B PROGRAM REPRESENTS A HAZARDOUS MATERIAL FOR THE PERSONNEL INVOLVED IN TESTING AND CRYOGENIC SYSTEM OPERATIONS. EXTREME CARE SHOULD BE USED WHEN WORKING AROUND OR WITH HELIUM.

3.1 Close/verify closed MV1, MV2, MV3, and MV4 and torque to 40 ±5 in.-lbs. and record torque here:

| | MV1 | MV2 | MV3 | MV4 |
|---|---|---|---|---|
| Torque (in-lbs.) | | | | |

3.2 Close all outlet manifold valves, OMG1, OMG2, OMG3, OMG4, OMP1A, and OMVent (and OMVent2 if available).

Quality: _____

3.3 Verify ECU is connected to the GMA and running.

3.4 Start CSTOL script "gma_sleep.prc."

3.5 Use this script to open all GMA solenoid valves, V30 – V1.

3.6 Record the GMA pressures at GP1 through GP6 here:

| | GP1 | GP2 | GP3 | GP4 | GP5 | GP6 |
|---|---|---|---|---|---|---|
| Expected | – | =GP1 | =GP1 | >15 | >15 | >15 |
| Pressure | | | | | | |

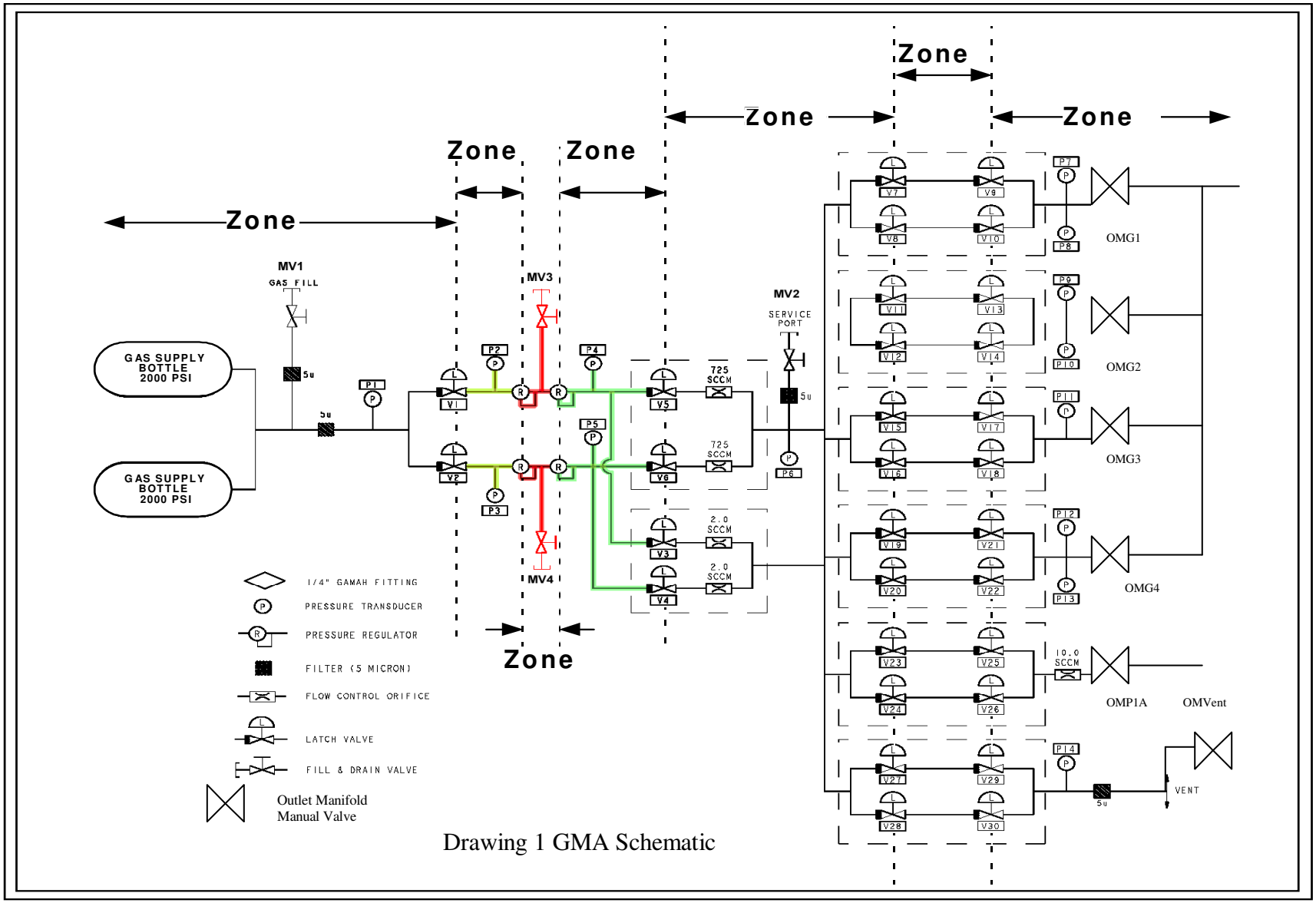
3.7 Verify that GP3, GP4, GP5, and GP6 are all greater than 15 psia.

3.8 Use the ECU script to close all GMA solenoid valves, V30 – V1.

3.9 Shut down the ECU, if desired.

Quality _____

## G.4 Drawings




Drawing 1 GMA Schematic

## G.5 Pre-Test Checklist

| DATE | PROCEDURE # | CHECKLIST ITEM | COMPLETED | REMARKS |
|---|---|---|---|---|
| | | 1. VERIFY THE TEST PROCEDURE BEING USED IS THE LATEST REVISION. | | |
| | | 2. VERIFY ALL CRITICAL ITEMS IN THE TEST ARE IDENTIFIED AND DISCUSSED WITH THE TEST TEAM. | | |
| | | 3. VERIFY ALL REQUIRED MATERIALS AND TOOLS ARE PRE-STAGED AND AVAILABLE IN THE TEST AREA. | | |
| | | 4. VERIFY ALL HAZARDOUS MATERIALS INVOLVED IN THE TEST ARE IDENTIFIED TO THE TEST TEAM. | | |
| | | 5. IF HELIUM IS TO BE USED VERIFY THAT A BLUE "HELIUM" TAG IS AROUND THE NECK OF THE HELIUM CYLINDER. | | |
| | | 6. VERIFY ALL HAZARDOUS STEPS TO BE PERFORMED ARE IDENTIFIED TO THE TEST TEAM. | | |
| | | 7. VERIFY EACH TEAM MEMBER KNOWS THEIR INDIVIDUAL RESPONSIBILITIES. | | |
| | | 8. CONFIRM THAT EACH TEST TEAM MEMBER CLEARLY UNDERSTANDS THAT HE/SHE HAS THE AUTHORITY TO STOP THE TEST IF AN ITEM IN THE PROCEDURE IS NOT CLEAR. **NOTE**: **DURING A HAZARDOUS OPERATION THE TEST WILL ONLY BE STOPPED WHEN IT IS SAFE TO DO SO**. | | |
| | | 9. CONFIRM THAT EACH TEST TEAM MEMBER CLEARLY UNDERSTANDS THAT HE/SHE HAS THE AUTHORITY TO STOP THE TEST IF THERE IS ANY ANOMALY OR SUSPECTED ANOMALY **NOTE: DURING A HAZARDOUS OPERATION THE TEST WILL ONLY BE STOPPED WHEN IT IS SAFE TO DO SO** | | |
| | | 10. NOTIFY MANAGEMENT OF ALL DISCREPANCY REPORTS OR D-LOG ITEMS IDENTIFIED DURING THE PROCEDURE. IN THE EVENT AN INCIDENT OCCURS DURING PROCEDURE PERFORMANCE, MANAGEMENT WILL BE NOTIFIED IMMEDIATELY. | | |
| | | 11. CONFIRM THAT EACH TEST TEAM MEMBER UNDERSTANDS THAT THERE WILL BE A POST-TEST TEAM MEETING. | | |
| | | TEAM LEAD SIGNATURE: | | |

## G.6 Post Test Checklist

| DATE | PROCEDURE # | CHECKLIST ITEM | COMPLETED | REMARKS |
|---|---|---|---|---|
| | | 1- VERIFY ALL STEPS IN THE PROCEDURE WERE SUCCESSFULLY COMPLETED. | | |
| | | 2- VERIFY ALL MINOR/MAJOR DISCREPANCIES DISCOVERED DURING TESTING ARE PROPERLY DOCUMENTED. | | |
| | | 3- ENSURE MANAGEMENT HAS BEEN NOTIFIED OF ALL MINOR/MAJOR DISCREPANCIES. | | |
| | | 4- ENSURE THAT ALL STEPS THAT WERE NOT REQUIRED TO BE PERFORMED ARE PROPERLY IDENTIFIED. | | |
| | | 5- IF APPLICABLE SIGN-OFF TEST COMPLETION. | | |
| | | | | |
| | | TEAM LEAD SIGNATURE | | |

**H PROCEDURE SIGN OFF**

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

_____ date: _____
Test Director

Discrepancies if any:

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

Approved: _____ date: _____
QA Representative

Approved: _____ date: _____
D. Ross, QA