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Gravity Probe B Relativity Mission

GSS Aft Full Functional Software Test Procedure

Nvember 20, 2000

GP-B Procedure
P0695 Rev -

Prepared by: Ron Zilm RE, Mission Operations	Date
Approved by: William Bencze RE, Gyroscope Suspension System (GSS) Group	Date
Approved by: Dorrene Ross GP-B Quality Assurance	Date
Approved by: GP-B System Engineering	Date

Record procedure number and section of master test procedure which called this software test procedure:

Called by:
Date:

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1.0 Revision History

Rev Level	Comments/notes	Date	Revised By
-	First release of this test procedure	20-Nov-00	R. Zilm

2.0 Scope:

This procedure provides the details for functional tests performed using software on the GSS Aft Computer Unit subsystem (ACU).

This test plan has been written to certify flight GSS Aft Unit Assemblies. The test is automated to a large degree and requires minimal intervention from an operator.

Data generated during this test are recorded to a single data file; each test of a board will use its own copy of this procedure, and will be identified by serial number in the upper right corner.

This procedure is not intended to stand alone, but is to be called from a higher level hardware test procedure (i.e. P0768 – Aft Full Functional Test Procedure). It is this calling procedure which specifies the hardware configuration for this software test.

3.0 Reference Documents

3.1. Aft Full Functional Test Procedure for the GSS AFT Suspension Unit, P0768

3.2. Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies, and Equipment, MIL-STD-1686

3.3. GSS Test Set Bring Up, P0691

3.5. Lockheed Command and Telemetry Handbook Section SCSE-16 Section 9.2.5

4.0 Test Facilities

4.1. Primary location: HEPL Room 127, Stanford University

4.2. Alternate location (specify):_____

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) 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)

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 his/her approval at the end of this procedure.

6.0 Test Personnel

This test procedure is to be conducted only by the following personnel:

6.1. William Bencze

6.2. Scott Smader

6.3. Joe Kilner

6.4. Ron Zilm

7.0 General Instructions

7.1. This procedure is not intended to stand alone; it is called by a higher level procedure which specifies the hardware configuration for this test.

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

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

7.4. 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.

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

7.6. All software used in this procedure shall be released and under configuration control prior to the start of this procedure.

7.6. Items to be typed are in **Bold**. Hit the "*Return*" key after every line of typed commands.

8.0 Test Software Required

8.1. Verify current version against the revision noted in the “Version Number” Column

8.2. Update version number as required.

	Name and Description	Version Number
8.1.	OASIS-CC*	**2.0514.3**
8.2.	MSS 3.2.0s GSS Test Set Software*	**3.2.0s**
8.3.	Ground RealTime Software*	**3.4.0s**
8.4.	SUN Solaris Operating System*	**5.6**
8.5.	testrts - program to test for G.S.S. presence and location on the spacecraft bus(1553).	**1.1**
8.6.	probe_10hz - program to test availability of 10 hz clock from GSE.	**1.1**
8.7.	GSS System software (GSW)	**2.0.2.1**
8.8.	Gssloader.csh - The shell script to load GSS software into SRAM memory on gss flight processor via 1553 bus. Runs on SUN Solaris OS(see above #9).	**1.1**
8.9.	Gss1553ramload - The executable that loads the GSS software into SRAM memory on gss flight processor via 1553 bus. This executable is launched by the gssloader shell script and receives its setup values via rtloader_setup data file.	**1.1**
8.10.	Rtloader_setup - Is a data file containing necessary setup information to configure gss1553ramload.	**1.1**
8.11.	gss_start.prc - Cstol to configure test set for test.	**1.3**
8.12.	aft_full.prc - Cstol to perform functional test on aft unit GSS.	**1.1**
8.13.	Perl Script Interpreter: ActiveState's ActivePerl or equivalent. Used to run report-extraction scripts on data output files.	**5.6**
8.14.	Datax.pl - Perl Script to strip commanding and telemetry information from test output report.	**1.1**
8.15	Clock_ipt - Cstol script to test ability of GSS to differentiate input clocks and ability of GSS to withstand clock variations.	**1.1**

9.0 Device Under Test (DUT):

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

GSS Aft Control Unit (ACU) PN: 26226-101	SN:	
Test Operator:	Name:	
Start of test:	Date:	

10.0 System Functional Tests Description:

Note: Tests run in this section are run with the hardware in "flight" configuration. The tests will be run using our "flight-like", OASIS-CC based, Test Set SUN Workstation (hereafter referred to as "Test Set"). This system simulates the ground station and the Spacecraft Mission Computer to provide a realistic simulation of the mission environment. This simulation provides for commanding, scripting, data display and data recording for the GSS subsystem.

This test sequence is a scripted sequence of commands that launches software commands which reside in the memory systems of the GSS payload processor onboard the Aft unit of our GSS under test. The input and output data can be viewed using screen displays. Data is selected and processed to obtain a useful report. This report is recorded to a file on the Test Set. A paper copy shall be attached to this test procedure upon completion.

10.1. Summary of testing activity

Test Name	Relevant Test Case	Telemetry Output Mnemonic	Success Criteria
ACS 16 f0 AB Detection Test	Shows that ACS sees a 16f0 clock(A or B)	PY_cmdCompStat1	Completion Status = SUCCESS
ACS 10 Hz SRE Signal Aliveness Test	Checks for presence of 10 Hz(INT0) signal.	PY_cmdCompStat1	Completion Status = SUCCESS
ACS Control Effort in Range Test	Verifies 16 f0 clock counts by comparing to Alt-10hz clock signal.	PY_cmdCompStat1	Completion Status = SUCCESS
ACS 16 f0 clock functional Test	Tests the operation of the PLL by reading the value from the mux output.	PY_cmdCompStat1	Completion Status = SUCCESS
ACS SRE clocks OFF Test	Shows that the GSS continues to function without SRE (external) clocks.	PY_cmdCompStat1	Completion Status = SUCCESS
Aft Mux Function Test	To Show Function and Representative Output From Aft Mux.	PY_cmdCompStat1, RY_diagMon#4, RY_diagMon#5, RY_diagMon#6, RY_diagMon#7, RY_diagMon#8	Two criteria: Completion Status = SUCCESS, record two values each from 4 PIT 3 diagnostic telemetry monitors in four passes (16 values total, 13 are used).
AMT Analog Monitor Test	Shows that the 16 Analog HW channels are within the specified limits.	PY_cmdCompStat1	Completion Status = SUCCESS
AMT Register Test	Shows that the AMT's read/write registers function by writing test patterns then reading them back for comparison.	PY_cmdCompStat1, RY_diagMon041	Two criteria: Completion Status = SUCCESS, Correct Mask Value(257) in PIT 3 Diagnostic Monitor 4
AMT Interrupts Off Test	Shows that INT 1-3 can be turned off.	PY_cmdCompStat1	Completion Status = SUCCESS
AMT Alternate 10 Hz Presence Test	Shows that ALT10Hz is present.	PY_cmdCompStat1	Completion Status = SUCCESS
AMT Tri-State Logic Test	Shows that the Triple-Redundant Logic in the FPGA is sound with a series of test patterns.	PY_cmdCompStat1	Completion Status = SUCCESS
AMT Interrupt Period Test	Shows that the INT1 signal is set for 220 Hz by timing it.	PY_cmdCompStat1	Completion Status = SUCCESS
AMT Interrupt Delay Test	Shows that INT2 signal can be programmed for variable delays.	PY_cmdCompStat1	Completion Status = SUCCESS
AMT Alt. 10 Hz Error Count Test	Shows that ALT10Hz is correctly synched to 16f0 clock.	PY_cmdCompStat1	Completion Status = SUCCESS
ACL Diagnostic Test A-SIDE	Test to show that Comm Link can write and read from forward unit registers.	PY_cmdCompStat1	Completion Status = SUCCESS
FMR Diagnostic Test A-SIDE	Shows that Forward mode Register is functioning properly and confirms that GFAB synch. delay is within spec.	PY_cmdCompStat1	Completion Status = SUCCESS

ADDA HW Triggers A-SIDE	Shows that additional signal lines on GFAB are functioning.	RY_diagMon041	The value 0x0003 for the initialization of the ADDA Conversion triggers register must be present in PIT 3 diagnostic monitor #4.
Redundant 1553 Test B-Side	Shows that the redundant side of the spacecraft communications bus is correctly identified and used by GSS.	Not Applicable - CSTOL massaged Output to Message File	B-SIDE ACL/FMR Tests must both Pass.
ACL Diagnostic Test B-SIDE	Test to show that Comm Link can write and read from forward unit registers.	PY_cmdCompStat1	Completion Status = SUCCESS
FMR Diagnostic Test B-SIDE	Shows that Forward mode Register is functioning properly and confirms that GFAB synch. delay is within spec.	PY_cmdCompStat1	Completion Status = SUCCESS

Note: References to PIT Tables/Telemetry Mnemonics refer to Lockheed Command and Telemetry Handbook Section SCSE 16.9.2.5

10.2. Pre-test:

Prepare 1 formatted IBM floppy double-sided, high density for the end of the test. This is to collect the output of the test for documentation purposes. Label the disk with the information: GSS AFT Unit Functional Test MMDDYY <Operator Name> <test location> Note also the purpose of the test. Note any other pertinent information in an additional log, to be attached to printout of test data for records.

10.3. Bring up the test set per P0691.

10.4. At the close of P0691 you shall see a menu of choices. Type: **SREClocks** . This will select the SRE Clocks test for unit #1.

10.5. Follow the instructions in the ASK window.

10.6. Read the Results from the U_MESSAGES window.

10.7. For this test you will be using the switch bank on the black Ground Support Electronics rack.

10.7.1. The switch bank is on the upper right corner of the unit. It holds six switches. Three are for the A-clocks and three are for B-clocks - switch them as a unit(A/B) when prompted.

10.7.2. There are also two buttons marked 10 Hz ADVANCE and 10Hz DELAY. These will be used also - push them once when prompted

10.8. Record the Outputs from the test below:

Note: Ignore DN ouputs on screen.

10.8.1. 10 Hz ADVANCE		
Per.Cts (-1.60200E+03 means PASS)	Error Count (greater than 0)	P/F

This test passes if the interval counts in and are both -1602 and the error counts are greater than zero.

10.8.2. 10 Hz RETARD		
Per.Cts (-1.60200E+03 means PASS)	Error Count (greater than 0)	P/F

- This test passes if the interval counts in and are both -1602 and the error counts are greater than zero.

10.9. Expected Value / PPI Value:

- Place a check mark in the box to indicate that the condition was observed.

13/13	14/14	15/15	P/F

- This test passes if all three boxes are checked.

10.10. When the test has completed it will exit to the menu.

10.11. Perform the following:

10.11.1. Right-click on an unused portion of the desktop.

10.11.2. Left Double-click on the *file manager* option.

10.11.3. Left Double-click on the folder icon in the upper, left-hand portion of the file manager window. There will be a / underneath to indicate root directory.

10.11.4. Scroll to the bottom of the window using the page-down key.

10.11.5. Left Double-click on *usr6*

10.11.6. Left Double-click on *lab*

10.11.7. Left Double-click on *messages*

10.11.8. Look for files that look like *foo*.event_messages* (Where * represents arbitrarily chosen alphanumeric characters.). Delete any that are present.

10.11.9. Left Double-click on bar icon, to close window.

10.12. Run the Aft Full Functional Checkout.

10.13. From the menu, you shall see a number of choices. Type: **aftfull** This will select the aft full functional test for unit #1.

10.13.1. Guidelines for operating the aft abbreviated functional test procedure as follows:

- There will be instructions in the "U Procedures" window, follow them.
- The CSTOL procedure contains instructions and output logging.
- There will be warnings that a command is hazardous, when these warnings are obtained: **Left Click on *Yes*** *(*This will dismiss the warning screen and continue the test.)
- The test will notify you of pass/fail, if PASS the DUT has passed.
- (In the case of a test run on a gold system: AMT Analog Monitor Test will fail due to differences between the Gold System and Flight Unit designs. In this case the indicators will say 22/23 tests have passed, DUT has failed. This is a PASS!)
- **Estimated test duration:** 7 minutes

Indicate here for PASS/FAIL	**Sign and Date Here**

11.0 Completion of procedure:

11.1. Shut down OASIS-CC(Test Environment):

- Click on the *QUIT* button in OASIS.
- When the OASIS windows close, double left-click on the *StopLab* icon

11.2. Retrieve the test data file and place it on a floppy.

11.2.1. Right-click on an unused portion of the desktop.

- Left Double-click on the *file manager* option
- Left Double-click on the folder icon in the upper, left-hand portion of the file manager window. There will be a / underneath to indicate root directory.

11.2.2. Scroll to the bottom of the window using the down-arrow key.

- Left Double-click on *usr6*
- Left Double-click on *lab*
- Left Double-click on *messages*

11.2.3. Look for files that look like *f00*.event_messages* (Where * represents arbitrarily chosen alphanumeric characters). There should only be one.

- Left click on the name and rename it to the form: aftUNITNUMBERfullMMDDYY.txt (where M=month, D=day and Y=year and UNITNUMBER = GSS Serial Number).

11.2.4. Insert Blank, Formatted IBM floppy into test-set floppy drive.

- Left click file menu. Left click on *Open Floppy*.
- Left click and hold renamed file's icon (in file manager window) to drag file to floppy window.
- Left click *file* in floppy drive window. Left click *eject floppy*.
- Arrange for generation of report.

(The steps below may be performed as a post-test wrap up to this procedure at a later date)

11.2.5. Copy data file aftUNITNUMBERfullMMDDYY.txt from floppy to perl_script directory on gss41-pc.

- From the DOS prompt or in the RUN menu(on START)…
- Type copy a:\ aftUNITNUMBER*.txt c:\windows\desktop\perl_script*.*
- Type perl c:\windows\desktop\perl_script\datax.pl
- Type name of file when prompted.
- Type optaftUNITNUMBERDDfullMMDDYY.txt for name of output file when prompted.
- Type xxxx for Low line number
- Type xxxx for High line number.

11.2.6. Print output file.

- Review printout for correctness.
- Staple output to top of aftgss and attach to DUT documentation package.

12.0 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	