HESSI SPACECRAFT
RETURN TO BASE FUNCTIONAL

HSI_MIT_059B

2001-MAY-18

DAVE CURTIS

As Run on: _____ (Date/Time)

By _____ (Test Conductor)

Test _____

DOCUMENT REVISION RECORD

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A	2000-12-1	First Release
B	2001-05-18	Including Modified S/C Power On/Off Steps

Western Range/NASA Safety:_____ _____
Date

Project Manager: _____ _____
Peter Harvey Date

System Engineer: _____ _____
David Curtis Date

QA: _____ _____
Ron Jackson Date

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1. INTRODUCTION

1.1 Purpose

This document establishes the Return To Base (RTB) Functional Test Procedure for the HESSI Spacecraft to be performed at the Hot Pad at VAFB or CCAS. The purpose of this procedure is to verify functional operation of the spacecraft to the extent possible while in the fairing.

1.2 Scope

This procedure will be performed at the Hot Pad following the Combined System Test, and following any ferry or launch attempt that involves the OCA leaving the ground.

2. SETUP

2.1 Test Setup

The spacecraft shall be connected to the EGSE via the TAC and Battery Relay Box. The Flight Enable Plug (FEP) shall be disconnected to avoid accidental RF transmission or solar array deployment.

The Battery Relay shall be enabled, and the TAC supply voltage shall be set to trickle-charge the battery at 0.2A.

Verify the test set-up is per the HESSI Spacecraft Power ON/OFF Procedure, HSI_MIT_049, Section 3.0, Spacecraft Power via Test Access Connector (TAC). Verify the following conditions:

a. Spacecraft (S/C) to Ground Support Equipment (GSE) interface connectors shall be mated at the start of this procedure. Including:

TAC-J1	_____ OK
BFP-J1	_____ Relay Box
FEP	_____Removed
UMB-J1	_____Connected to Launch Vehicle

b. List any non-flight configuration of the spacecraft

QA Verify:
TC Verify:

Spacecraft Non-Flight Configurations

1	
2	

3. POWER ON PROCEDURE

3.1 Spacecraft Power On

a. Power ON the spacecraft using the Spacecraft Power ON/OFF procedure, HSI_MIT_049, Section 3.0, Spacecraft Power via Test Access Connector (TAC). Record the TAC Voltage and Current.

TAC Voltage		28–36 Vdc
TAC Current		TAC-BATT = 0.5 – 1.4 Adc
Batt Current		

1. Verify Mission Mode on the ITOS PACI page is MISSION (not LAUNCH) _____OK

- If LAUNCH mode, run ITOS script "sc_mm_nom", power off the bus, and start again at step a.

b. Enable the battery onto the bus:

1. Set the TAC voltage to match the BATT VOLT value on the ITOS PACI telemetry page plus 0.7V. _____Volts

2. Enable the battery onto the bus by clicking on the Battery Relay button on the PC _____OK

3. Increase the TAC voltage by 0.2V steps while monitoring the BATT CURRENT on the ITOS PACI page. Increase TAC voltage until BATT CURRENT reads +1Amp _____OK

c. Enable power to all of the ACS components using the following sequence:

2. Display the “FSW Menu” ITOS telemetry display by typing “page fswmenu,1,1” at the ITOS STOL command prompt.

2. In the FSW Menu telemetry display click on the “PCB Interface” button to display the PCB status ITOS telemetry page.

3. In the “PCB Interface” telemetry display click on the NEB1 “ON” button to command the PCB NEB1 bus on, and verify that the status indicator for NEB1 displays “ON.” _____OK

4. In the “PCB Interface” telemetry display click on the FSS “ON” button to command the PCB to turn on power to the fine sun sensor, and verify that the status indicator for the FSS displays “ON.” _____OK

5. In the “PCB Interface” telemetry display click on the Torque Rod XZ “ON” button to command the PCB to turn on power to the ADB X and Z1

torque rod drivers, and verify that the status indicator for the Torque Rod XZ displays “ON.” _____OK

6. In the “PCB Interface” telemetry display click on the Torque Rod YZ “ON” button to command the PCB to turn on power to the ADB Y and Z2 torque rod drivers, and verify that the status indicator for the Torque Rod YZ displays “ON.” _____OK

7. In the “PCB Interface” telemetry display click on the Magnetometer “ON” button to command the PCB to turn on power to the Magnetometer, and verify that the status indicator for the Magnetometer displays “ON.”

8. In the FSW Menu telemetry display click on the “ACS Subsystem” button to display the ACS status ITOS telemetry page.

9. In the ACS telemetry display verify that the magnetometer magnetic field values are updating. _____OK

10. If possible, verify torque rods are active ("singing") _____OK

11. Turn off acquisition sequence: "/acssetmode idle" _____OK

12. Record the TAC voltage and current:

TAC Voltage		28–36 Vdc
TAC Current		TAC-BATT = 1.0 – 1.5 Adc
Batt Current		

d. This section powers on the batter pressure monitors

a. In the “PCB Interface” telemetry display click on the NEB2 “ON” button to command the PCB NEB2 bus on, and verify that the status indicator for NEB2 displays “ON.” _____OK

b. In the "PCB Interface" telemetry display click on the SPARE 1 "ON" button to command on the battery pressure monitor, and verify the status indicator for SPARE 1 displays "ON" _____OK

c. Record the Battery Pressure telemetry on the "PACI" page

Batt Press 1		3000-5000
Batt Press 2		3000-5000

d. This section powers on the SSR and prepares it for use

1. Start the procedure SSR_ON. Verify SSR status is ON on the "PCB Interface" page _____OK

2. Record TAC voltage and current:

TAC Voltage		28–36 Vdc
TAC Current		TAC-BATT = 1.3 – 1.9 Adc
Batt Current		

3.2 Power on the Instrument

a. This section powers on the IDPU. Instrument displays should be on a separate ITOS computer if possible.

1. Display the “IGSE Menu” ITOS telemetry display by typing “page igse_pages” at the ITOS STOL command prompt.

2. In the IGSE menu click on the "SOH Executive" button and the "IDPU Voltages" button

3. Start the "SC_IDPUON" procedure. In the “PCB Interface" page verify that the status indicator for the IDPU displays “ON.” Verify IDPU current is less than 0.7A _____OK

4. Verify that the IDPU_MODE on the "SOH Executive" displays "Normal"_____OK

5. Record any errors on "SOH Executive" page (SPECTEMP error is normal if detectors are warm)

Error Count: _____ Errors Code:_____

6. Start the "SC_CPCON" procedure. In the “PCB Interface" page verify that the status indicator for the CRYO displays “ON.” Verify CRYO Current is less than 0.1A _____OK

7. On the "PCB" page verify no OC trips. _____OK

8. Record TAC voltage and current:

TAC Voltage		28–36 Vdc
TAC Current		TAC-BATT = 1.8 – 2.2 Adc
Batt Current		

b. Turn on the Imager

1. In the IGSE menu click on the "SOH ADP" button and the "SOH Imager Voltages" button

2. Start the IMGR_ON procedure. Verify that 5 IADP_PWR fields on the SOH ADP page are all "ON". _____OK

3. Send /IDPUCLEAR to clear errors. Verify that the IDPU_ERRCODE field on the SOH Executive page reads "NONE" _____OK

4. Send /IADPMODE VALUE=15 to clear ADP errors. Verify that the 4 ADP_STATUS fields on the SOH ADP page read "OK" _____OK

5. Load the default parameter file: start "v4s0r0_003". Verify all 4 IADP_STATUS values on the SOH ADP page are "OK" _____OK

6. Send /IADPRUN. Verify all 4 IADP_STATUS values on the SOH ADP page are "OK" _____OK

7. Record TAC voltage and current:

TAC Voltage		28–36 Vdc
TAC Current		TAC-BATT = 2.0 – 2.6 Adc
Batt Current		

c. Turn on the Spectrometer Interface

1. In the IGSE menu click on the "SOH Spec Power" button

2. Display the "IDIB" ITOS page

3. Start the IDIB_ON procedure. Verify that the voltages (+12, +5, -5, -12) for all 9 DIBs are nominal (+/-0.3V) _____OK

4. Start the IDIB_TM_ON procedure _____OK

5. Record TAC voltage and current:

TAC Voltage		28–36 Vdc
TAC Current		TAC-BATT = 2.9 – 3.5 Adc
Batt Current		

d. Power on the Particle Detector (NOTE: No PMT HV)

1. In the IGSE menu click on the "SOH Particle Detector", "SOH PMT", and "SOH MEM DUMP" buttons

2. Enable the particle detector high voltage. "/IDPUARM PDHV". Verify that the PDHV value on the SOH Particle Detector page reads "ENABLED" _____OK

3. Turn on the particle detector using the IPD_ON procedure. Verify that the IPDHVDAC value on the SOH Particle Detector page starts to increment once a second. _____OK

4. Enable PMT VC1 telemetry: On the Downlink ITOS page, select "Bypass Transmitter", then "Stored SOH On", then "IDPU Diagnostics ON" _____OK

5. Start PMT telemetry: "/IDPUDUMPTABL PMTVARS". _____OK

6. Wait for IPDHVDAC and IPMT_HVDAC to reach their final values. (IPDHVDAC = 122, IPMT_HVDAC = 130) _____OK

7. Record bus voltage and current:

TAC Voltage		28–36 Vdc
TAC Current		TAC-BATT = 3.0 – 3.5 Adc
Batt Current		

e. Increase the TAC current limit on the PC GSE to 6Amps _____OK

f. Increase the TAC voltage on the PC GSE in 0.1V steps until the Batt Current is about 0.8A (0.2A if I&T battery), but not greater than 36V. _____OK

g. Record Battery Temperature on PACI page. If greater than 25C notify engineer immediately _____OK

h. Organize screens so that all data can be seen. Take page snaps of all screens (Instrument and Spacecraft). Be sure that a system clock is on each screen _____OK

3.3 Collect Trending Data

a. Start the 'Sprt_trnd" ITOS Procedure to collect trending data _____OK

Completed Date/Time: _____

4. TEST PROCEDURE

4.1 IAD Position Check

Do not move the IADs. They have been positioned for launch. Record their positions as viewed on the PACI page:

IAD1 Position (expect -1.4)_____

IAD2 Position (expect -9.8)_____

4.2 Fine Sun Sensor & Coarse Sun Sensor Functional

The FSS stimulus head is not installed so minimal testing can be performed.

a. Verify the FSS indicator on the ITOS ACS page reads "No Sun"

TC Verify _____

b. Verify the CSS indicator on the ITOS ACS page reads "No Sun", and the CSS currents are all below 4 microamps

TC Verify _____

4.3 Torque Rod Compensation Matrix

a. From ITOS, start the torque rod compensation matrix test procedure by typing, “start tqrod_comp” from the ITOS STOL prompt. Verify that the magnetic filed responds to each torque bar.

b. Rename the output file "tqrod.comp.plt" in hessiops /usr/tmp to "trqrod_comp_YYMMDD.plt" (e.g. trqrod_comp_000311.plt). Verify that the report file says "PASSED" _____OK

c. Record filename here

_____

4.4 Telecommunications Test

No RF transmissions are allowed in the fairing, and the antenna hats are off, so almost no telecom testing can be performed.

a. On the ITOS PACI page verify the signal strength (RCV STRENGTH) is less than 1.2

TC Verify _____

b. On the ITOS PACI page, verify that the RCV SUBLOCK and RCV CARLOCK are "NO LOCK".

TC Verify _____

c. On the PACI ITOS page, verify that the transmitter (XMIT POWER) is OFF

TC Verify _____

d. On the PACI ITOS Page, verify the transmit antenna selected is FWD

TC Verify _____

4.5 ELECTRICAL POWER TEST

No solar array simulation is possible (solar arrays are installed), so only a subset of the electrical power test is possible.

4.5.1 Mission Mode Relay Test

a. Type “start test_ccb_mission_mode” from the ITOS STOL prompt. TC verify _____

b. Wait for the test to complete and then review the data. (May need to re-load the .rpt screen to see the final results on these tests) Passed _____

c. Type "start sc_mm_nom" to set back to mission mode. TC verify _____

4.5.2 Battery Temp Select Test

a. Type “start test_ccb_temp_select” from the ITOS STOL prompt. TC verify _____

b. Wait for the test to complete and then review the data. Passed _____

4.5.3 Battery Voltage Test

a. Measure and record the Battery voltage telemetry as measured by the CCB.

Battery Voltage_____

b. Measure and record the Battery Half voltage telemetry as measured by the CCB.

Battery Half Voltage_____

c. Measure and record the bus voltage using the Power PC . Bus Voltage_____

4.5.4 VT Select Telemetry Test

a. Type “start test_ccb_vtcurve_tlm” from the ITOS STOL prompt. TC verify _____

b. Wait for the test to complete and then review the data. Passed _____

5. INSTRUMENT TESTS

5.1 PMT Test

The PMT HV is off because the PMT cover is off. Verify PMT counts are zero. The first three bytes on the IDPU Dump page should read zero. TC Verify_____

5.2 Particle Detector Test

a. With the nominal PD settings (IPDTHRESH=6, IPDHVDAC=122), record the PD counters (should be 0/0) IPDCTRA_____ IPDCTRB_____

b. Set the PD threshold to 4: Send ITOS command "/IPDTHRESH VOLTAGE=4". Record the PD Counters (should be 0/0):
IPDCTRA_____ IPDCTRB_____

c. Set the PD threshold to 2: Send ITOS command "/IPDTHRESH VOLTAGE=2". Record the PD Counters (should be <30/0):
IPDCTRA_____ IPDCTRB_____

d. Set the PD threshold back to 6: Send ITOS command "/IPDTHRESH VOLTAGE=6". Record the PD Counters (should be 0/0):
IPDCTRA_____ IPDCTRB_____

5.3 Cryocooler Test

a. Run ITOS command "CFGMON CRYOPOWER" to calculate the Cryocooler power level on the Spectrometer power page.

b. Verify that the CPC Status on the SOH Spectrometer Power page is "TRIPPED"
TC Verify:_____

c. Start the ITOS script "ICRYO_ON". Verify that CPC Status is now "OK"
TC Verify:_____

d. Record the ICT1T Temperature on the SOH Spectrometer Power ITOS page
ICT1T:_____

e. Record the accelerometer setting on the SOH Spectrometer Power ITOS page. Should be about 10mG IACCEL:_____

f. Start the ITOS proc "ICRYOMAIN_RAMP(20)". Record the following values:
TIME_____
ICRYOMAIN_____
ICRYOBAL_____
ICRYOPHASE_____
CRYO POWER_____
IACCEL_____

g. Wait 2 minutes, then record ICT1T (should have decrease from previous measurement in (d)) ICT1T:_____

h. Start the ITOS proc "ICRYOMAIN_RAMP(0). Verify that CRYO_POWER returns to zero (+/- 3W) TC Verify:_____
Record the time the Cryocooler stops. TIME:_____
Enter the elapsed on-time in the cryocooler log

5.4 Detector Interface / SSR Test

a. Send the ITOS command "dlsetrate rate4mbps". Verify that ITOS telemetry is discontinued and the BitSync on the signal rack loses lock. TC Verify:_____
b. Set the BitSync to 4Mbps HL (use the preset file). Verify that the BitSync regains lock and ITOS telemetry returns. TC Verify:_____
c. Start the ITOS procedure "IDIB_TM_ON" TC Verify:_____
d. If the SSR has not yet been partitioned, do so now using the button on the SSRCONTROL page.
e. On the SSR ITOS page, push the "PlayOffset=0" button, then the "Start Record" button. Verify that the record pointer on the SSR ITOS page starts incrementing. TC Verify:_____
f. Start the ITOS procedure "idib_evtsim1". Wait 1 minute to collect data in the SSR. TC Verify:_____
g. Stop SSR and Record SSR Last Stored Write Position TC Verify:_____
h. Send the ITOS command "/ssrplayrtsi numpackets=10000, bypassedac=0". Verify that the playback pointer on the SSR ITOS page starts incrementing. TC Verify:_____
i. Wait for the playback to finish.
j. Send the ITOS command "dlsetrate rate125kbps". Verify that ITOS telemetry is discontinued and the BitSync on the signal rack loses lock. TC Verify:_____
k. Set the BitSync to 125kbps HL (use the preset file). Verify that the BitSync regains lock and ITOS telemetry returns. TC Verify:_____

6. POWER OFF PROCEDURE

6.1 Instrument Power Down

a. Start the "IPD_OFF" ITOS procedure. Verify IPDHVDAC is set to zero in the Particle Detector ITOS page _____OK
b. Start the "IMGR_OFF" ITOS procedure. Verify that the 5 IADP_PWR settings on the ADP ITOS page are all OFF _____OK
c. Start the "IDIB_OFF" ITOS procedure. Verify that the voltages on the IDIB ITOS page are all less than 1 volt. _____OK
d. Verify that the ICRYOMAIN and ICRYOBAL values on the ITOS Spectrometer Power page read zero. **DO NOT PROCEDE OTHERWISE** _____OK
e. Start the "SC_CPCOFF" ITOS procedure. Verify the Cryocooler status on the PCBINTERFACE page indicates OFF _____OK
f. Start the "SC_IDPUOFF" procedure. Verify the IDPU status on the PCBINTERFACE page indicates OFF _____OK

6.2 Spacecraft Power Down

This section powers off the SSR

a. In the “PCB Interfaces” ITOS telemetry display window command off the SSR by clicking on the SSR “OFF” button. Verify that the status indicator for the SSR changes to “OFF.” _____OK

This section commands off all of the ACS components at the conclusion of the testing and powers down the spacecraft.

a. In the "PCB Interfaces" ITOS telemetry display window command off the magnetometer by clicking on the Magnetometer "OFF" button. Verify that the status indicator for the magnetometer changes to "OFF." _____OK

b. In the "PCB Interfaces" ITOS telemetry display window command off the fine sun sensor by clicking on the FSS "OFF" button. Verify that the status indicator for the FSS changes to "OFF." _____OK

c. In the "PCB Interfaces" ITOS telemetry display window command off the power to the ADB X and Z1 torque rod drivers by clicking on the Torque Rod XZ "OFF" button. Verify that the status indicator for the Torque Rod XZ changes to "OFF." _____OK

d. In the "PCB Interfaces" ITOS telemetry display window command off the power to the ADB Y and Z2 torque rod drivers by clicking on the Torque Rod YZ "OFF" button. Verify that the status indicator for the Torque Rod YZ changes to "OFF." _____OK

e. In the "PCB Interfaces" ITOS telemetry display window command off NEB1 by clicking on the NEB1 "OFF" button. Verify that the status indicator for NEB1 changes to "OFF." _____OK

f. If the BFP is installed:
   - Adjust the TAC voltage so that the battery current reads zero on the PACI page
   - Remove the BFP

g. Power down the spacecraft per HSI_MIT_049, "Spacecraft Power On/Off Standard Operating Procedure," Section 3.3. _____OK

Completed date/time: _____