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Gravity Probe B Relativity Mission

CERTIFICATION PROCEDURE FOR THE GYROSCOPE SUSPENSION SYSTEM (GSS) THERMAL VACUUM CHAMBER

GP-B Procedure
P0699 Rev -

Prepared by: Paul Shestople — Date
RE, Global Positioning System (GPS) Group

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RE, Gyroscope Suspension System (GSS) Group

Approved by: Dorrene Ross — Date
GP-B Quality Assurance

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1.0 Revision History

Rev Level	Comments/notes	Date	Revised By
-	First release of this test procedure	3-Mar-00	P Shestople

2.0 Scope

This procedure details the tests required to perform the certification process for the Thermal Vacuum Chamber.

3.0 Reference Documents

3.1 Environmental Stress System, Inc., **Operational Manual for RC 900 Controller**.

3.2 Watlow Controls, **Series 97 User's Manual**.

4.0 Test Facilities

TVAC Chamber Laboratory, HEPL Room 175, Stanford University.

5.0 QA Provisions:

5.1 This procedure shall be conducted on a formal basis to its latest approved and released version. The QA Program Engineer (D. Ross) or their designated representative and ONR shall be notified 24 hours prior to the start of this procedure. QA may monitor the execution of all or part of this procedure should they elect to do so.

5.2 Upon completion of this procedure, the GSS manager and the GP-B QA manager shall certify her/his concurrence that the procedure was performed and accomplished in accordance with the prescribed instructions by signing and dating their approval at the end of this procedure.

6.0 Test Personnel

This test procedure is to be conducted only by the following certified personnel or their designated representatives:

6.1. William Bencze

6.2. Paul Shestople

7.0 General Instructions

7.1. Redlines can be initiated by the certified test personnel listed in Section 6.0 and must be approved by QA.

7.2. Test operators shall read this procedure in its entirety and resolve any apparent ambiguities prior to beginning this test.

7.3. Any nonconformance or test anomaly should be reported by a Discrepancy Report. Refer to the Quality Plan, P0108, for guidance. Do not alter or break test configuration if a test failure occurs; notify quality assurance.

7.4. Only the following persons have the authority to exit/terminate this test or perform a retest: Certified test operators listed in Section 6.0 and GP-B QA.

8.0 Test Equipment

The following support hardware, test equipment, or software will be used and the applicable information for the instruments shall be recorded below. Hand-written additions to this list may be made in the spaces provided.

Equipment Description	Make	Model	SN	Calibration
1. GSS Thermal Vacuum Chamber	Stanford	N/A	02589	N/A
RC 900 Temperature Controller	ESS	RC 900	981S22CCCUEP	
Temperature Controller Alarm 1	Watlow	Series 97	001709	
Temperature Controller Alarm 2	Watlow	Series 97	001710	
Pressure Readout	Varian	CC2C	LIL80064	
2. PC Computer			00895	N/A
COMM6 Software	Watlow	Watlow	N/A	N/A
3. Serial Cable	Any	Any	N/A	N/A
4.				
5.				

9.0 Pre-test Visual Inspection

9.1 Verify that all equipment inside the TVAC chamber is temperature resistant from –60° C to 100° C.

9.2 Inspect the TVAC Chamber Dome O-ring for damage and proper lubrication (use approved vacuum grease for lubrication). Inspect the O-ring mating surface for cleanliness, and clean with isopropyl alcohol or ethanol if necessary.

9.3 Check all cables for damage and strain relief. Ensure that a serial cable is connected from the TVAC Chamber front control panel to the PC serial port, and that the rocker switch on the front panel of the TVAC Chamber control panel is in the RS232 position.

10.0 Test Procedure

10.1 TVAC Chamber

10.1.1 Begin the procedure by closing the TVAC Chamber Dome. Make sure that the bleeder valve (located on the left side of the Chamber base) is closed. Turn on the pump switch, located on the front control panel of the TVAC Chamber. The chamber has a huge volume; at least 15 minutes will elapse before the cold cathode display will read out a pressure. A pressure of 10^{-4} mbar is sufficient for this test. Ensure that a full dewar of liquid Nitrogen is attached to the chamber LN port (located on the right side of the Chamber base), and that the valve is open. Turn on the Cold and Heater switches, also located on the front panel of the TVAC Chamber.

10.1.2 Program the RC 900 Temperature controller, located on the front of the front of the TVAC Chamber control panel, with the following Temperature profile.

Step 1: Set Temp = 100° C, ramp rate = 1° C/min

Step 2: Soak for 2 hours

Step 3: Set Temp = 40° C, ramp rate = 1° C/min

Step 4: Soak for 1 hour.

Step 5: Set Temp = -60° C, ramp rate = 1° C/min

Step 6: Soak for 2 hours

Step 7: Jump Step = 1, Jump Count = 2

Step 8: End

See appendix A for detailed programming instructions for the RC 900 Controller and refer to the **Operational Manual for the RC 900 Controller** if necessary. See Appendix B for a graphical representation of the above profile.

10.2 Test Software

Boot up the PC located next to the TVAC Chamber. Run the COMM6 software, located in the COM6 directory.

10.2.1 Check that the software is properly configured. Under the File menu, click the Port Settings option. The baud rate should be '9600'. The port should be '1'. In the Command Center (see Figure 1), The Device Address should be set to '1', and the **Modbus** Protocol box should be selected.

10.2.1.1 Check to see if the RC 900 Controller is communicating with the software. Click the **Smart Hex** box under Data Format, **Read** for Command Type, enter a '1' for Start Register and Number of Registers, then click the **Send Command** button. If the software is properly configured, you will see a **11** in the Command History window. The value returned in the Command Response window should be equal to the current temperature, shown in the upper readout of the RC 900 Controller.

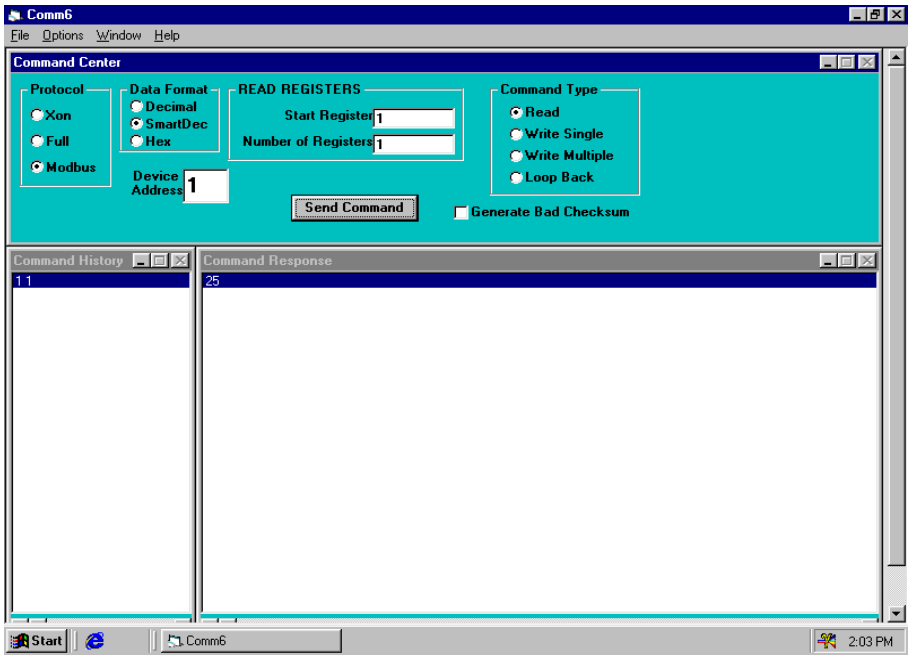

Figure 1: COMM6 Command Window.

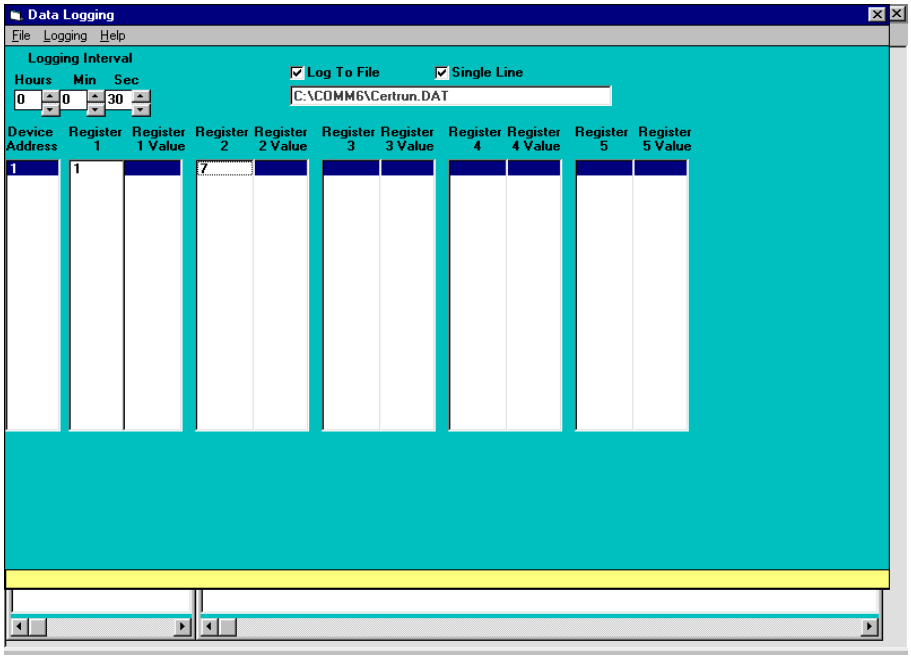

Figure 2: COMM6 Data Logging Window.

10.2.1.1.1 Under the OPTIONS menu, click on the DATA LOGGING option. In the DATA LOGGING window (see Figure 2), click the **Log to File** box, the **Single Line** box. Change the file name to C:\COMM6*Whatever*.DAT'. Since COMM6 is an old program, file names are limited to eight characters.

File Name:_____

10.2.1.1.2 The RC 900 Controller stores the current temperature in register 1 and the set temperature in register 7. In the DATA LOGGING window, right click

on the Device Address column and enter a value of “1”. Double click on the Register 1 column and enter a value of “1”. Double click on the Register 2 column and enter a value of “7”. Use the arrows to select 30 seconds for the Logging Interval.

10.2.1.1.3 Once you have verified that the TVAC Chamber is under vacuum, begin data logging by selecting the Begin Data Logging option, under the Options menu.

10.3 Begin the temperature profile by pressing the **Start**/**Stop** button on the RC 900 Controller.

10.4 During the certification run, check the equipment periodically to ensure proper operation. The LN dewar may need to be changed after the second cycle.

10.5 After the certification run, graph the data from the COMM6 data logger, and attach the graph to this PDOC.

10.6 Check the temperature alarm controllers as follows:

While data logging, enter a temperature of -75° C into the RC 900 Controller. Monitor the chamber during this test. When the temperature of the chamber falls below -70° C, the alarm should activate, and the temperature should stop decreasing. Allow the test to proceed for ten minutes after the alarm has been activated. Record this test results below.

File Name:_____.

Temperature at which alarm sounded:_____.

Did temperature stop decreasing?_____.

Graph the data from the COMM6 data logger. Attach the graph to this PDOC.

11.0 Completion of Procedure:

The completed procedure should be composed of this PDOC and both successful data graphs.

The procedure is considered complete when all the data has been graphed and reviewed by the test engineer and the QA representative. The reviewers should look for temperature difference greater than 10° between the actual temperature and the set temperature during ramping. Once the actual temperature has reached the soak temperature, and during the soak, the actual temperature should never deviate from the soak temperature by more then two degrees. The alarm data is considered successful if it is clear that the temperature controller shut down after alarm activation.

I certify that the this procedure was performed in whole and that the data recorded above, and included, is complete and accurate.

Test Engineer		Date	

This is to certify that the information obtained under this test procedure is as represented and the documentation is completed and correct.

GP-B Electronics Manager		Date	
Quality Assurance		Date	

12.0 Appendix A: Programming the ESS RC 900 Controller

Please refer to the ESS **Operation Manual for RC 900 Controller** for additional comments.

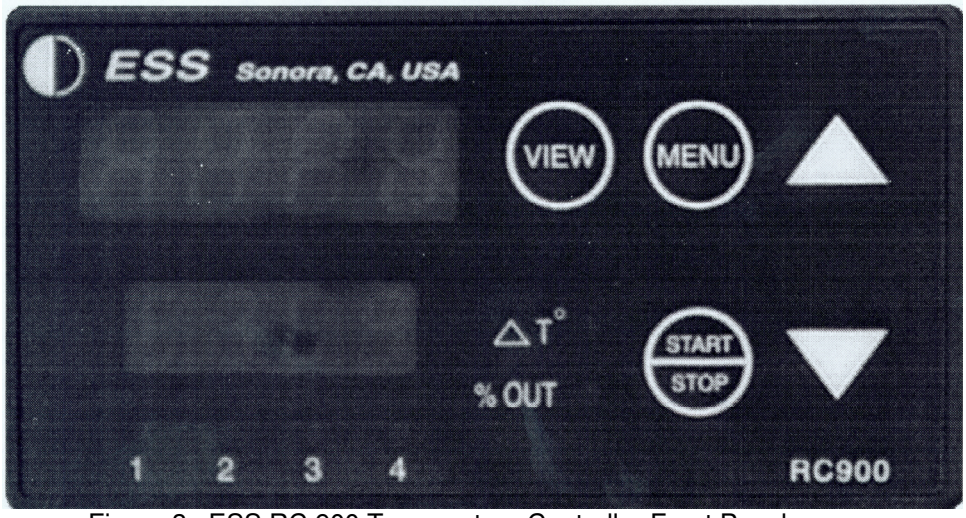

Figure 3: ESS RC 900 Temperature Controller Front Panel

13.1 Depress the **Menu** button on the front panel of the controller. Depress the **Down** arrow until **Pro9** appears in the upper display. Press the **Menu** button again. **StEP** will be displayed in the lower display. Press the **Up** or **Down** arrow until **1** appears in the upper display. You are now ready to program the RC 900 Controller. The following commands can be accessed by pressing the **Menu** button (the command appears in the lower display, use the **Up** and **Down** arrows to change the value of the upper display. Press the **Menu** button to access the sub commands.):

StyP = Set Type, the main command which allows access to all the following commands.

StPt = This command allows a set point to be entered

SP = Set Point (enter a value between –75° C and +100° C)

rAtE = Ramp Rate (in degrees per minute)

SoAH = Soak time

Hour = hours

Min = minutes

Sec =seconds

JMP = This command is used to repeat previous step. This is the only command type used in step 7.

JStP = Specifies the Jump to Step number, 1 through 6.

JCnt = Specifies the number of times the controller will jump to the jump step.

End = Step 8 is the final step and is always **END**.

HoLd = Commands the RC 900 to hold the final **SP**.

OFF = Turns the RC 900 Controller off.

13.2 For the Certification Run profile used in this procedure and shown graphically in Appendix B, enter the following information.

Menu. **Down** until **Pro9** appears in upper display. **Menu**. Arrow until **1** appears in upper display. **Menu**. **Menu**. Use the **Up** button to change the value of the upper display to **100**. **Menu**. Use the arrows to change the value of the upper display to **1**. **Menu**. **Up**. You are now in Step 2. **Menu**. Use the arrows until **SoAH** is displayed in the upper display. **Menu**. Change the value of the upper display to **2**, thus programming the controller to soak for 2 hours. **Menu**. **Menu**. **Menu**. **Up**. **3** should now be shown in the upper display. **Menu**. **Up** arrow until **StPt** is shown in the upper display. **Menu**. Use the arrow buttons to change the value of the upper display to **40**. **Menu**. Use the arrows to change the value of the upper display to **1**. **Menu**. **Up**. You are now in Step 4. **Menu**. Use the arrows until **SoAH** is displayed in the upper display. **Menu**. Change the value of the upper display to **1**, thus programming the controller to soak for 1 hour. **Menu**. **Menu**. **Menu**. **Up**. **5** should now be shown in the upper display. **Menu**. **Up** arrow until **StPt** is shown in the upper display. **Menu**. Use the arrow buttons to change the value of the upper display to **-60**. **Menu**. Use the arrows to change the value of the upper display to **1**. **Menu**. **Up**. You are now in Step 6. **Menu**. Use the arrows until **SoAH** is displayed in the upper display. **Menu**. Change the value of the upper display to **2**, thus programming the controller to soak for 2 hours. **Menu**. **Menu**. **Menu**. **Up**. **7** should now be shown in the upper display. **Menu**. **Menu**. Use the arrows to change the value of the upper display to **1**. **Menu**. Use the arrow buttons to change the value of the upper display to **2**. **Menu**. **Up**. **Menu**. **Menu**. Use the arrow buttons to change the upper display to **OFF**. **VIEW**. Press the **START/STOP** button twice to begin the profile. The profile may be stopped at any time by pressing the **START/STOP** menu once.

13.0 Appendix B: Temperature Profile Graph

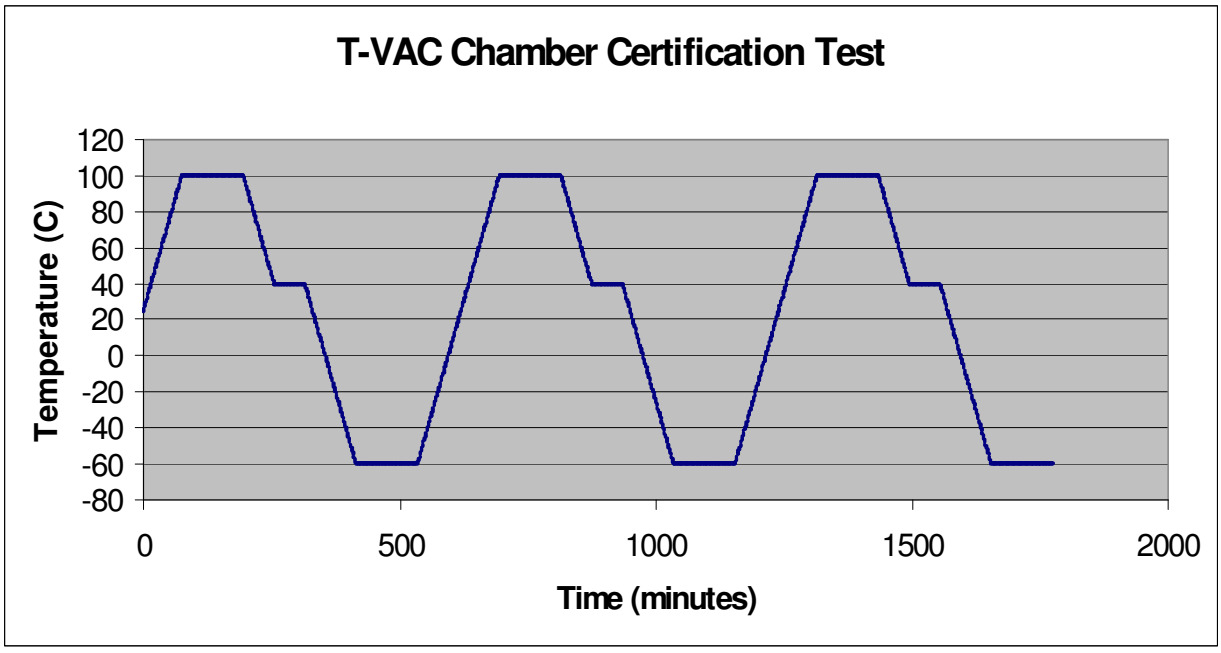

Figure 4: Temperature Profile Graph