STEREO
IMPACT

Boom Suite On-Orbit Power Cycle Procedure

IMPACT-BOOM-PowerCycle_D.doc
Version D – 2007-Jun-15

_____
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Date Run:_____

Observatory:_____

Document Revision Record

Rev.	Date	Description of Change	Approved By
A	2006-Jul-20	Preliminary Draft	-
B	2006-Nov-16	Add options, default settings	
C	2006-Dec-15	Add burst patch, SWEA spec tlm, PLASTIC SSR limit	
D	2007-Jun-15	Update per latest software load (38/39)	

Distribution List

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Table of Contents

1. Overview

1.1. *Introduction*

The STEREO IMPACT Boom Suite consists of the Instrument Data Processing Unit (IDPU) plus the boom-mounted instruments (SWEA, STE-D, STE-U, and MAG). The IDPU if the single point interface between these instruments and the STEREO spacecraft for telemetry. The IDPU also interfaces to the SEP Suite and PLASTIC instruments.

This document describes the procedure for power cycling the boom suite on-orbit.

This proc should only be run when the spacecraft is in orbit.

1.2. *Document Conventions*

In this document, TBD (To Be Determined) means that no data currently exists. A value followed by TBR (To Be Resolved) means that this value is preliminary. In either case, the value is typically followed by a code such as UCB indicating who is responsible for providing the data, and a unique reference number.

Commands to be typed into the C&T GSE (stgsect) are indicated as follows: ***/SystemNOP.*** After typing the command hit the Enter key to send.

1.3. *Applicable Documents*

The following documents are closely interrelated with this specification. All documents can be found on the Berkeley STEREO/IMPACT FTP site unless otherwise indicated:

http://sprg.ssl.berkeley.edu/impact/dwc/

1. 7381-9012B (IMPACT/Spacecraft ICD, on the APL web page)
2. ICD/IMPACT_CTM (command & telemetry database)

2. Test Setup

2.1. *Test Equipment*

1. Command & Telemetry GSE connected to spacecraft emulator via TCP/IP
   C&T GSE version date_____
   C&T Database version:_____, Date:_____

2.2. *Startup GSE*

1. Power up C&T GSE PC and start C&T GSE software (stgsect).
2. On the C&T GSE PC start up the SSH client and connect to the MOC (at cho.jhuapl.edu; a profile should be set up to allow you to do that – see SSH.txt if not). You will need a password.
3. Connect C&T GSE to the MOC – push the TCP/IP next to the TLM display on the Received Data Panel:
   Verify the TLM light comes on:_____
4. Connect C&T GSE to MOC for commands – push the button next to the CMD display on the Received Data Panel:
   Verify the CMD light comes on:_____
5. On the C&T GSE push the Record button. Determine the name of the telemetry file
   File Name:_____
6. Enable the stgsect Telemetry Server.

3. Power On

Record Start Time_____

3.1. *Startup IDPU*

1. Request the spacecraft TC power-on the IDPU. Record the bus voltage and IDPU current from the spacecraft displays

   Bus Voltage _____V
   IDPU Current _____mA
2. Verify C&T GSE is getting telemetry. On IDPU SOH panel, UTC time should correspond to time on Emulator PC (typically set to UTC), and should be incrementing every two seconds.

   Verify C&T GSE getting telemetry _____
3. If an EEPROM code image other than 0 is desired, set the ***/Boot Select*** command within 10 seconds of power-up (or send ***/RestartToPage 0*** to reset the IDPU, then send ***/Boot Select*** command within 10 seconds)

   BootSelect _____
4. After 10 seconds ISoftwareVersion should change to correspond to the EEPROM software version number. Verify no errors are reported and the version changes

   Record value of ISoftwareVersion _____
   Record value of IERRORCount _____
   Record value of IBootSelect _____

3.2. *Startup MAG Heater*

1. If the MAG heater is powered off, request the TC to power it on. Record the MAG Heater current from the spacecraft displays

   MAG Heater Supply Current_____mA
2. Record the MAG temperature on the C&T GSE:

   IMAGTemp_____C
3. Record the telemetry MAG heater current (note that this is not expected to be an accurate measure of the actual current, but should correspond to the measurement made above to ~20%). The MAG heater will not come on above 10C, but will take a ~5mA standby current.

   IMAGHeater_____mA

3.3. *MAG Check*

1. If MAG starts up saturated (MAG values on MAG GSE all =1) , send ***/MAGEnableIF*** to restart interface

   Y/N_____

3.4. *Configuration*

1. Clear the error by sending ***/ClearErrors***. IErrorCode should return to blank and IErrorCount should return to zero.

   Verify_____

2. Enable the instrument startup/shutdown sequences. ***Start IMPACTPowerSeqEnable.*** Verify the IDPU SOH CmdSeqEnable housekeeping shows sequences 0-5 and 8-11 enabled.

   Verify_____

3.5. *Startup SWEA/STE-D*

1. Request the TC power-on the SWEA/STE-D service. Wait 10 seconds, then record the current monitor on the spacecraft monitor

   SWEA Current _____mA

2. Verify that on the C&T GSE ISCStatus display the SWEA Power display shows On (1), and on the Interface Active display, SWEAInterface shows active (1).

   Verify_____

3.6. *SWEA MCP Heater Adjust*

- Monitor the SWEA MCP Temperature for a while (in parallel with other activities). Set the MCP heater to maintain an MCP temperature between –25 and +30C. Within this range a cooler temperature is desirable, but leave margin to cover low bus voltage cases. Use the command ***/SetSWEAMCPHeater*** to set the heater duty cycle between 0 and 10 (10=100%). Default value = 0. **Nominal value for Obs A is 1, Obs B is 2**.

UTC Date/Time	Bus Voltage	Heater Setting	ISWEA MCP Temp	ISWEA DAC Temp	SWEA Temp (S/C)	ISTED Temp

3.7. *STE Adjustment*

- Start the STGSE-STE GSE (ste.exe). Enable the C&T GSE telemetry server and connect the STE gse (TCP/IP button). Verify that the Connect light comes on on the STE GSE.

  Verify_____

- Speed up the Monitor Rates accumulation interval to 2 seconds. Send ***/SetSTERateInt 2***. Verify the accumulation interval as displayed on the STE Rates Panel reads 2 seconds:

  Verify_____

- Set the STE LUT for adjustment: Send ***Start STEDoorLUT***
- Display the STE Rates panel and wait for it to update. Set to Raw Counts, so it reads counts per accumulation interval (2 seconds). Record the rates:

	LLD	ULD	RESET
STEU Det0	_____	_____	_____
STEU Det1	_____	_____	_____
STEU Det2	_____	_____	_____
STEU Det3	_____	_____	_____
STED Det0	_____	_____	_____
STED Det1	_____	_____	_____
STED Det2	_____	_____	_____
STED Det3	_____	_____	_____

- Enable the STE Spectra display on the STE GSE and wait for the display to update. Verify nominal STE door source spectra

  Verify_____

3.8. *STE Bias Adjust*

- Set to a lower threshold, ~1.5keV: ***/SetSTEThreshold 0 6 6 6 6 8 8 8 8.*** Verify STE rates are <10,000c/s (if not, adjust thresholds up).

  Verify_____

- Adjust STE-U bias voltage to optimize the spectra. The system performance will improve with bias voltage up to some value above which little improvement is seen. Set to the lowest voltage which achives good performance. Set the bias voltage with ***/SetSTEUBias*** commands. Default bias value is 20 (0.8V/step). Good performance typically requires ~100. (Nominal is 30 for STE-U-A, 120 for STE-D-A, 20 for STE-U-B, 100 for STE-D-B) . Partial depletion can be achieved at ~12 (~10% energy gain loss).

Bias	Det 0 LLD	Det 1 LLD	Det 2 LLD	Det 3 LLD

- Adjust STE-D bias voltage to optimize the spectra. The system performance will improve with bias voltage up to some value above which little improvement is seen. Set to the lowest voltage which achives good performance. Set the bias voltage with ***/SetSTEDBias*** commands. Default bias value is 22. Good performance typically requires ~100.

Bias	Det 0 LLD	Det 1 LLD	Det 2 LLD	Det 3 LLD

3.9. *STE Threshold Adjust*

In the following steps adjust the STE thresholds with the command ***/SetSTEThreshold <n> <v>***, where <n> is the detector number (0-3 for STE-U, 4-7 for STE-D), and <v> is the desired value. You can set 4 thresholds at once with the command ***/SetSTEThreshold 0 <v0> <v1> <v2> <v3> <v4> <v5> <v6> <v7>***. The DAC settings are ~100eV per step, with the default value set to 12 (~2keV).

- Adjust the threshold for each detector while monitoring the Spectra and LLD rates. Find the lowest threshold value at which the Spectra count rate is < 10/sec (100/sample) in the lowest energy bin. Record the threshold setting and count rate below. From the spectra display note the lowest energy bin receiving counts.

	Threshold	LLD	Energy Bin
STEU Det0	_____	_____	_____
STEU Det1	_____	_____	_____
STEU Det2	_____	_____	_____
STEU Det3	_____	_____	_____
STED Det0	_____	_____	_____
STED Det1	_____	_____	_____
STED Det2	_____	_____	_____
STED Det3	_____	_____	_____

Nominal thresholds are 7,7,7,7,12,12,13,12 for Obs A, 8,8,8,8,11,9,19,11 for Obs B.

3.10. *STE Door Source*

- Set to hi res door monitor mode. ***Start STEDoorLUT***. Wait 2 minutes and start an accumulation. Accumulate for at least 10 minutes.

Verify_____

3.11. *STE Door Open*

- Verify that the Emulator Spacecraft Status has IDPU Power and Thruster Warnings OFF (they will inhibit opening of the STE door)

Verify_____

- If at ambient conditions (not vacuum, below +40C), send the following command to adjust the door timing: ***start STEDoorAir.*** If in vacuum with STE temperatures below –35C do: ***start STEDoorVacCold***. If in vacuum and between –35C and +20C do: ***start STEDoorVacWarm***. If in vacuum and above between +20C and +40C do: ***start STEDoorVacHot***

STE-U temperature_____C
STE-D Temperature_____C
Script:_____

3.11.1. STE-U Door Open

- Record the state of the STE-U door housekeeping on the STEDoor SOH display. If ISTEUCovStat is not CLOSED skip this proc:

ISTEUDoorCount_____
ISTEUDoorStart_____
ISTEUDoorDone_____
ISTEUCovStat_____
ISTEUCovSW_____

- Command the door open. Send the command ***/STEUDoorOpen***. Verify by inspection that the cover opens and no instrument error occurs:

Verify_____

- If the GSE indicates an STE AFE trip (STE housekeeping goes blue), send ***/STEUAFEOn***

Verify_____

- Record the STEU Door housekeeping.

ISTEUDoorCount_____
ISTEUDoorStart_____
ISTEUDoorDone_____
ISTEUCovStat_____
ISTEUCovSW_____

- Verify that the DoorCount increases by 1, the start and done times are in limit (not red/yellow), ISTEUCovStat is now OPEN, and ISTEUCovSW is now OFF.

Verify_____

3.11.2. STE-D Door Open

- Verify that the SWEA Enable plug in SWEA-J2 supports opening the STE-D Door.

Verify_____

- Record the state of the STE-D door housekeeping on the STEDoor SOH display. If ISTEDCovStat is not CLOSED skip this proc:

ISTEDDoorCount_____
ISTEDDoorStart_____
ISTEDDoorDone_____
ISTEDCovStat_____
ISTEDCovSW_____

- Command the door open. Send the command ***/STEDDoorOpen***. Verify by inspection that the cover opens and no instrument error occurs:

Verify_____

- If the GSE indicates an STE AFE trip (STE housekeeping goes blue), send ***/STEDAFEOn***

Verify_____

- Record the STED Door housekeeping.

ISTEDDoorCount_____
ISTEDDoorStart_____

ISTEDDoorDone_____
ISTEDCovStat_____
ISTEDCovSW_____

- Verify that the DoorCount increases by 1, the start and done times are in limit (not red/yellow), ISTEDCovStat is now OPEN, and ISTEDCovSW is now OFF.

Verify_____

3.12. *Final STE Configuration*

- Speed up the Monitor Rates accumulation interval to 10 seconds. Send ***/SetSTERateInt 10***. Verify the accumulation interval as displayed on the STE Rates Panel reads 10 seconds:

Verify_____

- Set the STE LUT to normal: Send ***Start STENormalResLoad.*** Verify STEID returns to zero.

Verify_____

3.13. *SWEA High Voltage Power On*

TO BE PERFORMED ON ORBIT, NO SOONER THAN 1 HOUR AFTER SWEA COVER OPEN, TO AVOID DAMAGE TO SWEA MCP

3.13.1. SWEA NRHV

The SWEA Non-Regulated High Voltage (NRHV) supply is used to generate the analyzer deflector and sweep supply voltages. It operates at ~1500V, and is protected by a number of hardware and software protections against accidental turn-on. Generally on the bench this supply is safe to be powered up. However, ensure that the MCP is not enabled except in vacuum.

- Verify the SWEA door has been open for at least 1 hour. If not, use 6.5 to open it.

  Verify_____

- Verify a high voltage enable plug is installed in SWEA-J2.

  Enable Type_____

- Enable NRHV by sending the following two commands separated by no more than 15 seconds.

  /SWEAArmNRHV
  /SWEANRHVOn

  Verify no commanding errors reported on the C&T GSE

  Verify_____

- Verify that the SWEA NRHV state is On (on the C&T GSE ISWEASTEDDig display, NRHVENB = 1).

  Verify_____

- Record the following high voltage values from the C&T GSE SWEA/STE-D Housekeeping display:

  ISWEANR5V_____
  ISWEAAnal_____
  ISWEADefl1_____
  ISWEADefl2_____

- Send ***/SWEAFHKPAnal*** to request a readout of the analyzer HV waveform. Later use DECOM to display the waveform and append to this proc. Verify three ApID 214 packets are sent.

  Verify_____

- Send ***/SWEAFHKPDef1*** to request a readout of the Deflector 1 HV waveform. Later use DECOM to display the waveform and append to this proc. Verify three ApID 214 packets are sent.

  Verify_____

- Send ***/SWEAFHKPDef2*** to request a readout of the Deflector 1 HV waveform. Later use DECOM to display the waveform and append to this proc. Verify three ApID 214 packets are sent.

  Verify_____

3.13.2. SWEA MCP HV

TO BE PERFORMED ON ORBIT, NO SOONER THAN 1 HOUR AFTER SWEA COVER OPEN, TO AVOID DAMAGE TO SWEA MCP

- Verify the SWEA door has been open for at least 1 hour.
  Verify_____
- Verify a high voltage enable plug or enable GSE in installed in SWEA-J2
  Enable Type_____
- Enable MCPHV by sending the following two commands separated by no more than 15 seconds.
  /SWEAArmMCPHV
  /SWEAMCPHVOn
  Verify no commanding errors reported on the C&T GSE
  Verify_____
- Verify that the SWEA MCPHV state is On (on the C&T GSE ISWEASTEDDig display, MCPHVENB = 1).
  Verify_____
- Record the following high voltage value from the C&T GSE SWEA/STE-D Housekeeping display:
  ISWEAMCP (0V)_____

3.13.3. SWEA MCP HV Ramp Up

Ramp the SWEA MCP HV up to its nominal level through a few steps. Record the indicated data at each step. Note that the IDPU will ramp the voltage up to the desired setting at ~100V/second. Wait for ramping to complete before taking the measurement.

Command	Nominal Voltage	Instrument Current	ISWEAMCP (C&T GSE)	Moment N (SWEA GSE)
/SetSWEAMCP 0	0			
/SetSWEAMCP 36	500			
/SetSWEAMCP 73	1000			
/SetSWEAMCP 109	1500			
/SetSWEAMCP 146	2000			
/SetSWEAMCP 182	2500			
/SetSWEAMCP 190	2600			
/SetSWEAMCP 197	2700			
/SetSWEAMCP 204	2800			
/SetSWEAMCP 208	2850			

3.13.4. SWEA V0 Setting

If a non-zero V0 value is desired send

/SWEAManualV0

/SetSWEAManualV0 <value>

Value is –Voltage*256/25 (so a value of 10 is ~0.98V)

V0 Setting_____

3.14. *Final Configuration*

The system is now ready for SEP and/or PLASTIC power up. If desired, adjust the configuration as follows:

1. Disable the STE door opening sequences (thruster warning clear, coarse pointing warning clear) if desired (not needed for IDPU software rev 38 or greater; sequences no longer open STE-U doors)
   /DisableCmdSequence 9 Y/N_____
   /DisableCmdSequence 11 Y/N_____
2. Enable SEP Crash Recovery (after SEP is operational) if desired:
   /EnableCmdSequence 12 Y/N_____
3. Enable PLASTIC power sequences if desired (check with PLASTIC)
   /EnableCmdSequence 6 Y/N_____
   /EnableCmdSequence 7 Y/N_____
4. Enable PLASTIC sequences if desired (check with PLASTIC)
   /EnableCmdSequence 20 Y/N_____
   /EnableCmdSequence 21 Y/N_____
   /EnableCmdSequence 22 Y/N_____
   /EnableCmdSequence 24 Y/N_____
   /EnableCmdSequence 27 Y/N_____
   /EnableCmdSequence 29 Y/N_____
5. Start PLASTIC startup sequence if desired (check with PLASTIC)
   /StartCmdSequence 21 Y/N_____
6. Record final IcmdSeqMask: _____

7. Update the SWEA power warning sequence to ramp down the MCP HV before shutting it off (not needed for IDPU FSW version 28 or greater): ***start SeqSWEAPwrWarn***. Y/N_____

8. Disable SWAVES burst trigger inputs (until SWAVES code is updated to generate triggers): ***Start SWAVESBurstDisable.*** Verify that IBurstCurCriteria is <255 IBurstCurCriteria_____

9. Update the Burst trigger system. Not needed for IDPU FSW version 38 or greater. ***Start BurstPatch***. Y/N_____

10. Disable IMPACT "disable science on SSR full" system if desired (causes trouble to Real Time data if they are not keeping SSR empty during commissioning): ***/SetIMPACTSSRLimit 101*** Y/N_____

11. Disable PLASTIC "disable science on SSR full" system if desired (causes trouble to Real Time data if they are not keeping SSR empty during commissioning): ***/SetPLASTICSSRLimit 101*** Y/N_____

12. If desired, enable SWEA spectra data. Send ***/SetBurstRate 492*** to reduce the burst telemetry rate a bit to make room for spectra. The send ***/SetSWEASpecInterval 10*** (one 48-energy spectra every 10 seconds), and ***/SWEAEnableSpecTlm*** Y/N_____

13. If desired, set the default IMPACT burst trigger weights. Send ***Start IMPACTBurstDefault***. Y/N_____

14. Dump the parameter tables: ***/DumpSystemTable*** Y/N_____

15. Set to nominal housekeeping rate**:** ***/SetHKPRate 60*** Y/N_____

Completion Time_____

4. Power Off

Record Start Time_____

- This procedure powers off the IMPACT Boom suite. SEP and PLASTIC should be powered off first.

  Verify SEP Powered Off_____
  Verify PLASTIC Powered Off_____
- Set the Housekeeping rate to every 2 seconds to speed up the response on the following tasks. ***/SetHKPRate 2***. Verify housekeeping packets are now coming every 2 seconds

  Verify_____

4.1. *Power off SWEA HV*

- Ramp down the SWEA MCP HV in the following steps. After each step wait for the MCP voltage to stabilize before proceeding to the next step.

Command	Nominal Voltage	ISWEAMCP (C&T GSE)
/SetSWEAMCP 146	2000	
/SetSWEAMCP 109	1500	
/SetSWEAMCP 73	1000	
/SetSWEAMCP 36	500	
/SetSWEAMCP 0	0	

- Power off the high voltage supplies: Send ***/SWEAMCPHVOff***, ***/SWEANRHVOff***. Verify MCPHVENB and NRHVENB are off (0) in ISWEASTEDDig on the C&T GSE.

  Verify_____

4.2. *STE Door Close*

- If at ambient conditions (not vacuum, below +40C), send the following command to adjust the door timing: ***start STEDoorAir.*** If in vacuum with STE temperatures below –35C do: ***start STEDoorVacCold***. If in vacuum and between –35C and +20C do: ***start STEDoorVacWarm***. If in vacuum and above between +20C and +40C do: ***start STEDoorVacHot***

  STE-U temperature_____C
  STE-D Temperature_____C
  Script:_____

4.2.1. STE-U Door Close

- Command the door closed. Send the command ***/STEUDoorClose***. Verify by inspection that the cover closes:

  Verify_____

- If the GSE indicates an STE AFE trip (STE housekeeping goes blue), send ***/STEUAFEOn***

  Verify_____

- Record the STEU Door housekeeping.

  ISTEUDoorCount_____
  ISTEUDoorStart_____
  ISTEUDoorDone_____
  ISTEUCovStat_____
  ISTEUCovSW_____

- Verify that the ISTEUDoorCount increases by 1, the start and done times are in limit (not red/yellow), ISTEUCovStat is now OPEN, and ISTEUCovSW is now OFF.

  Verify_____

4.2.2. STE-D Door Close

- Command the door closed. Send the command ***/STEDDoorClose***. Verify by inspection that the cover closes:

  Verify_____

- If the GSE indicates an STE AFE trip (STE housekeeping goes blue), send ***/STEDAFEOn***

  Verify_____

- Record the STEU Door housekeeping.

  ISTEDDoorCount_____
  ISTEDDoorStart_____
  ISTEDDoorDone_____
  ISTEDCovStat_____
  ISTEDCovSW_____

- Verify that the ISTEDDoorCount increases by 1, the start and done times are in limit (not red/yellow), ISTEDCovStat is now OPEN, and ISTEDCovSW is now OFF.

  Verify_____

4.3. *SWEA Power Off*

- Request the MOC power off SWEA.

  Verify SWEA Power Down Status Flag set_____
  Verify SWEA Power shut off 90 seconds later_____
  Verify SWEA Interface Disabled_____
  Verify SWEA Survival Heater powered on_____
  Record SWEA Survival Heater Current_____

4.4. *IDPU Power Off*

- Request the MOC power off IDPU.

Verify IDPU Power Down Status Flag set_____
Verify IDPU Power shut off 90 seconds later_____
Verify MAG Heater power ON_____
Record MAG Heater Current_____

Completion Time_____