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Gravity Probe B Relativity Mission

Mission Operation Center (MOC)
Functional Verification
of the
Goddard Network Test Plan
procedures

P0956 Rev. -
29 October 2002

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S/W Quality Effectiveness

ITAR Assessment Performed _____ITAR Control Req'd? ☐ Yes ☐ No
(Tom Langenstein)

This producer allows Gravity Probe-B (GP-B) MOC and Stanford University (SU) Quality Effectiveness to track and verify the procedural steps contained within the Goddard Network Test Plan (NTP). The procedural steps, as listed within the NTP, test the functionality required between the MOC and the Space Network (SN) and Ground Network (GN). MOC functionality is referenced via Interface Control Documents (ICD's). The execution and/or demonstration of the network test are the responsibility of Goddard Space Flight Center.

Relevant Documents:

CSOC-GSFC-TEST-002077	10/29/02	Gravity Probe-B (GP-B) Network Test Plan (includes procedures)
451-ICD-GN/WDISC-GP-B	Sept 2002	Interface Control Document between Gravity Probe B Mission and Ground Network (GN)/WSC TCP/IP Data Interface Service Capability (WDISC)
451-DMR-GP-B	Sept 2002	Detailed Mission Requirements (DMR) for the Gravity Probe B Mission (GP-B)
451-ICD-NCCDS/MOC	June 1999	Annex 12 NCC to Interface Control Document between the Network Control Center Data System and the MOC

1 Space Network (SN) Verification Test Outline

1.1 SN VER-2 Scheduling Verification Test

Purpose:
This test will verify that the GMOC or ITF scheduling and real-time control systems can communicate with the ANCC to send a SHO to the ANCC as a SAR and delete the SHO, as required, for the planned SN GP-B activities and then use that schedule to automatically configure all SN station equipment for a GP-B operational support. This test will also verify that the ANCC can communicate with the GMOC to send a Daily Schedule of SN GP-B activities, send UPD, and submit a GCMR for such actions as a forward link antenna sweep, data rate change, link reacquisition, etc.

SN VER-2 Scheduling Verification Test

NTP section	Owner	Procedure step	Check / Done
3.5.10.2 a	GMOC	Configure and send a SAR, and receive an accept or reject message from ANCC. Submit a Schedule Delete Request (SDR), if an accept message was received and confirm the event was successfully deleted.	
3.5.10.2 b	GMOC	Submit an additional SAR and confirm the SAR was accepted. Request and configure to receive UPD when the test event goes active. Submit all possible GCM requests, and verify all confirmations are received.	
3.5.10.2 c	ANCC	Provide access to ANCC systems and provide appropriate response messages. Simulate ground terminal activity via NCC Test System.	
3.5.10.2 d	ANCC	Schedule and assign an SN station event support period.	
3.5.10.2 e	ANCC	Configure and send a GP-B SN Event Schedule to the GMOC.	
3.5.10.2 f	GTD	Verify that the GMOC or ITF has received a valid GP-B Schedule from the ANCC.	
3.5.10.2 g	GTD	Verify that the SN ground station has accepted and processed the GP-B SHO.	
3.5.10.2 h	GTD	Verify that the SN ground station has correctly configured all required systems for GP-B support.	
3.5.10.2 i	GMOC or ITF	Verify that the SN ground station configured and provided valid UPD to the GMOC or ITF during the scheduled test event.	

Additional Comments/Print-outs/messages:

Hardware and Software Version Control - If Different than TRR

H/W and S/W	Version

Test Operator _____ QA Witness _____

1.2 SN VER-3 2287.5 MHz S-Band Telemetry Verification Test

Purpose:
This test will verify the GMOC and ITF capability to receive and process simulated GP-B MA (1.0 kbps) or SSA (2.0 kbps) I and Q Channel Pulse Code Modulation/Quadriphase Shift Keyed (PCM/QPSK) telemetry data (convolutional 1/2 rate encoded, randomized and Reed-Solomon encoded) from the WDISC PTP at the SN ground station. The SN station will amplify, decode, demodulate, and transfer via the WDISC PTP to the GMOC or ITF, as scheduled by the ANCC. SN GP-B verification testing supports will be requested by the GMOC or ITF and then scheduled through the ANCC, via SWSI.

SN VER-3 2287.5 MHz S-Band Telemetry Verification Test

NTP section	Owner	Procedure step	Check / Done
3.5.11.2 a	GMOC	Configure and send a SAR, and confirm an accept message was received from the ANCC. Request and configure to receive UPD when the test event goes active.	
3.5.11.2 b	GTD	Verify that the SN ground station has accepted the SN SHO and is configured to support the scheduled GP-B test event.	
3.5.11.2 c	GTD	Configure WDISC to initiate connections for the transfer of telemetry data to the GMOC or ITF.	
3.5.11.2 d	GTD	Verify that WDISC PTP has initiated and completed the connections for the transfer of telemetry data to the GMOC or ITF.	
3.5.11.2 e	GTD	Verify that the WDISC PTP has initiated the transfer of valid telemetry data to the GMOC or ITF.	
3.5.11.2 f	GMOC	Verify receipt of valid telemetry data from the WDISC PTP for the scheduled test event.	

Additional Comments/Print-outs/messages:

Hardware and Software Version Control - If Different than TRR

H/W and S/W	Version

Test Operator _____ QA Witness _____

1.3 SN VER-4 2106.4 MHz S-Band Command Verification Test

Purpose:
This test will verify that the WDISC PTP can receive, process, and send 2 kbps SSA or 125 bps MA command data to the uplink system to simulate commanding of the GP-B spacecraft via the SN ground station. The test will also verify the GMOC and ITF capability to send spacecraft commands, switch WDISC operations from the WDISC prime to the backup PTP and back to the prime PTP and verify the WDISC command modules, SN Forward SSCs used for testing and operations. LMMS engineers will peak and calibrate pointing of the SN portable antenna for spacecraft commanding. The GMOC and ITF will each be scheduled to send NO-OP or commands via the forward link and TDRSS while testing the SSA (2 kbps) and MA (125 bps) forward services.

SN VER-4 2106.4 MHz S-Band Command Verification Test

NTP section	Owner	Procedure step	Check / Done
3.5.12.2 a	GMOC	Configure and send a SAR, and confirm an accept message was received from the ANCC. Request and configure to receive UPD when the test event goes active.	
3.5.12.2 b	GTD	Verify that the SN ground station has accepted the SN SHO and is configured to support the scheduled GP-B test event.	
3.5.12.2 c	GTD	Configure WDISC to initiate connections for the transfer of command data with the GMOC.	
3.5.12.2 d	GTD	Verify that WDISC PTP has initiated and completed the connections for the transfer of command data with the GMOC and ITF.	
3.5.12.2 e	GMOC	Initiate the transfer of valid command data to the WDISC PTP, after the WDISC is configured to receive commands for the scheduled test event.	
3.5.12.2 f	GTD.	Verify that WDISC PTP has accepted and processed the command data from the GMOC or ITF.	

Additional Comments/Print-outs/messages:

Hardware and Software Version Control - If Different than TRR

H/W and S/W	Version

Test Operator _____ QA Witness _____

2 Ground Network (GN) Verification Test Outline

2.1 VER-2 Scheduling Verification Test

Purpose:
This test will verify that the GMOC can communicate with WOTIS to request a daily schedule of GN GP-B planned activities and receive a daily schedule of GN GP-B scheduled activities. This test will also verify that the GN can communicate with WOTIS to receive a daily schedule of GP-B activities, with a valid ephemeris, and then use that schedule to automatically configure all station equipment for GP-B operational support. The WOTIS will not attach the ephemeris to be sent to the GN master computer.

VER-2 Scheduling Verification Test

NTP section	Owner	Procedure step	Check / Done
4.6.10.2 a	GMOC	Configure and send a GP-B daily schedule request to the WOTIS system, requesting a GN support period.	
4.6.10.2 b	FDF	Sends valid ephemeris data to the WOTIS system.	
4.6.10.2 c	GP-B TD	Verify that WOTIS has received a valid GP-B daily schedule request from the GMOC and valid ephemeris data from FDF.	
4.6.10.2 d	WOTIS	Schedule and assign a GN station event support period with no ephemeris attached.	
4.6.10.2 e	WOTIS	Configure and send a GP-B daily schedule to the GN master controller and GMOC mission planning and control system.	
4.6.10.2 f	STC	Verify that the master controller has accepted and processed the GP-B daily schedule.	
4.6.10.2 g	STC	Verify that the master controller has correctly configured the remote nodes and other required systems for GP-B support.	
4.6.10.2 h	GMOC	Verify that the ground data system has accepted the GN schedule and is configured to support the scheduled test event.	

Additional Comments/Print-outs/messages:

Hardware and Software Version Control - If Different than TRR

H/W and S/W	Version

Test Operator _____ QA Witness _____

2.2 VER-3 S-Band TT&C Verification Test

Purpose:
This test will verify that the GN can receive GP-B simulated 5.12 MS telemetry data from the test PTP and S-Band RF signal generator. The GN will then amplify, decode, demodulate, and transfer via the OPS PTP and S-SAFS to the C-SAFS and other test elements, as scheduled by WOTIS. GP-B supports will be scheduled by WOTIS for verification testing and the GMOC for verification testing. The GP-B GN OPS PTP will record all telemetry data and then perform a post-pass transfer of the data to the S-SAFS for subsequent transfer to the GSFC C-SAFS, for GMOC retrieval, during this phase of testing. This test will also verify that the GP-B GN OPS PTP can record all required telemetry data and then transfer all the recorded data and corresponding metadata files to the S-SAFS for transfer to the C-SAFS for GMOC retrieval. Post-pass the GN site will send the tracking data file to FDF. FDF will check to make sure the parameters are correct for the GPB spacecraft.

VER-3 S-Band TT&C Verification Test

NTP section	Owner	Procedure step	Check / Done
4.6.11.2 a	WOTIS	Configure and send a GP-B daily schedule to the GN master controller with no ephemeris attached.	
4.6.11.2 b	GN OPS	Verify that the master controller has accepted and processed the GP-B daily schedule.	
4.6.11.2 c	GMOC	Configure to receive telemetry and command socket connections.	
4.6.11.2 d	GN OPS	Verify all equipment has configured to initiate the transfer of telemetry receive commands.	
4.6.11.2 e	GN OPS	Verify that the Station Status Broadcaster has connected to the GMOC. Verify the OPS PTP has good telemetry and socket connections.	
4.6.11.2 f	GMOC	Verify the Station Status Broadcaster is sending valid updates.	
4.6.11.2 g	GMOC	Transfer of command data to the GN station.	
4.6.11.2 h	STC	Verify the OPS PTP is receiving commands and the GMOC is receiving telemetry.	
4.6.11.2 i	STC	Verify that the OPS PTP performed a normal post-pass shutdown and transferred all telemetry and meta-data files to the S-SAFS.	
4.6.11.2 j	STC	Verify that the S-SAFS received all VC files.	
4.6.11.2 k	GP-B TD	Verify that the ground data system has received all expected real time telemetry data products from the GN station.	
4.6.11.2 l	GP-B TD	Verify that the GMOC has received all expected post-pass telemetry data files from the C-SAFS, with the corresponding meta-data files also received.	
4.6.11.2 m	FDF	Verify receipt of the post-pass tracking data file from the GN site. Send a detail report verifying correct parameters for the GPB spacecraft.	

Additional Comments/Print-outs/messages:

Hardware and Software Version Control - If Different than TRR

H/W and S/W	Version

Test Operator _____ QA Witness _____