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

GMA SLEEP PROCEDURE
AT VAFB

GP-B ENGINEERING PROCEDURE

To be performed at Vandenberg Air Force Base
To be performed in Building 1610/MST

THIS DOCUMENT CONTAINS NON-HAZARDOUS OPERATIONS

P0962 Rev –

26 February, 2003

PREPARED

_____   _____
S. Buchholz, Technical Writer   Date

APPROVED

_____   _____
C. Gray, GMA REE   Date

APPROVED _____   _____
Harv Moskowitz, LMSSC Safety Engineer   Date

APPROVED _____   _____
NASA/KSC Safety   Date

APPROVED _____   _____
D. Ross, Quality Assurance   Date

APPROVED $\underline{\hspace{5cm}}$ $\underline{\hspace{3cm}}$
R. Brumley, Hardware Manager   Date

REVISION HISTORY

Rev	Date	Comments
-	2/26/03	

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List of Abbreviations and Acronyms

AP	Air Products	lpm	Liters per Minute
BIP	Built in Purifier	MEOP	Maximum Expected Operating Pressure
CCW	Counter clockwise	NASA	National Aeronautics and Space Administration
CW	Clockwise		
D-Log	Discrepency Log	psi	pounds per square inch
DR	Discrepency Report	psia	pounds per square inch absolute
ECU	Electronic Control Unit	psig	pounds per square inch gauge
ESD	Electro Static Discharge	ONR	Office of Naval Research
GDS	Gas Delivery System	QA	Quality Assurance
GMA	Gas Management Assembly	scfm	Standard Cubic Feet per Minute
GP-B	Gravity Probe B	SU	Stanford University
He	Helium	TD	Test Director
LM	Lockheed Martin	VAFB	Vandenberg Air Force Base

LIST OF SPECIFIC HEADING DEFINITIONS

Each type of alert message will precede the procedural step to which it applies

1.	NOTE:	Used to indicate an operating procedure of such importance that it must be emphasized
2.	CAUTION: Used to identify hazards to equipment	
3.	WARNING: Used to identify hazards to personnel	

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 the portion of the GMA downstream of the pressure regulators is pressurized to above one atmosphere. This procedure is a revision of P0930, which was used at LM and SU. The revision incorporates requirements for VAFB.

B   SAFETY

B.1   General

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 located under the GMA pallet are also fracture-critical items

B.2   Mishap Notification

B.2.1   Injury

In case of any injury or illness requiring medical treatment - Dial 911

B.2.2   Hardware Mishap

In case of an accident, incident, or mishap, notification is to proceed per the procedures outlined in Lockheed Martin Engineering Memorandum EM SYS229 and Stanford University GP-B P0879. Additionally, VAFB NASA Safety and 30th Space Wing Safety will be notified as required.

B.2.3   Contingency Response

Responses to contingencies/emergency (e.g., power failure) are listed in Section **G.7**.

C   QUALITY ASSURANCE

C.1   QA Notification

This operation will be conducted on a formal basis to approved and released procedures. **The QA program office and NASA program and NASA Safety 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. Additionally, approval by the Payload Technical Manager shall be required if, in the judgement of the TD or QA Representative, experiment functionality may be affected.

C.3   Discrepancies

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

D   TEST PERSONNEL

D.1   Personnel Responsibilities

The Director shall be Chris Gray or an alternate that he shall designate.   The person performing the operations (Test Director or Test Engineer) has overall responsibility for the implementation of this procedure and shall sign off the completed procedure and relevant sections within it.

D.2 Personnel Qualifications

Test Director must have a detailed understanding of all procedures and experience in all of the GMA operations. The Test Director shall designate a Test Engineer as required.

D.3 Required Personnel

The following personnel are essential to the accomplishment of this procedure:

FUNCTIONAL TITLE	NUMBER	AFFILIATION
Test Director/Test Engineer	1	Stanford
GP-B Quality Assurance	1	Stanford

E   REQUIREMENTS

E.1 Electrostatic Discharge Requirements

When working on the space vehicle, proper ESD protection is required. All wrist straps will be checked using a calibrated wrist strap checker prior to use.

E.2 Lifting Operation Requirements

N/A

E.3 Hardware/Software Requirements

- ECU, installed on space vehicle

- CSTOL script "gma_sleep.prc"

- Flight GMA, installed on space vehicle

- Torque wrench Calibration Due_____ Serial number_____

E.4 Instrument Pretest Requirements

All GMA instrumentation used in taking data shall be "in calibration" at time of test.

E.5 Configuration Requirements

- The GMA is physically mounted, plumbed, and electrically grounded on the Space Vehicle (per LMMS INT-334 and SU P0945).
- ECU operations are available.

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

Drawing No.	Title
26273	GMA Schematic, GP-B Dwg

F.2 Supporting Documentation

Document No.	Title
SU/GP-B P0108	Quality Plan
SU/GP-B P059	GP-B Contamination Control Plan
LM/P479945	Missile System Prelaunch Safety Package
EM SYS229	Accident/Mishap/Incident Notification Process
EWR 127- 1	Eastern and Western Range Safety Requirements
KHB 1710.2 rev E	Kennedy Space Center Safety Practices Handbook

F.3 Additional Procedures

Document No.	Title
SU/GP-B P0879	Accident/Incident/Mishap Notification Process
SU/GP-B P0875	GP-B Maintenance and Testing at all Facilities
Various	ECU operations as applicable

G OPERATIONS

G.1 Verify Appropriate QA Notification

QA Notified:

_____
(Date & Time)

G.2 Verify Configuration Requirements

Verify GMA is intended to be left idle for an extended period of time. Complete Pre-Test Checklist in Section **G.5**.

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.

G.3.1 Complete Pre-Test Checklist (Section **G.5**)

G.3.2 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.)				

G.3.3 Close/verify closed Top Hat Valves S1, S2, S3, S4 and P1A. (Torqued to 60 $\pm$ 5 in-lbs)
       Close/verify closed Fill & Drain valves S1, S2, S3, S4 and P1A. (Torqued to 40 $\pm$ 5 in-lbs)

G.3.4 Verify ECU is connected to the GMA and running

G.3.5 Start CSTOL script "gma_sleep.prc."

G.3.6 Use this script to open all GMA solenoid valves.

G.3.7 Record the GMA pressures at GP1 through GP6 here:

	GP1	GP2	GP3	GP4	GP5	GP6
Expected	>300	=GP1	=GP1	>15	>15	>15
Pressure						

G.3.8 Verify that GP3, GP4, GP5, and GP6 are all greater than 15 psia
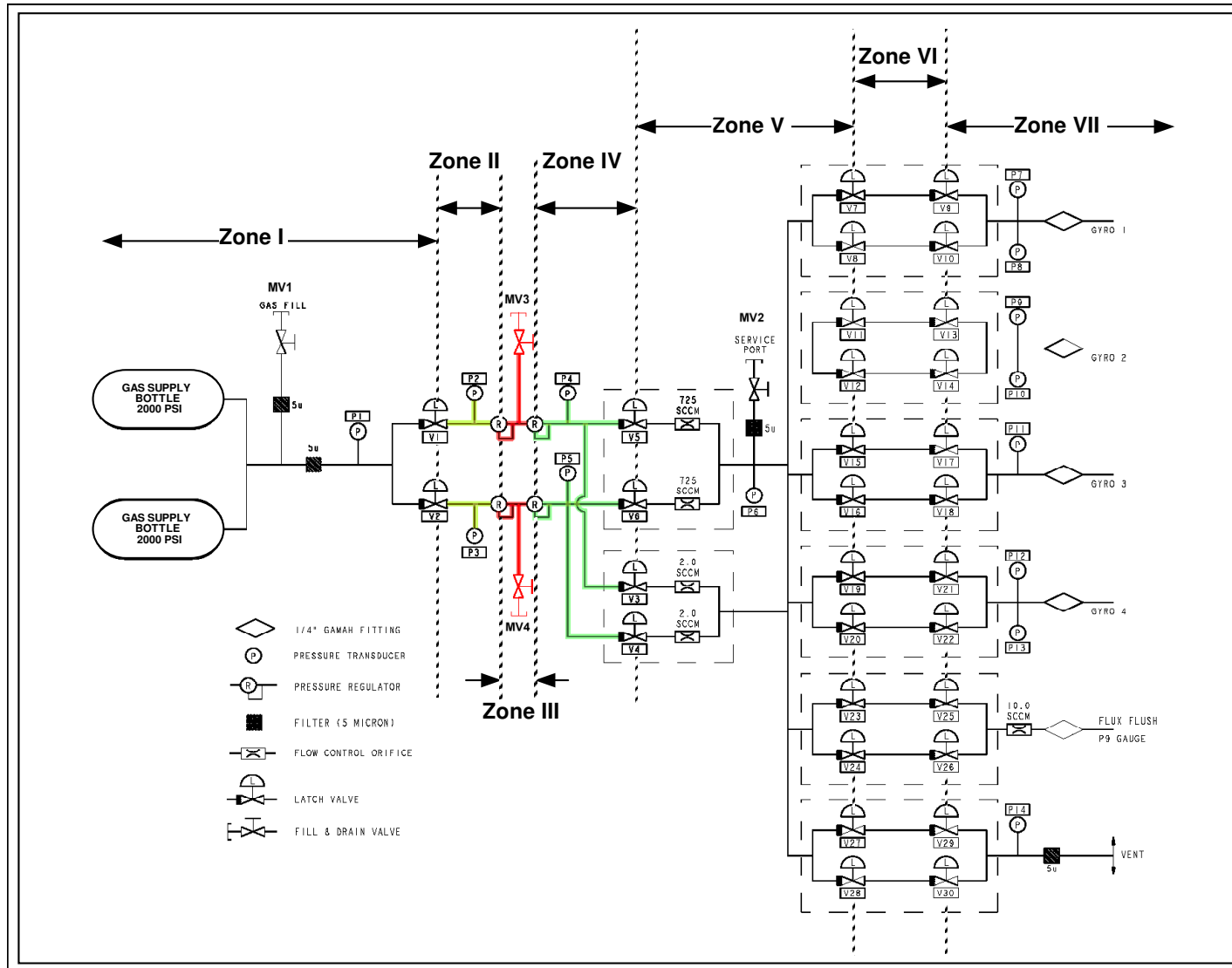
G.3.9 Use the ECU script to close all GMA solenoid valves

G.3.10 Shut down the ECU, if desired

G.3.11 Complete Post Test checklist (Section **G.6**)

Quality _____

G.4 Drawings

G.5 Pre-Test Checklist

DATE	DATE	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 available in the test area.		
		4. Verify all hazardous materials involved in the test are identified to the test team.		
		5. Verify all hazardous steps to be performed are identified to the test team.		
		6. Verify each team member is certified for the task being performed and know their individual responsibilities.		
		7. 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.		
		8. Confirm that each test team member clearly understands that he/she must stop the test if there is any anomaly or suspected anomaly.		
		9. Notify management of all discrepancy reports or d-log items identified during procedure performance. In the event an incident or major discrepancy occurs during procedure performance management will be notified immediately.		
		10. 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	CHECKLIST ITEM	COMPLETED	REMARKS
	1. Verify all steps in the procedure were successfully completed.		
	2. Verify all anomalies discovered during testing are properly documented.		
	3. Ensure management has been notified of all major or minor discrepancies.		
	4. Ensure that all steps not required to be performed are properly identified.		
	5. If applicable sign-off test completion.		
	Team Lead Signature: _____		

G.7 CONTINGENCY/EMERGENCY RESPONSES

In the event of an emergency requiring shutdown and/or evacuation which does allow time for steps to be taken without endangering personnel, the following general steps should be taken, in order of priority (operator to determine sequence):

- Use ECU to close all GMA solenoid valves.
- Record state of GMA and related flight volumes as known (valves open/closed, current pressures, ECU status, etc.).

In the event of a power failure, the Test Director shall implement similar steps as (see above emergency shutdown steps).

In the event that these steps have been taken (in part or whole), when it safe for personnel to return to the equipment:

- The Test Director shall perform an evaluation of the current state of the hardware.
- With concurrence of the GMA Responsible Engineer and QA, the Test Director shall issue a d-log detailing the steps required to return the flight equipment to its prior state and to establish which step the procedure shall continue from.
- If the Test Director, Responsible Engineer, or QA believe it necessary, a discrepancy report may be issued for MRB review.

In the event of a liquid nitrogen spill the area will be cleared until all spilled liquid has evaporated.

In the event of a Oxygen Monitor Alarm the facility will be evacuated.

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 Responsible Engineer

Approved: _____   date: _____
    QA Representative

Approved: _____   date: _____
    D. Ross, QA