Catching gamma ray bursts on the fly . . .

UVOT Comprehensive Functional Test Procedure

410.4-PROC-246

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Prepared by: Peter Gorog / Code 568

Goddard Space Flight Center Greenbelt, Maryland

UVOT Comprehensive Functional Test Procedure

Rev. – 6.0

PREPARED BY:

____
Peter Gorog Raytheon ITSS, Chief Systems Engineer

REVIEWED BY:

____
Mark Edison/Spectrum Astro Swift Observatory Integration and Test Manager

____
Terry Fletcher SPECTRUM ASTRO, Quality Assurance

____
Phil Smith, MSSL, Software engineer

APPROVED BY:

____
Joanne Baker/568
Swift Instrument Module Integration and Test Manager

DOCUMENT CHANGE RECORD

(Explicitly note if changes have safety implications)

Revision	Description	Date	Approval
-1.0	Initial Release	02/13/2003	
-2.0	Updated for IST	03/24/2003	
-3.0	Updated for IST	03/28/2003	
-4.0	Updated for DPU/ICU code upload	05/05/2003	
-5.0	Updated for AIST	05/27/2003	
-6.0	Updated for UVOT flight SW uploads via MOC. New uvot_functional_test.proc records housekeeping and NEB4 currents automatically.	08/04/2003	

1. OVERVIEW

This document describes the UVOT Comprehensive Functional Test Procedure that will provide the functional verification as required by the UVOT Electronics Boxes Electrical Integration Procedure for Spacecraft Bus, (CONTRACT NO. NAS5-97256, D.O. NO. 7) document.

The test procedure described in this document is based on the

- UVOT Short/Long Functional Test Procedure (SWIFT-UVOT-112-R00, Rev. 1.3, 12, December, 2002).
- UVOT Electronics Boxes Functional Test Procedure (410.4-PROC-0240 ver. 1.0 December 19, 2002)

The purpose of the UVOT Comprehensive Functional Test is to demonstrate the functionality of the UVOT DEM and TM after integration to the SWIFT spacecraft. It is designed to provide a test procedure that demonstrates that the instrument possesses most of the functionality. The UVOT Spacecraft Functional Test would take approximately 3 hours to execute and verify.

This procedure requires that the DEM and the TM be connected to the SWIFT Spacecraft Power Bus, to the 1553 Bus as well as to the Thermal Connector. These connections assumed to be verified according to UVOT Electronics Boxes Electrical Integration Procedure.

2. TEST CONFIGURATION

The UVOT Spacecraft Functional Test Configuration is described in the UVOT Electronics Boxes Electrical Integration Procedure.

3. INITIAL CONDITIONS

Before commencing the UVOT Comprehensive Functional Test all setups and verifications described in the UVOT Electronics Boxes Electrical Integration Procedure must have been successfully completed. It is also assumed that all power lines to the UVOT are disabled and turned off.

This telescope has image intensifiers and is damaged or aged by any light. Any light visible to the human eye can damage this detector! When powered, a telescope door or cover is not sufficient protection from light. At the correct darkness, the instrument can operate at atmospheric pressure and high vacuum. Intermediate pressures can however allow electric discharges that will damage the instrument! MSSL
hardware and/or software personnel must be present for operation!

This test may be performed in ambient light condition.

The UVOT test conductor must visually verify that the "SAFE PLUG" is installed (par. 3.4 Step 1).

The test conductor must verify that no inappropriate ICU or DPU error codes have been issued before checking pass box after each step.

This test procedure requires the following ITOS workstations:

- Spacecraft workstation (SCWS)
- UVOT workstation (UWS)
- 1553 Bus monitoring workstation (BWS)
- AC 1000 workstation (AWS)

All commanding will be executed from the SCWS and the results will be simultaneously observed on both the SWCS and the UWS. The BWS will monitor all activities and errors, if any, on the 1553 bus. The ACS will provide the proper spacecraft parameters (no constraint).

The telemetry data will be archived on the SCWS only and the archive files will be copied over to UWS after the test is completed.

Before issuing any command the test conductor at the SCWS console shall confirm it with personnel at the UWS. The test conductor at the UWS is responsible for verifying the status of the UVOT both before and after the execution of a command.

4. Test Conductors & Commanding

The following roles have been established to clarify responsibility during the execution of this test procedure. Please record the names of the individuals who are performing these roles.

ROLE	INDIVIDUAL
a) Test & Integration Manager (TIM):	______________________________
b) Designee of Test & Integration Manager (DTIM):	______________________________
c) UVOT Instrument Test Conductor (UTC):	______________________________
d) Quality Assurance Personnel (QA):	______________________________
e) Operator At The SCWS Console (OSC):	______________________________
f) Operator At The 1553WS Console (O1553):	______________________________
g) Operator At The UWS Console (OUVOT):	______________________________
h) Operator At The AWS Console (OAWS):	______________________________

It is Spectrum Astro's responsibility to assign a person as the Test & Integration Manager (TIM).

The UVOT Instrument Test Conductor (UTC) has the full responsibility for the proper execution of this procedure. The UTC has to confirm visually and verbally every command sent to the spacecraft. When a proc is executed and it stops waiting for operator input the TCS must wait for the UTC's instruction before responding to a prompt or clicking on the GO button on the upper left corner of the proc window.

If an incorrect command is sent to the spacecraft the UTC has the authority to take whatever corrective action is necessary depending of the classification of the command. The commands used in this procedure are classified as follows:

- Hazardous (H)
- Critical (R)
- Conditionally Critical (C)
- Not critical (N)

The ITOS currently does not distinguish among Hazardous, Critical and Conditionally Critical therefore we reference these three categories in the rest of this document as Critical.

4.1. Critical Commands.

This procedure assumes that the proper designations (H, R, C or N) are entered into the ITOS database (Command Record: Field 11). ITOS will prompt for permission to send the command whenever a Critical command is entered by the operator.

The following commands used in this procedure are in this category:

- See attached list

If a Critical command is sent inadvertently or with the wrong parameter(s) the UTC shall immediately notify the Test & Integration Manager (TIM) or its designee (DTIM). No further action/function shall be performed without the explicit written approval of the TIM. The TIM will open a QAR and will decide the corrective action after consultation with the UTC, the QA and if necessary with other instrument managers.

All actions and decisions must be properly documented and attached to the QAR and the "As Run" test procedure.

4.2. Non-Critical Commands.

ITOS will NOT prompt for permission to send these commands.

All commands that are not listed in par. 4.1 are Non-Critical.

If these commands are sent inadvertently or with the wrong parameter(s) the UTC shall immediately notify the Test & Integration Manager (TIM) or its designee (DTIM).

No further action/function shall be performed without the explicit written approval of the TIM. The TIM will decide if a QAR shall be opened and the corrective action to be taken.

All actions and decisions must be properly documented and attached to the "As Run" test procedure and the QAR if one was opened.

4.3. Configuration Management

The UTC shall record and verify the software versions used to conduct this procedure.

The Integrated Test Operating System (ITOS) version number is displayed above the Spacecraft Telecommunications Operating Language (STOL) prompt.

If used, the AC-1000 version number can be found on its main screen, and the AstroRT version is found on its main screen.

The instrument software version number and revision shall be proved by the applicable instrument software manager.

This procedure can be executed in the following two S/C power configurations:

1. Battery
2. SAS

It is the responsibility of the UTC to request and verify the actual S/C power configuration.

S/C power configuration (battery or SAS): ____

EGSE Software Version Number and Revision: ____

ITOS Software Version Number and Revision: ____

S/C ITOS Pages, Procs and DBX Version Number and Revision: ______________________________

Flight Software Version Number and Revision:____

AC-1000 Software Version Number and Revision:____

Astro RT Software Version Number and Revision: ____

BAT Instrument Software Version Number and Revision: ___________________________________

UVOT ICU Software Version Number and Revision: ____

UVOT DPU Software Version Number and Revision: ____

UVOT ITOS Pages, Procs and DBX Version Number and Revision: ______________________________

XRT Instrument Software Version Number and Revision: ___________________________________

UVOT Primary DEM Serial Number: ____

UVOT Redundant DEM Serial Number: ____

UTC_________________
QA_________________

4.4. Quality Assurance Report (QAR) and Non-conformance Report (NCR) List

Table 4-1 lists the current QARs and NCRs that are outstanding against the S/C.

Table 4-1. Non-Conformance Items and QARs/NCR

Document Number	Summary/Comments
	See attached list of the current QARs and NCRs.
	See VDD for details
	Indicate here and attach continuation page if necessary.

This list has been reviewed as to the effect these items may have on execution of this procedure.

UTC:__________

QA:___________

5. WORKSTATIONS

When this procedure is performed as an independent CFT continue with 5.1. If this procedure is called from the UVOT Flight Software Update Procedure continue with Section 7 Step 1.

Independent CFT (yes/no): ______________

5.1. Start Spacecraft workstation (SCWS)

If the S/C ITOS system must be aborted for any reason during this procedure the operator at the UWS console has to be notified. The ITOS on the UWS also has to be stopped and it shall be restarted after the S/C ITOS is up and running again. Failing to follow this procedure will disconnect the UWS from the SCWS and UWS will not receive telemetry.

5.1.1. Power ON the spacecraft in idle mode.

When this procedure is executed as part of the Integrated System Test (IST) the following step is performed prior to commencing this procedure.

Is this an Integrated System Test (IST)? _____________________
If the answer is yes and continue at 5.1.2

Execute the Swift Spacecraft Power ON/OFF procedure, 1143-EP-W27641. Spacecraft Power is supplied via Solar Array Simulator.

Record :

- Bus Voltage: _____________V
- Current: _________________A

This will automatically start the S/C ITOS system. No valid telemetry is expected during warm-up and no commanding is allowed.

5.1.2. Run shell script in a terminal window to configure ITOS symbolic links.

- Set directory
  1. cd /swift-sc/swift-itos
- Channel selected (prime, redundant): _______________
  - For Primary channel
    1. ./iprime
  - for the Redundant channel
    1. ./iredundant

This proc can be run even after the ITOS had been started. The steps in this procedure designed for testing the PRIMARY side are marked with P and for the REDUNDANT side with R in the Steps column. The REDUNDANT side steps can only be executed if the operator runs the "iredundant"

DO NOT EXECUTE STEPS THAT ARE NOT CONSISTENT WITH THE SIDE SELECTION!

5.1.3. Configure the SSR in ITOS STOL window

When this procedure is executed as part of the Integrated System Test (IST or AIST) or Day in the Life Test (DiLT) skip to par. 5.1.4

IST, AIST or DiLT: _______________

5.1.3.1. start sc_config_ssr
This procedure runs for approximately 20 minutes if the "test" option is used.
5.1.3.2. Write Enable SSR for UVOT, S/C and HIPRI telemetry
5.1.3.3. Verify that the SSR is receiving data: on page scdownlink

5.1.4. Enable archiving all virtual channels in ITOS STOL window
5.1.4.1. start masterarchive

At this point we expect that the "telemetry relay" is turned on, so SCWS will relay telemetry to UWS when the UVOT power is turned on.

5.2. Start UVOT workstation (UWS)

If the S/C ITOS system must be aborted for any reason during this procedure the operator at the UWS console has to be notified. The ITOS on the UWS also has to be stopped and it shall be restarted after the S/C ITOS is up and running again. Failing to follow this procedure will disconnect the UWS from the SCWS and UWS will not receive telemetry.

5.2.1. UWS power on
5.2.2. Log onto UWS
5.2.2.1. Type: cd itos_groupdir,
5.2.2.2. Run shell script to configure ITOS symbolic links. Start procs according to the Selected Channel (prime, redundant): _________________
- For Primary channel: ./iprime
- for the Redundant channel: ./iredundant

5.2.2.3. Start ITOS: itos

At this point we expect that the "telemetry relay" is turned on, so UWS will receive telemetry when the UVOT power is turned on.

5.3. Start 1553 bus monitoring workstation (BWS)
5.3.1. BWS power on
5.3.2. Log onto BWS
5.3.3. Run bustools

5.4. Start AC 1000 workstation (AWS)

AWS is used (yes/no):____________
If the response is NO go to 6.1

If the AWS is used and this procedure is executed as part of the Integrated System Test (IST or AIST) or the Day in the Life Test (DiLT) skip to Section 6.

IST, AIST or DiLT: _______________

5.4.1. AWS power on
5.4.2. Log onto AWS
5.4.3. **Get S/C into mission mode**
5.4.3.1. at the ITOS prompt type:

- start scacs_require_error_trap
- start scacs_powerup_nebs("AB")
- wait until the proc completes
- start scacs_end_grb. Follow prompts in script when to place AC 1000 into open or closed loop mode
- Record the proc name, date and version #: __________________________________
- When the proc prompts: Perform Slews select OK button.
- When the proc prompts "Shutdown ACS?" select CANCEL button.
- start scacs_rwbias_ac1000
- start scacs_sc3arcmin

5.4.3.2. Verify ACS Mode on the SCWS. Expected Mode: inertial point
page scstartup.
Actual Mode = ____________

6. POWER SUPPLY VERIFICATION PROCEDURE:

When this procedure is performed as an independent CFT continue with 6.1. If this procedure is called from the UVOT Flight Software Update Procedure continue with Section 7 step 1.

Independent CFT (yes/no): ______________

Step	Action / ITOS	Monitor	Verification	Pass / Fail Signature	Date & Time
1	Verify that the "SAFE PLUG" is installed. QA must verify and sign this step!	Spacecraft, UVOT	The UVOT test conductor must visually verify that the "SAFE PLUG" is installed.	☐ ☐ UTC:_____ QA:_______	
2	Check S/C Power	Power line	Both power lines are turned off. Record from the EGSE computer: BUSVOLT:__________V	☐ ☐	
3	Verify UVOT Power OFF page shw_NEB4_switches Follow the instructions on the page.	Record Switch positions. NEB4A and NEB4B should be ON after the S/C mode was set in 5.4.3.1 All the other switches must be OFF!	NEB4A Current:_______ NEB4B Current:_______ NEB4A:_____________ NEB4B:______________ UVOT Elec DEMA :____ UVOT Elec DEMB :____ UVOT TelescopA :_____ UVOT TelescopB :_____	☐ ☐	
4	Verify : Survival Heaters=OFF page shw_NEB3_switches	Record Currents and Switch positions. All but NEB3A, NEB3B and IPCU TLM Conv A must be OFF!	NEB3A Curr:_________ NEB3B Curr:_________ NEB3A:_____________ NEB3B:_____________ UVOT:______________ IPCU TLM Conv A:____	☐ ☐	
5	Check: Survival Heaters on page uvotsctm or page scace_sf2	Record temperatures. UVOT = Temp CH 11-15	Temp CH 11 :________ Temp CH 12 :________ Temp CH 13 :________ Temp CH 14 :________ Temp CH 15 :________	☐ ☐	

7. UVOT SPACECRAFT FUNCTIONAL TEST

The Steps described in this section are performed by the uvot_power_on.proc. The UTC shall record the values every time the proc halts. When this procedure is performed as an independent CFT continue with 6.1. If this procedure is called from the UVOT Flight Software Update Procedure continue with Section 7 step 1.

Independent CFT (yes/no): ______________

Time	Step	Action	ITOS Command, or other action	ITOS display	Remarks	P/F
	1.	Verify Channel Selection	Verify the TM channel (prime or redundant) selected in par. 5.1.2. Record the configuration.	Primary:__________________ Redundant:________________	IF this procedure is performed as part of the ICU/DPU software upload procedures the side selection shall be confirmed using the relevant paragraph of those procedures	

	2.	Verify if this procedure is part of an ICU and/or DPU software upload. If it is then UVOT is already powered on therefore the procedure should continue at Step 12.	IF DPU and/or ICU software upload performed then
			goto Step 12
			Else
			goto Step 3
				Record:
				DPU software upload performed:_______
				
				ICU software upload performed:_______		

	3.	Run Functional Test	start uvot_functional_test ("PRIME") or start uvot_functional_test ("REDUNDANT")	Verify the proc started in the PROC window Procedure started at : Date: _____________ Time: _____________		
	4.	Check for 1553 errors	Check for error messages related to 1553 communications.	DPU Errors: No Response: _____________ ME/Illegal: _______________ ICU Errors: No Response: _____________ ME/Illegal: _______________		
	5.	Select NEB4 A or B		NEB4 (A or B):_________________ UVOT_ICU "ENA":________ UVOT_DPU "ENA":________ UVOT_ICU BUS_ (A or B) :____________ UVOT_DPU BUS_(A or B) :____________		
	6.	check ICU housekeeping and limits after DEM power ON		Record: NEB4A Current:__________ A NEB4B Current:__________ A		
	7.	check ICU housekeeping and limits after DEM and TM power ON		Record: NEB4A Current:__________ A NEB4B Current:__________ A		

Time	Step	Action	ITOS Command, or other action	ITOS display	Remarks	P/F
	8.	Choose power on/aliveness or functional test	Respond to: “Do you want to continue with the functional test?” Click on OK to continue Click on Cancel to skip	Response (OK or Cancel): _____________		
	9.	Check for 1553 errors	Check for error messages related to 1553 communications.	DPU Errors: No Response: _____________ ME/Illegal: _______________ ICU Errors: No Response: _____________ ME/Illegal: _______________		
	10.	Select "beam steerer" test	"do you want to move the beam steerer?" Click on OK to continue with step Click on Cancel to skip	Response (OK or Cancel): _____________		
	11.	Check for 1553 errors	Check for error messages related to 1553 communications.	DPU Errors: No Response: _____________ ME/Illegal: _______________ ICU Errors: No Response: _____________ ME/Illegal: _______________		
	12.	Verify if this procedure is part of a DPU software upload. If it is then UVOT must not be powered OFF !	If this procedure was called from the UVOT DPU Flight Software Upload Procedure (410.4-PROC-0284) return to that procedure (Section 7 Step 52.)	Record: DPU software upload performed:_______	The current version of the uvot_functional_test.proc would turn OFF the UVOT before the exposure test. The proc should ask the operator before starting the uvot_power_on.proc or the uvot_power_off.proc.	
	13.	Verify if this procedure is part of an ICU software upload. If it is then UVOT must not be powered OFF !	If this procedure was called from the UVOT ICU Flight Software Upload Procedure (410.4-PROC-0253) return to that procedure (Section 7 Step 19.)	Record: ICU software upload performed:_______		
	14.	Turn the UVOT power off.	start uvot_power_off	Verify the proc started in the PROC window Proc started: ________________ Power off (yes/no): ____________		
	15.	Before the S/C is powered down the data stored on the SSR must be downloaded		Check archive directory for files: uvot_functest_mm_dd_ yyyy_VC6 uvot_functest_mm_dd_ yyyy_VC6	page scdownlink Enable Downlk Stat for UVOT, S/C and HIPRI	
	16.	Stop Archiving	archive stop all			
	17.	In order to retrieve data from the S/C workstation execute the three steps	1. Disable TLM 2. Enable TLM 3. acquire scptp_gn			
	18.	Copy archive files and sequential logs to a backup medium				

8. DATA ANALYSIS

8.1. Test Acceptance

Verify that the following tests were performed correctly and produced the expected results. Use the attached log file to verify the results.

8.1.1. Verify Selection of the 1553A for ICU and DPU

Pass/Fail: _________

8.1.2. Verify UVOT DEM Power-on

Pass/Fail: _________

8.1.2.1. Verify ICU housekeeping

Pass/Fail: _________

8.1.3. Verify UVOT TM Power-on

Pass/Fail: _________

8.1.3.1. Verify Verify ICU housekeeping and limits

Pass/Fail: _________

8.1.4. Verify ICU watchdog test

Pass/Fail: _________

8.1.4.1. Verify ICU housekeeping and limits

Pass/Fail: _________

8.1.5. Verify ICU housekeeping after switching to safe

Pass/Fail: _________

8.1.6. Verify DPU housekeeping and limits after DPU reboot

Pass/Fail: __________

8.1.7. Verify Selection of the 1553B for ICU and DPU

Pass/Fail: __________

8.1.8. Verify Selection of the 1553A for ICU and DPU

Pass/Fail: __________

8.1.9. Verify time sync test

Pass/Fail: __________

8.1.10. Verify SSI test

Pass/Fail: __________

8.1.11. Verify heater test

8.1.11.1. Verify currents for heaters: off

Pass/Fail: __________

8.1.11.2. Verify currents for heaters: main

Pass/Fail: __________

8.1.11.3. Verify currents for heaters: forward

Pass/Fail: __________

8.1.11.4. Verify currents for heaters: focus

Pass/Fail: __________

8.1.11.5. Verify currents for heaters: secondary
Pass/Fail: _________

8.1.12. Verify ICU EEPROM test
Pass/Fail: _________

8.1.13. Verify DPU EEPROM test
Pass/Fail: _________

8.1.14. Verify "beam steerer" test
Pass/Fail: _________

8.1.15. Verify Filter wheel test
Pass/Fail: _________

8.1.16. Verify BPE RAM test
Pass/Fail: _________

8.1.17. Verify low-voltage safety circuit test

Pass/Fail: _________

8.1.17.1. Verify ICU housekeeping and limits

Pass/Fail: _________

8.1.18. Verify Detector intensifier characteristics exposure

Pass/Fail: _________

8.1.19. Verify DPU window test

Pass/Fail: _________

8.1.20. Verify flatfield test

Pass/Fail: _________

8.1.21. Verify TM power-off

Pass/Fail: _________

8.1.22. Verify DEM power-off

Pass/Fail: _________

THIS IS TO CERTIFY THAT THE UNIT HAS MET THE ACCEPTANCE STANDARDS OF THIS PROCEDURE.

ENGINEER DATE

QUALITY ASSURANCE DATE