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Gravity Probe B Relativity Mission

FULL FUNCTIONAL TEST PROCEDURE FOR THE GYROSCOPE SUSPENSION SYSTEM (GSS) AFT SUSPENSION UNIT (ASU) SUBSYSTEM

GP-B Procedure
P0768 Rev A

DUT PN: 26226-101 REV:_____   SN: _____

Date Performed:_____

Prepared by: William Bencze	Date
RE, Gyroscope Suspension System (GSS) Group	

Approved by: William Bencze	Date
Payload Electronics Manager.	

Approved by: Dorrene Ross	Date
GP-B Quality Assurance	

Approved by:	Date
GP-B System Engineering	

Total power-on time for this procedure (hrs):		Record P-number and section of master test procedure, if applicable:	Called by: Date:

Table of Contents:

1.0 Revision History

Rev Level	Comments/notes	Date	Revised By
-	First release of this test procedure	1-Nov-2000	WJ Bencze
A	Revised per ECO 1230 based on redlines from first run of this procedure on flight hardware. Changes in sections 14.6, 15, 16.	1-Dec-2000	WJ Bencze

2.0 Scope:

This procedure details the operations required to perform a box-level full functional test on a GSS aft unit, PN 26226-101

3.0 Formal Requirements Verification

This procedure verifies by test and/or inspection the following GSS box-level requirements:

Item	Spec Paragraph PLSE 13-1 Rev A	Requirement Title	Verified via test item in this procedure:
3.1.	3.2.3	Communications Interfaces	15.0
3.2.	3.2.4	Software command interfaces	15.0
3.3.	3.2.5	HLD interfaces	16.0
3.4.	3.2.8.1	SRE Interfaces	15.0
3.5.	3.2.8.2	Operation during clock switching	15.0
3.6.	3.2.8.4.1	Recovery from missed timing pulses	15.0
3.7.	3.2.8.4.2	Recovery from extra timing pulses	15.0

4.0 Reference Documents

4.1.	PLSE 13-1 Rev A	GSS Specification
4.2.	P0663	GSS Gold System Hardware and Software Configuration Standard
4.3.	P0695	Aft Full Functional Software Test Procedure
4.4.	P0772	Aft Full Functional Software Test Procedure using GSS test environment.
4.5.	P0758	GSS GSE Electrical Test Procedure
4.6.	26224	Assembly Drawing for the Aft Computer Unit (ACU)
4.7.	26226	Assembly Drawing for the Aft Suspension Unit (ASU)
4.8.	MIL-STD-1686	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies, and Equipment

5.0 Test Facilities

5.1.   Primary facility: HEPL Room 127, Stanford University

5.2.   Alternate facility (specify): _____

6.0 QA Provisions:

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

Date/time:_____   Date/time:_____
GP-B QA (D. Ross)   Government Rep. (E. Ingraham)

6.2.   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 his approval at the end of this procedure.

7.0 Test Personnel

This test procedure is to be conducted only by the following personnel, or others designated by the GSS RE at the time of test (redline names in below as required)

7.1.   William Bencze

7.2.   Ron Zilm

7.3.   Scott Smader

7.4.   Lo Van Ho

8.0 General Instructions

8.1.   Redlines can be initiated by the test personnel listed in Section 7.0 and must be approved by QA.

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

8.3.   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.

8.4.   Only the following persons have the authority to exit/terminate this test or perform a retest: test operators listed in Section 7.0 and GP-B QA.

9.0 Hardware Safety and Data Recording Requirements

9.1.   Electrostatic Discharge (ESD) Protection:

  9.1.1.   This assembly is ESD sensitive; special care shall be exercised per the "Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies, and Equipment", MIL-STD-1686.

9.2.   Connectors/Cables:

  9.2.1.   Ensure that power is removed from cable assemblies before connecting or disconnecting cable connectors.

  9.2.2.   Connector savers are to be used on all flight connector interfaces unless otherwise specified.

  9.2.3.   All mates and de-mates to flight connector interfaces (not to connector saver interfaces) shall be recorded in the **Connector Mate/Demate Log** for this assembly

  9.2.4.   Connectors shall be examined before attempting to mate them. Remove any foreign particles. Look for any damaged pins or sockets. Do not force the coupling action if excessive resistance is encountered. Ensure that key-ways are aligned when mating connectors.

9.3.   Application of Power:

  9.3.1.   Power on and off times shall be recorded in the **Power Log** for this assembly.

10.0   External Test Equipment

The following support hardware 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 space provided.

Item	Equipment Description	Qty	Make	PN	SN	Cal Due
1.	GSS Spacecraft emulator	1	SU	NA	01	
2.	GSS FSU gold system	1	SU	NA	01	
3.	FSU Power supply, triple output	1	HP/Agilent			
4.	FSU Power supply, 50 V	1	HP/Agilent			
5.	Multimeter	1	Fluke			
6.	Oscilloscope + probes	1	Tek	TDS460A		
7.	2-stub 1553 coupler	2	MilesTek	90-50202		NA
8.	FSU PC630 power cable	1	SU	NA	01	NA
9.	GSS testset workstation	1	SU	NA	NA	NA
10.	GSE power cable	1	LMCO	8A02084GSE-101	NA	NA
11.	GSE timing cable	1	LMCO	8A02085GSE-101	NA	NA
12.	GSE GFAB A cable	1	LMCO	8A01473-101	NA	NA
13.	GSE GFAB B cable	1	LMCO	8A01474-101	NA	NA
14.	GSE 1553 cable	2	LMCO	8A00673GSE-501	NA	NA
15.	1553 terminator	4	MilesTek	10-06403-025	NA	NA
16.	1553 patch cable	2	Trompeter	CA-2014-120	NA	NA
17.	APU J21 breakout box	1	SU	NA	01	NA
18.	DB15 breakout box	1	SU	NA	01	NA
19.						
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11.0   Software Environment

This test may be run with either the LMCO supplied Testset software or using the GSS developed test environment, know collectively as "PitView" In both cases, the tests run on the GSS hardware are identical; the choice of the testing tool is made at the discretion of the test engineer at run time.

11.1.   For this test, the following software test procedure shall be used:

Software test procedure	Description	Used for this test (choose one)
P0695 Rev:_____	ASU Full Functional Test Procedure using LMCO Testset tools	
P0772 Rev:_____	ASU Full Functional Test Procedure using PitView software tools.	

11.2.   Record revision level of the chosen software test procedure in the space provided above.

11.3.   All software version information is recorded in the body of the subordinate procedures.

11.4.   An as-run copy of the subordinate procedure shall be completed and attached to this document each time the test is run.

End of Section

12.0   Equipment Pretest Requirements:

12.1.   The GSS Gold System items with which this subsystem is to be tested must have passed the P0663 – Gold System Certification Procedure prior to the start of this test. Record the Gold System serial number and date of its certification, below

GSS Gold System SN:	
Date of Certification	
Configuration (circle one)	Full Partial

	P/F	Notes:
12.2. Verify P0758 has been run on the Spacecraft Emulator GSE within the past 60 days or since the rack has been moved to the current test location.		Date: Revision:

13.0   Device Under Test (DUT):

Record the serial number of the Device Undergoing Test, or DUT.

26226-101 GSS Aft Suspension Unit (ASU)	SN:	

Test Operator:	Name:	

Start of test:	Date: Time:	

14.0   Test Connection

Note: *All handling of this DUT shall be performed using ESD control methods, as outlined in MIL-STD-1686. Unit shall be inspected at an ESD certified station. Wrist straps and/or heel grounding straps shall be used.*

Important: Insure that power is removed from cable assemblies before connecting or disconnecting cable connectors.

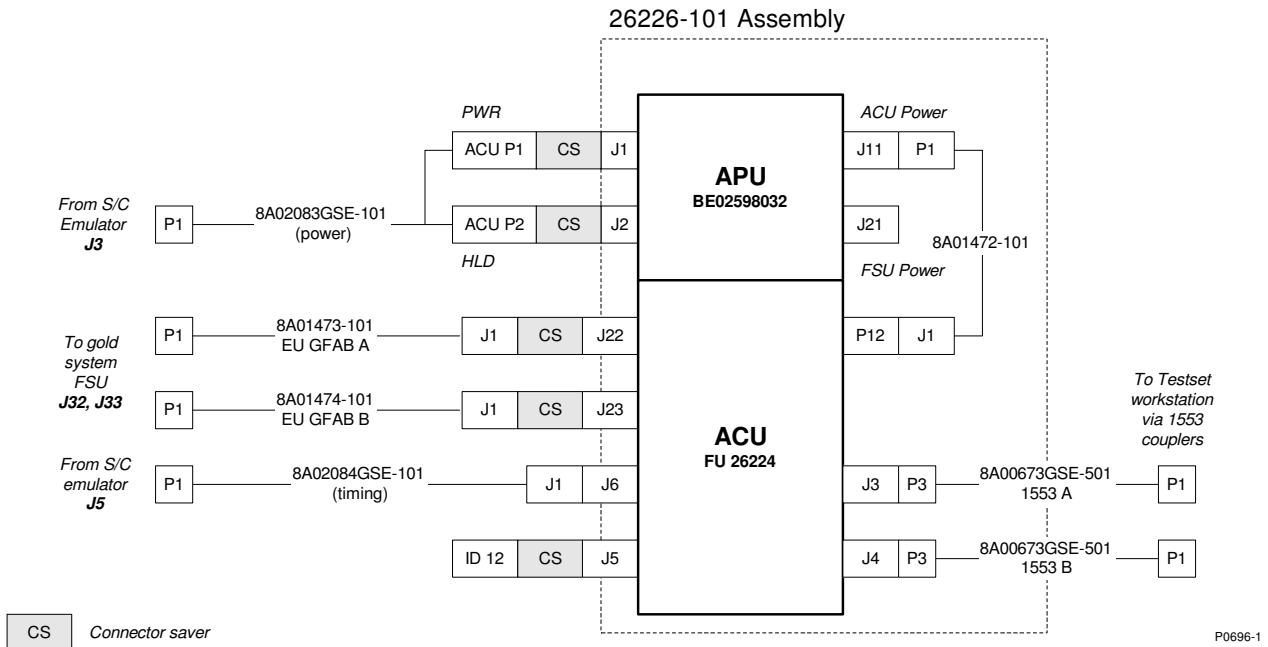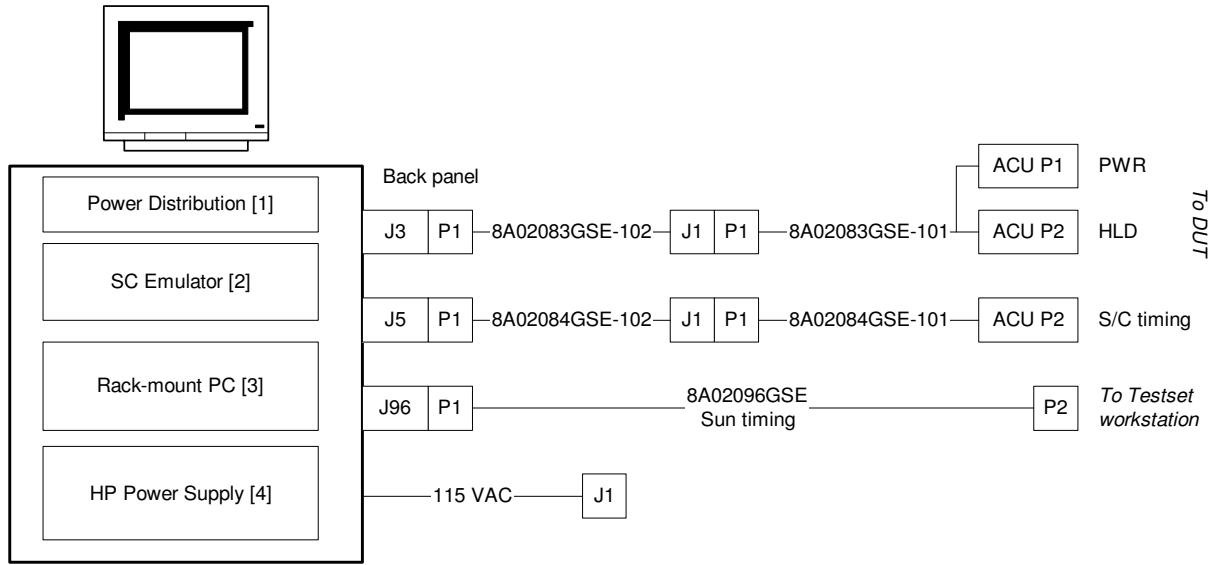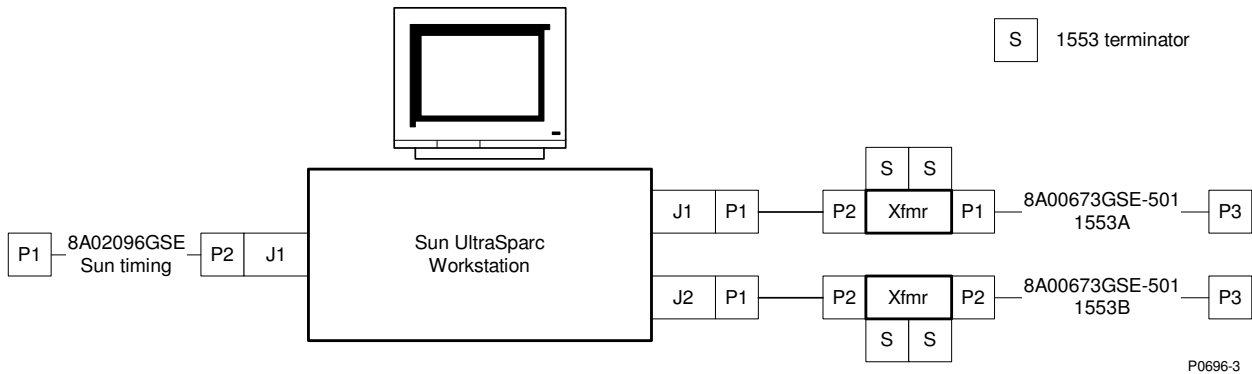|		P/F	Notes
14.1.	If this procedure has been called by another test procedure, record the P-number and section that made the callout on the space provided on the coversheet of this document.		
14.2.	Remove DUT from storage container. Verify that all connectors appear undamaged		
14.3.	Verify that LabView is not running on the S/C emulator PC.		
14.4.	Verify that the front panel of the HP power supply indicates 0.0V output.		
14.5.	Configure the system as shown in Figures 1, 2 and 3.		

Figure 1: Connection Diagram for ASU tests

Figure 2: Spacecraft Emulator Wiring Diagram

Figure 3: Testset workstation wiring diagram

End of Section

	P/F	Notes
14.6. Set current limit on HP power supply in S/C emulator rack to 2.0 A A) Close any LabView program that may be running. B) Key in the following sequence on the front panel of the HP supply: "**LOCAL, Function:CURRENT, 2.0, ENTER**"		
14.7. Restart the LabView *GSE Test* virtual instrument.		
14.8. Set supply voltage to **28.0 V** on the *GSE test* panel.		
14.9. Set Spacecraft clock simulator to the following: **16fo:** **A + B** **10 Hz:** **A + B** **Sun 10 Hz:** **A + B**		
14.10. Apply power via by turning on "Aft Main" on LabView control panel; record power on time in Power Log for this unit.		
14.11. Verify that current is < 550 mA; if greater remove power and cancel test.		
14.12. Record indicated main bus current as indicated on HP power supply front panel.		Current:

End of Section

15.0   Software Tests:

Verifies operation of the software communication and command interfaces, operation of 1553 bus, A side and B side, Tests the operation over full required bus voltage range.

Note: Record power on and power off cycles in Power Log for this unit.

	P/F	Notes
15.1. Confirm bus voltage to ASU is **28.0 V** as indicated on the *GSE Test* window.		
15.2. Perform "AFT FULL" software functional test per procedure specified in Section 11.0		
15.3. Attach completed copy of the software test procedure.		
15.4. Turn off power to unit via the *GSE Test* panel.		
15.5. Set bus voltage to ASU to **21.0 V** as indicated on the *GSE Test* panel.		
15.6. Turn on power to unit via the *GSE Test* panel. Record current from front panel of HP power supply at right:		Current:
15.7. Perform "AFT FULL" software functional test per procedure specified in Section 11.0		
15.8. Attach completed copy of the software test procedure.		
15.9. Turn off power to unit via the *GSE Test* panel.		
15.10. Set bus voltage to ASU to **35.0 V** as indicated on the *GSE Test* window.		
15.11. Turn on power to unit via the *GSE Test* panel. Record current from front panel of HP power supply at right:		Current:
15.12. Perform "AFT FULL" software functional test per procedure specified in Section 11.0		
15.13. Attach completed copy of the software test procedure.		

End of Section

16.0   HLD Tests

Verifies operation of the HLD (high level discrete) functions

		P/F	Notes
16.1.	Turn off power to unit via the *GSE Test* panel.		
16.2.	Set bus voltage to ASU to **28.0 V** as indicated on the *GSE Test* window.		
16.3.	Connect FSU power breakout box to APU J21		
16.4.	Verify voltage levels on breakout box for the following configuration of FSU power and HLD signals: **Leave Aft power OFF during this test.**		

Inputs					Outputs on APU J21 (pins)								P/F
FSU Pri	FSU Sec	Heater	HLD A	HLD B	2	12	11	5	3	A1	A2	6	
off	off	off	off	off	0	0	0	0	0	0	0	0	
ON	off	off	off	off	+7.2 ± 0.5	+16.2 ± 0.5	-16.2 ± 0.5	+60.5 ± 1.0	-60.5 ± 1.0	x	x	x	
off	ON	off	off	off						x	x	x	
ON	ON	off	off	off						x	x	x	
ON	ON	off	off	ON						+870 ± 30	-870 ± 30	x	
ON	ON	off	ON	off	x	x	x	x	x	+870 ± 30	-870 ± 30	x	
ON	ON	off	ON	ON						+1680 ± 50	-1680 ± 50	x	
x	x	ON	x	x	x	x	x	x	x	x	x	12	
Measured w.r.t pin (ground):					1	4	4	4	4	4	4	13	

Measure high voltages A1 and A2 with HV probe; use banana jumper to connect meter to J21 pin 4 on breakout box.

"x" = Don't care.

16.5.	Return FSU Primary, FSU secondary, and Heater power ports to the off condition.	

End of Section

17.0 Completion of Procedure:

	P/F	Notes
17.1. Turn off power via LabView *GSE Test* window; record off time in Power log.		
17.2. Remove all external cables from ASU		
17.3. Return DUT to storage container.		
17.4. Attach test results from Section 15.0		

End of Section

18.0 Certification:

I certify that this procedure was performed in whole and that the data recorded above 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.

GSS Representative		Date	

Quality Assurance		Date	