GRAVITY PROBE B

PROCEDURE FOR

PAYLOAD VERIFICATION

CONFIGURE PAYLOAD FOR TRANSPORT FOLLOWING ACOUSTIC TEST

P0788 Rev-
January 03, 2001

Prepared by: J. Maddocks

Approvals:

Program Responsibility	Signature	Date
Jim Maddocks Cryo Test Director		
D. Murray Cryo. Test Director		
M. Taber Payload Test Director		
Harv Moskowitz LM Safety		
D. Ross GP-B Quality Assurance		
B. Muhlfelder Payload Technical Manager		

NOTES:
Level of QA required during performance of this procedure:
_X_ Stanford QA Representative
___ Government QA Representative

All redlines must be approved by QA

Revision Record:

Rev	Rev Date	ECO #	Summary Description
-			

Acronyms and Abbreviations:

Acronym / Abbreviation	**Meaning**
GSE	Ground Support Equipment
GT	Guard Tank
LGS	Leakage Gas System
MT	Main Tank
NBP	Normal boiling point
PPMS	Probe Pressure Measurement System
RGA	Residual Gas Analyzer
SMD	Science Mission Dewar

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A **Scope**

This procedure effects the preparation of the Payload (Probe-C integrated with the SMD) for shipment to Stanford following Payload Acoustic Test. The shipping configuration is specific to this test and is not necessarily appropriate for other transport situations.

B **Requirements Verification:**

N/A

C **Configuration Requirements**

Probe-C is integrated into the SMD per drawing 65113-1C34292 and oriented with the +Z axis vertical in the Tilt Dolly. The Main Tank is at NBP and venting through the Gas Module valves EV-9 and ERV-1. The Guard Tank is either empty of liquid and being maintained at a pressure slightly above atmospheric by an external source of helium gas, or is at least 15% full of liquid helium. The Well and Probe are both evacuated, and the The Fill Bayonet (B3, see Fig. 1) has a standard GSE Fill Cap Assembly installed.

D **Hardware Required**

D.1 Flight hardware required

Description	No. Req'd
65113-1C34292 Probe-C / Science Mission Dewar Assembly	1

D.2 Commercial test equipment:

Manufacturer	Model	Serial Number	Calibr. Exp. Date
Varian He Leak Detector	960	DRAD6002	N/A
Varian Calibrated He leak for LD	K3264302	LLF0059	5/30/01

D.3 Mechanical/Electrical special test equipment: N/A

D.4 GSE / hardware: N/A.

D.5 Tools

Description	No. Req'd

D.6 Expendables

Description	Quantity

E **Software Required**:

N/A

F **Procedures Required**

(Note: The following should be available; however, depending on circumstances, not all will be needed.):

SU GP-B Procedures

P0213, *SMD Connection of High Vacuum Module*
P0214*, Stop Pumping SMD Vacuum Shell / Disconnect Vacuum Module*

P0442*, Main Tank Fill with Guard Tank Precool – Main Tank at NBP*
P0595*, Reduce Level in MT (Liquid at NBP)*
P0613*, Repump Well with Probe Installed*
P0648*, Main Tank Fill After Uprighting – Guard Tank Initially Empty*
P0675*, Disconnect MT Vent Line from Gas Module – MT at NBP*
P0677*, Disconnect GT Vent Line from GM*
P0778*, Disconnect Electrical GSE from SMD*
P0789*, Connect TM&A to SMD*
P0794*, Drain GT into MT*
P0797*, Pressurize the Guard Tank*
P0801, *Guard Tank Pressurization for Transport*
Lockheed Procedures
PAT-008, *Post-Acoustic Test GP-B Payload Operations*.
PAT-023, *Tilt of GP-B Payload in S/V Tilt Dolly*
PAT-018, *GP-B Flight Sunshade Removal from Payload*
PAT-010, *Move GP-B Payload from B/159 Acoustic Cell to Transport Area*
PAT-011, *Install GP-B Payload in Medium Payload Transporter at LMB-159*

G **Equipment Pretest Requirements**: **N/A**

H **Personnel Requirements**

This procedure is to be conducted only by certified personnel. Persons certified to perform this procedure are Mike Taber, Dave Murray, Jim Maddocks, and Tom Welsh.

I **Safety Requirements**

These operations are to be performed in the vicinity of and on flight equipment. All tools that could drop onto flight equipment shall be tethered. Helium gas venting from the SMD shall be vented through the facility exhaust duct. Safety requirements in procedures called by this procedure shall be observed.

J **General Instructions**

J.1 QA Notification: ***The ONR representative and SU QA program office shall be notified 24 hours prior to the start of this procedure.*** Upon completion of this procedure, the QE Manager 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.

J.2 Redlines can be initiated by Mike Taber and must be approved by QA.

J.3 A Quality Assurance Representative designated by D. Ross shall review any discrepancy noted during this procedure, and approve its disposition. Discrepancies will be recorded in a D-log or a DR per Quality Plan P0108.

J.4 Work done inside the HEPA filter downflow unit should with proper clean room garb consistent with Class 1000 conditions.

K **References and Applicable Documents: N/A**

Op. Order No._____
Date Initiated_____
Time Initiated_____

L Operations

L.1 Verify Appropriate QA Notification

- o Verify SU QA program office notified.

  Record: Individual notified _____,

  Date/time _____/_____.

- o Verify ONR representative notified.

  Record: Individual notified _____,

  Date/time _____/_____.

L.2 Turn on/verify on Acoustic Cell exhaust fan. Ensure fan running in “normal” mode.

L.3 Check pressure in the SMD vacuum jacket:

L.3.1 Turn on the Ion Pump and record time / date:_____

L.3.2 Initiate [Monitor Data] on the DAS using channel no. 99.

L.3.3 Wait until the pressure stabilizes and record vacuum jacket pressure (IP):_____torr.

L.3.4 Exit [Monitor Data] and collect data with [Set Data Interval] (use existing data interval).

L.3.5 After the data cycle is complete, turn off the Ion Pump.

L.4 If the pressure measured by the Ion Pump is $>8 \times 10^{-6}$ torr, pump on the on SMD vacuum jacket using P0213, Connect Vacuum Module / Pump on SMD Vacuum Shell. Record the Op No.:_____.

L.5 Record liquid levels in Main Tank and Guard Tank:

Main Tank:_____%

Guard Tank:_____%

L.6 Prepare Main Tank for transport.

L.6.1 If Main Tank is >52% full, perform P0595, *Reduce Liquid Helium Level in Main Tank (Liquid at NBP),* adjust level to 50 – 52%.

Record: Date/time _____/_____, Op. No.:_____.

L.6.2 If Main Tank is <40% full, fill Main Tank to 50 –52% using one of the following procedures:

- Guard Tank empty: Perform P0648, *Main Tank Fill After Uprighting – Guard Tank Initially Empty*.

  Record: Date/time _____/_____, Op. No.:_____.

- Guard Tank >15% full: Perform P0442, *Main Tank Fill with Guard Tank Precool – Main Tank at NBP*.

  Record: Date/time _____/_____, Op. No.:_____.

  Note: Guard Tank should not be filled more than necessary.

L.7 Prepare Guard Tank for transport:

- Guard Tank ≤ 15% full: Perform P0797, *Pressurize Guard Tank*, Regulate Guard Tank pressure with Auxiliary Helium Pressurization System through CPR-1 at GTV-Va.

  Record: Date/time _____/_____, Op. No.:_____.

- Guard Tank >15% full: Perform P0794, *Drain Guard Tank into Main Tank*. Regulate Guard Tank pressure with Auxiliary Helium Pressurization System through CPR-1 at GTV-Va.

  Record: Date/time _____/_____, Op. No.:_____.

L.8 If the Well has not been pumped on since the last MT/GT transfer or since any other operation known to introduce He gas into the Well, perform P0613, Repump the Well with the Probe Installed, through section G.4 (Pump on Well). If the Well does not need to be pumped but the Well Vent Manifold is still installed, perform P0613, skipping sections G.4 and G.6, to remove the Well Vent Manifold.

Record: Date/time _____/_____, Op. No.:_____.

L.9 Prepare Guard Tank Vent:

L.9.1 Verify Guard Tank pressure regulated with Auxiliary Helium Pressurization System through CPR-1 at GTV-Va.

L.9.2 Perform P0677, *Disconnect Guard Tank Vent Line from Gas Module*.

L.9.3 Fasten short vent line, containing Guard Tank Vent Valve Assembly and vent cap, securely to dewar.

L.10 Prepare Main Tank Vent (B1) as follows. Perform P0675, Disconnect Main Tank Vent Line From Gas Module – Main Tank at NBP, with the following exceptions and options:

Record: Date/time _____/_____, Op. No.:_____.

Note: In the following steps the long and short vent lines are disconnected from SV-9 and the transport vent cap installed at SV-9, in order that Main Tank venting may be reestablished.

L.10.1.1 Install the Main Tank vent cap specified in Fig. 2 at SV-9 instead of the MTVC specified in P0675;

L.10.1.2 Turn on/verify on Acoustic Cell exhaust fan. Ensure fan running in "normal" mode.

L.10.1.3 Complete procedure through Section G.6.7. Observe the SMD temperatures (particularly at sta 200 and at the top of the lead bag) and pressures (particularly the GT pressure) until it is clear that conditions have stabilized.

L.10.2 When conditions have stabilized, Record:

Date/time _____/_____.

MT pressure (STG) _____ torr.

GT Pressure (GTV-G) _____ torr diff.

Station 200 temperature (CN [01]) _____ (K).

Lead bag temperature (CN [28]) _____ (K)

L.11 If the Well is being pumped on and at least 24 hrs. have elapsed since actual pumping was initiated (or since the last event which introduced helium into the Well, whichever was later), complete P0613, Repump the Well with the Probe Installed, starting at section G.5 and selecting option G.7, which provides for the removal of the Well Vent Manifold.

L.12 Verify that the Well Relief Valve (RV2, 5833420-101) is capped per 5833500.

L.13 Verify that the Well Orbit Vent (pyrovalve) Assembly (PV3, 5833903-101, Rev. A) is mounted on the SMD per 5833500, Rev. C with all openings covered with plastic caps. (Note: The bracket depicted in these drawings is obsolete flight hardware which is acceptable for Payload Acoustic Test but not for flight.) Tape the caps securely in place.

L.14 Verify Thruster Vent installed per Figure 5 (not Figure 1).

L.15 Visually inspect the Probe Cross Flange and Top Hat regions as well as the SMD Top Plate region to ensure that no transport preparation issues involving the forward part of the Payload were overlooked.

L.16 Install / verify installed 90-deg. elbows with plastic dust covers on burst disks BD5A&B and BD7A&B.

L.17 Inspect the vacuum jacket pyrovalve (PV1) to verify that all openings are covered with dust caps. Tape the dust caps securely in place.

L.18 If the Vacuum Module pumping line is connected to the SMD vacuum shell pumpout port (PO), perform P0214, Stop Pumping SMD Vacuum Shell / Disconnect Vacuum Module. Record Op. No.:_____.

L.19 Remove the high voltage cable from the Ion Pump (IP) and verify that the shield and magnet are securely installed.

L.20 Inspect the SMD fill bayonet (B3) to verify that the standard fill cap assembly is installed. Disconnect the pumping line, if connected, and install a KF cap where the pumping line connects.

L.21 Translate tilt-dolly with Payload out of Acoustic Cell (performed by Lockheed personnel per procedure PAT-008, *Post-Acoustic Test GP-B Payload Operations*.

Record: Date/time _____/_____.

L.22 Set up DAS prior to tilting payload.

Note: refer to instructions for definitions and operation of DAS keyboard/mouse.

L.22.1 Input comment to DAS “Begin tilt to horizontal orientation.”

L.22.2 Verify/place DAS in configuration 4m.

L.22.3 Set data collection interval to 5 min.

L.22.4 Set Main Tank liquid level sensor to LLS-A and 1 minute sample intervals.

L.22.5 Start special data collection using the pre-selected channels, except substitute CN [101] (LLS Main Tank) for CN [42] (fill valve V-13), and set to 30 sec. sample rate.

L.23 Tilt Payload to horizontal orientation (performed by Lockheed personnel per procedure PAT-023, *Tilt of GP-B Payload in S/V Tilt Dolly*.

Note: Stanford personnel to monitor temperatures at Station 200 and top of Lead Bag while tilting SMD. Record data in Table 1.

Record: Date/time _____/_____.

L.24 Remove sunshade from Payload once outside Acoustic Cell (performed by Lockheed personnel per procedure PAT-018, *GP-B Flight Sunshade Removal from Payload)*.

L.25 Disconnect Electrical GSE – perform procedure P0778, *Disconnect Electrical GSE from SMD*,.

Record Date/time _____/_____ Op. No. _____.

L.26 Connect TM&A – perform procedure P0789, *Connect TM&A to SMD*. .

Record Date/time _____/_____ Op. No. _____.

L.27 Install the Payload Protective Cover and external bagging per engineering instruction.

L.28 Move Payload, from position outside Acoustic Cell, to transport area.
Record Date/time _____/_____ Op. No. _____.

L.28.1 Remove temporary plastic vent hose from vent cap relief valves and stow plastic hose.

L.28.2 Move payload(performed by Lockheed personnel per procedure PAT-010, *Move GP-B Payload from B/159 Acoustic Cell to Transport Area*. Stanford personnel move Auxiliary Helium Pressurization System together with Payload to keep Guard Tank pressurized.

L.29 Install GP-B Payload in transporter ((performed by Lockheed personnel per procedure PAT-011, *Install GP-B Payload in Medium Payload Transporter at LMB-159*.

L.30 Load Auxiliary Helium Pressurization System onto transporter, per procedure P0801, *Guard Tank Pressurization for Transport,* immediately reconnecting helium gas supply to Guard Tank.

L.31 Rearrange TM&A cabling as necessary, with laptop PC in truck cab.

Operation completed.

Completed by: _____

QA witness: _____

Date: _____

Time: _____

QA Program Engineer_____**Date**_____

Payload Test Director_____**Date**_____

Figure 1 (Note: SMD valve references in the text have an “S” prefix.)

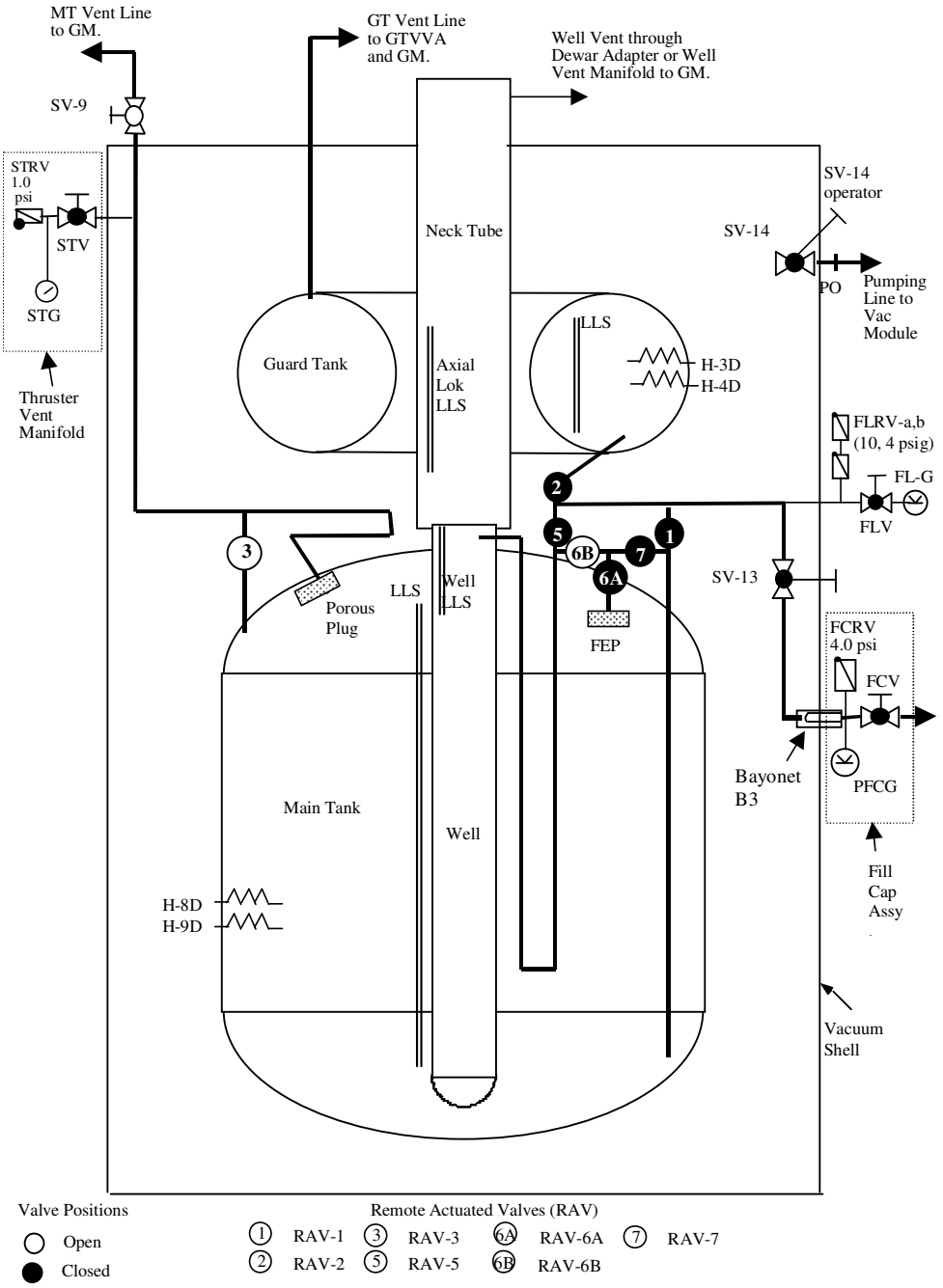

Figure 2 Special Main Tank vent cap for use during transportation.

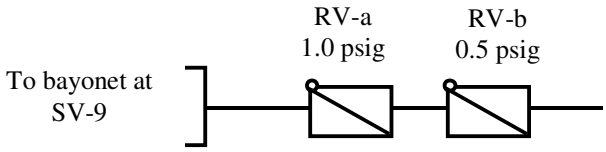

Figure 3 Main Tank vent line cap for use during uprighting after transportation.

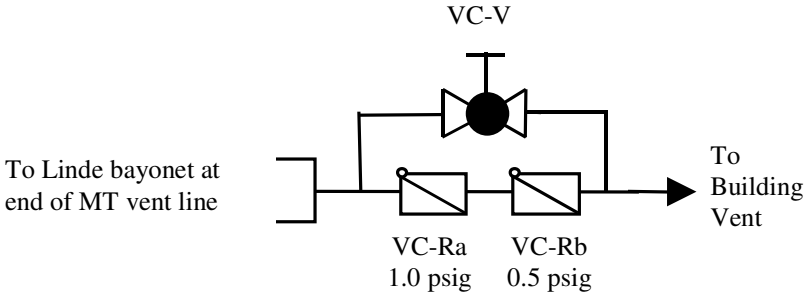

Figure 4 Auxiliary Helium Pressurization System.

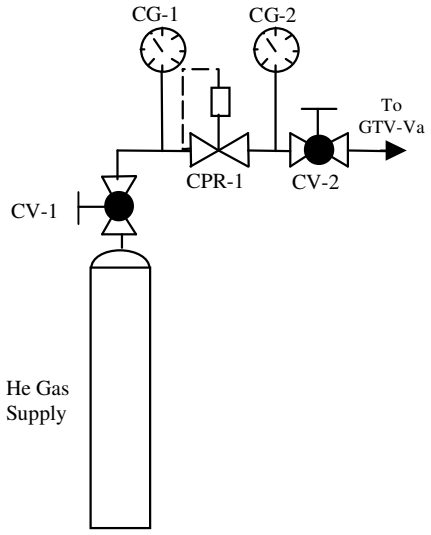

Figure 5. Thruster Vent Relief Assembly