HESSI SPACECRAFT PROCEDURES FOR LAUNCH VEHICLE PROCEDURES - IVT, FLIGHT SIMS, CST TESTS AND LAUNCH PREPARATION

HSI_MIT_062C

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DRAFT

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By _____ (Test Conductor)

Test _____

DOCUMENT REVISION RECORD

Rev.	Date	Description of Change
A	2000-12-4	Original draft
B	2000-12-5	Add COTS&DUT/Supply off prior to removing TAC (and back on after). Also move FEP installation to after CPU is off and TAC is removed.
C	2001-2-8	- Add VT select, Battery Pressure Monitor ON, EFCSET(17), and FWD antenna select in launch preps - Change Ferry preps for no EGSE - Add BFP to CST - Include steps to verify pre-launch battery SOC

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Date

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1. INTRODUCTION

1.1 Purpose

This document establishes the electrical configuration of the HESSI spacecraft for Launch Vehicle tests and launch preparation. The spacecraft will be in the launch configuration, with a small subset of the spacecraft electronics powered, and trickle-charging via the launch vehicle Umbilical.

1.2 Scope

These procedures will be used during the Orbital HESSI Interface Verification Test, Flight Simulations 3 and 4, and Combined System Tests. These tests will be run to Orbital procedures, which shall reference appropriate steps from this procedure to configure the HESSI spacecraft at appropriate points. During launch and ferry preparations, these procedures shall be used to power up the bus and prepare it prior to closing the fairing door. Note that the HESSI closeout procedure (HSI_MIT_047 for ferry and HSI_MIT_048 for launch) shall be performed as the final step prior to closing the fairing door.

1.3 Acronyms

BFP	Battery Flight Plug
CST	Combined System Test
EGSE	Electrical Ground Support Equipment
FEP	Flight Enable Plug
IVT	Interface Verification Test
TAC	Test Access Connector

2. SEQUENCE OUTLINES

These sections describe the test sequences from the spacecraft point of view. These sequences are more fully described in the relevant Orbital procedures, and are only here for reference (the Orbital procedures take precedence).

2.1 IVT Sequence

a. Prior to the test, setup per section 3.1
b. At the appropriate step power on the spacecraft using section 4.1
c. At the appropriate step prepare for a switch to (simulated) Launch Vehicle power using section 4.2 (36Volt 1Amp Current Supply)
d. At the appropriate step return to TAC power using section 4.5
e. At the appropriate step power-off the spacecraft using section 4.6

2.2 Flight Sim #3 Sequence

a. Prior to the test, setup per section 3.2
b. At the appropriate step power on the spacecraft using section 4.1
c. At the appropriate step prepare for a switch to (simulated) Launch Vehicle power using section 4.2 (36Volt 1Amp Current Supply)
d. At the appropriate step return to TAC power using section 4.5
e. At the appropriate step power-off the spacecraft using section 4.6

2.3 Flight Sim #4 Sequence

a. Prior to the test, setup per section 3.3
b. At the appropriate step power on the spacecraft using section 4.1 (using BFP)
c. At the appropriate step prepare for a switch to (simulated) Launch Vehicle power using section 4.2 (36Volt 1Amp Current Supply)
d. At the appropriate step remove the TAC harness to the HESSI EGSE using 4.3
e. At the appropriate step re-attach the TAC harness to the HESSI EGSE using 4.4
f. At the appropriate step return to TAC power using section 4.5
g. At the appropriate step power-off the spacecraft using section 4.6

2.4 CST Sequence

a. Prior to the test, setup per section 3.4
b. At the appropriate step power on the spacecraft using section 4.1 (using BFP)
c. At the appropriate step prepare for a switch to Launch Vehicle power using section 4.2 (36Volt 1Amp Current Supply)
d. At the appropriate step return to TAC power using section 4.5
e. At the appropriate step power-off the spacecraft using section 4.6

2.5 Ferry Flight Preparation Sequence

a. Prior to the preparation, setup per section 3.5
b. At the appropriate step prepare for a switch to Launch Vehicle power (30Volt 2Amps Voltage Supply)
c. At the end of the ferry flight power off the spacecraft by powering-down the ASE

2.6 Launch Preparation Sequence

a. Prior to the preparation, setup per section 3.6
b. At the appropriate step power on the spacecraft using section 4.1 (using BFP)
c. At the appropriate step prepare for a switch to Launch Vehicle power using section 4.2 (36V 1Amp Current Supply)
d. At the appropriate step remove the TAC harness to the HESSI EGSE using 4.3, and install the FEP using step 4.9

2.7 Return to Base Sequence via HESSI EGSE

In the event of a launch abort and return to base when the HESSI EGSE is available, use the following sequence to power-down the spacecraft

a. Setup the EGSE per HSI_MIT_049 section 3
b. At the appropriate step re-attach the TAC harness to the HESSI EGSE using 4.4
c. At the appropriate step return to TAC power using section 4.5
d. At the appropriate step power-off the spacecraft using section 4.6

2.8 Return to Base Sequence via the ASE

In the event of a launch abort and return to base when the HESSI EGSE is NOT available, use the following sequence to power-down the spacecraft

a. At the appropriate step power-off the spacecraft using section 4.7

3. SETUP

Prior to starting a test or preparing for launch, setup the EGSE and spacecraft as follows:

3.1 IVT Test Setup

a. The HESSI EGSE shall be configured per HSI_MIT_049.
b. The TAC connector from the HESSI EGSE shall be mated to the TAC-J1 connector on the spacecraft.
c. The Flight Enable Plug (FEP) shall NOT be installed to minimize the risk of damage to the solar panels by premature deployment, or accidental enabling of the spacecraft transmitter.
d. The battery relay box shall be connected to the HESSI EGSE and spacecraft BFP-J1 connector to provide remote enabling of the battery onto the bus.
e. The Umbilical connector shall be connected to the launch vehicle in the course of the IVT test

Verify_____

3.2 Flight Simulation #3 Test Setup

a. The HESSI EGSE shall be configured per HSI_MIT_049.
b. The TAC connector from the HESSI EGSE shall be mated to the TAC-J1 connector on the spacecraft.
c. The Flight Enable Plug (FEP) shall NOT be installed to minimize the risk of damage to the solar panels by premature deployment, or accidental enabling of the spacecraft transmitter.
d. The battery relay box shall be connected to the HESSI EGSE and spacecraft BFP-J1 connector to provide remote enabling of the battery onto the bus.
e. The Umbilical connector should be connected to the launch vehicle prior to this test.

Verify_____

3.3 Flight Simulation #4 Test Setup

a. The HESSI EGSE shall be configured per HSI_MIT_049.
b. The TAC connector from the HESSI EGSE shall be mated to the TAC-J1 connector on the spacecraft. During the test the TAC will be removed.
c. The Flight Enable Plug (FEP) shall NOT be installed to minimize the risk of damage to the solar panels by premature deployment, or accidental enabling of the spacecraft transmitter.
d. The battery relay box shall NOT be connected. During the course of the test the Battery Flight Plug shall be installed.
e. The Umbilical connector should be connected to the launch vehicle prior to this test.

Verify_____

3.4 CST Test Setup

a. The HESSI EGSE shall be configured per HSI_MIT_049.

b. The TAC connector from the HESSI EGSE shall be mated to the TAC-J1 connector on the spacecraft.

c. The Flight Enable Plug (FEP) shall NOT be installed to minimize the risk of damage to the solar panels by premature deployment, or accidental enabling of the spacecraft transmitter.

d. The battery relay box shall NOT be connected. During the course of the test the Battery Flight Plug shall be installed.

e. The Umbilical connector should be connected to the launch vehicle prior to this test.

Verify_____

3.5 Ferry Flight Setup

a. The TAC shall NOT be connected (the EGSE is on its way to CCAFS)

b. The Flight Enable Plug (FEP) shall NOT be installed to minimize the risk of damage to the solar panels by premature deployment, or accidental enabling of the spacecraft transmitter.

c. The battery relay box shall NOT be connected.

d. The Umbilical connector should be connected to the launch vehicle prior to this test.

Verify_____

3.6 Launch Setup

a. The HESSI EGSE shall be configured per HSI_MIT_049.

b. The TAC connector from the HESSI EGSE shall be mated to the TAC connector on the spacecraft. The TAC will be removed later in the sequence.

c. The Flight Enable Plug (FEP) shall NOT be installed until later in the procedure to minimize the risk of powering on the transmitter.

d. The battery relay box shall NOT be connected. The Battery Flight Plug shall be installed later in the sequence.

e. The Umbilical connector should be connected to the launch vehicle.

Verify_____

4. PROCEDURES

4.1 Spacecraft Power-On Procedure

This step is called out early in the test flow to power-up the spacecraft. It will not be used for pre-ferry flight (see 4.8 instead).

a. If the FEP is installed, remove it NOW Verify_____
b. Power up the spacecraft using HSI_MIT_049, section 3 via the TAC. Bring up the CPU.
c. Command the system to launch mode. Run procedure SC_MM_LNCH to set the mission mode to Launch. Verify that PACI telemetry shows LAUNCH mode. MODE:_____
d. On the ITOS CCB page select VT curve VT2 Verify_____
e. On the ITOS PCB page power on NEB1, NEB2, and Battery Pressure Monitor
Record Battery Pressure 1_____
Record Battery Pressure 2_____
Record Battery SOC 1_____
Record Battery SOC 2_____
f. If battery either SOC is less than 90% on the ITOS display, perform battery charging per HSI_MIT_017 (attach as-run to this procedure)
g. On the ITOS PCB page, select FWD antenna. Verify PACI shows FWD antenna selected Verify_____
h. Start the ITOS procedure EFCSET(17). Verify that EFC bit 17 is set. Verify_____
i. Power Off all services under NEB1 and NEB2 on the ITOS PCB page, including NEB1, but not NEB2 and Battery Pressure Monitor services. Verify:

SSR OFF_____
FSS OFF_____
Torque Rod XZ OFF_____
Torque Rod YZ OFF_____
IAD #1 OFF_____
IAD #2 OFF_____
ANT FWD_____
MAG OFF_____
NEB1 OFF_____

FSS Heater OFF_____
SAD Heater OFF_____
Torq Heater OFF_____
Xmit Heater OFF_____
SSR Heater OFF_____
SEM Heater OFF_____
BAT Heater 1 OFF_____
BAT Heater 2 OFF_____
Bat Press. Mon ***ON***_____
NEB2 ***ON***_____

IDPU Heater OFF_____
Cryocooler OFF_____

IDPU OFF_____
IDPU +28V OFF_____
Transmitter OFF_____

j. Power off the CPU. Verify CPU is OFF. Verify_____
k. Adjust the TAC voltage to match the battery voltage (as indicated on the ITOS PACI page) plus 0.7V.
Record Battery Voltage:_____
l. Enable the battery relay (IVT, FSIM#3) or install the BFP (FSIM#4, CST, Launch).
Relay or BFP_____
m. Set the TAC current limit to 1 Amp, and TAC voltage to 36V. The TAC should current-limit, with the battery current at about 0.2A.
Record TAC Voltage: _____
Record Battery Current:_____
n. Monitor SOH telemetry via TAC. Note any out of limit conditions and power-off if they persist.
o. Take page-snaps of the ITOS PACI telemetry page and append to the as-run version of this procedure

4.2 Switch to Launch Vehicle Power

This step precedes powering-on the payload ASE power supply (for charging through the Umbilical). In the interval between this step and the ASE power-on, the spacecraft will be discharging the battery, so the interval should be short.

a. Record the HESSI battery voltage, current, and SOC:
Record Battery Voltage_____
Record Battery Current:_____
Record Battery SOC1:_____
Record Battery SOC2:_____
b. Set the TAC voltage and current to zero
c. Disable the TAC supply
d. Report "HESSI Ready for ASE Power"
e. When the ASE power supply comes on, take page-snaps of the ITOS PACI and Bus Power telemetry page, and record the battery voltage, current, and SOC:
Record Battery Voltage_____
Record Battery Current:_____
Record Battery SOC1:_____
Record Battery SOC2:_____

4.3 Remove TAC connector

For some tests and Launch the TAC connector must be removed to provide a plugs-out configuration.

a. Verify that the Orbital HESSI telemetry pages are active and nominal

Verify_____

b. Verify that the TAC supply is disabled Verify_____
c. On the back of the power & signal rack, turn off the COTS Enable and DUT Enable switches to power down the TAC signals Verify_____
d. Disconnect the TAC connector from the spacecraft TAC plug

4.4 Re-install TAC connector

a. If the FEP is installed, remove it now. Verify_____
b. Verify that the Orbital HESSI telemetry pages are active and nominal Verify_____
c. Verify that the TAC supply is disabled Verify_____
d. Verify that the COTS enable and DUT enable switches on the back of the power and signal rack are off Verify_____
e. Re-connect the TAC connector to the spacecraft TAC plug
f. On the back of the power & signal rack, turn on the COTS Enable and DUT Enable switches Verify_____

4.5 Return to TAC Power

This step will be performed just after the ASE supply has been disabled. In the interval between this step and the ASE power-on, the spacecraft will be discharging the battery, so the interval should be short. This assumes the TAC is installed; if it has been removed, first perform step 4.4.

a. Record the HESSI battery voltage, current, and SOC:

Record Battery Voltage_____
Record Battery Current:_____
Record Battery SOC1:_____
Record Battery SOC2:_____

b. Set the TAC voltage to 36V and the current limiter to 1 Amp
c. Enable the TAC supply
d. Record the battery voltage and current from the PACI page here:

Record Battery Voltage_____
Record Battery Current:_____

4.6 Power-Off the Spacecraft via the TAC

At the end of a test or in the case of a Return To Base after a launch attempt, use this procedure to power-down the bus after battery charging has been returned to the TAC using step 4.5. Alternatively, step 4.7 can be used if the HESSI EGSE is unavailable.

a. Verify that the ASE supply is powered off Verify_____
b. Verify that the spacecraft is powered from the TAC and the BFP is in or the Battery Relay is enabled BFP or Relay_____
c. Adjust the TAC supply downwards in steps not to exceed 0.25V until the battery current on the ITOS PACI page reads between -0.1A and +0.1A
d. Remove the BFP or disable the relay

e. Record the battery Voltage and SOC

Record Battery Voltage_____
Record Battery SOC1:_____
Record Battery SOC2:_____

f. Power on the CPU via ITOS and wait for boot-up to complete
g. Command the system to Mission mode. Run procedure SC_MM_NOM to set the mission mode to Mission. Verify that PACI telemetry shows MISSION mode. MODE:_____
h. Power off the CPU. Verify the CPU is OFF Verify_____
i. Complete the power-off of the spacecraft and EGSE per HSI_MIT_049 section 3.3.

4.7 Power off the Spacecraft via the ASE

Use this procedure if the HESSI EGSE is unavailable and the spacecraft is to be powered down.

a. Verify that the spacecraft is powered from the ASE and the BFP is in or the Battery Relay is enabled BFP or Relay_____
b. Adjust the ASE supply downwards in steps not to exceed 0.25V until the battery current on the LPO HESSI page reads between -0.1A and +0.1A
c. Remove the BFP or disable the relay
d. Power off the ASE and disable the supply per the appropriate OSC procedure

4.8 Configure for Ferry Flight

When the ASE supply is powered on, the spacecraft will be ready for ferry flight with monitoring via the LPO station. The spacecraft can be powered off by simply powering off the ASE supply at the end of the ferry flight.

4.9 Install the Flight Enable Plug

This step will be performed just prior to closeout for Launch. The FEP enables the transmitter and solar array deployment. The FEP will not be installed for any other launch vehicle tests or for ferry flight to avoid accidentally deploying the solar arrays or powering on the transmitter.

Once the FEP is installed, the solar arrays will deploy shortly after the spacecraft is separated from the launch vehicle (as indicated by opening any 2 of the 3 separation loops in the Umbilical).

When the FEP is in, the transmitter is automatically turned on 80 minutes after the CPU comes up when the CPU is in Launch mode. The CPU is powered up by separation; it may also be powered by via the TAC. The CPU will NOT be powered on via the TAC following installation of the FEP

a. Verify that this is preparation for Launch, not some other test Verify_____
b. Verify that the TAC has been disconnected Verify_____
c. Verify via the LPO telemetry that the Spacecraft CPU is OFF Verify_____
d. Verify via the LPO telemetry that all 3 SEP indicators show MATED Verify_____
e. Install the Flight Enable Plug. Verify that it is seated properly. Verify_____