

## Command Action Procedure

<b>CAP #</b>	1543	<b>Originator:</b>	Ken Gage/Dan Patnaude
<b>Date:</b>	08/31/2020	<b>Commands Checked By:</b>	HRC Ops
<b>Participants</b>	OC	<b>Time of CAP execution:</b>	(OC to write in)
<b>Required for Execution:</b>	CC, HRC		

**Title:**

HRC Power Configuration Swap to CEA B on redundant bus

**Description/Rationale:**

Failure of the +/-15V power supply bus on side A of the HRC electronics requires a switch to the electronics on side B. This CAP executes the commands required to switch to side B, powered by the redundant power bus from the spacecraft. In particular, it configures the power to use the redundant +28V bus and turns on the side B +5V LVPS. Additionally, it turns on the side B +/- 15V LVPS and +24V power supplies. Finally, it configures the HRC-I in its default configuration, and sends commands to select pre-amp B for PMT#2, and select pre-amp A for PMT#1. The CAP performs cleanup for SCS 135 and 184, and if successful, will turn off the FA6 heater.

**Restrictions/Warnings/Notes**

Yes ☐ No ☒ CAP requires enabling of a disabled command? If yes, provide a list of Disabled Commands

**CARD Items:**

HRC-C-009 "Spacecraft Power Bus Configuration for the HRC"

HRC-C-010 "HRC Electronics Power Configuration"

HRC-C-011 "HRC Power Internal Configuration"

**Schedule Requirements/Load Interaction:**

- The CAP execution window is during the DSS-65 comm at 244:17:40:00 UT
- The HRC team estimates 2 hours are needed to complete this action

Yes ☒ No ☐ Daily load commands exist during execution window of CAP

Yes ☒ No ☐ CAP requires specific DSN comm. or timing requirements

Yes ☐ No ☒ CAP will be run concurrently with another CAP

Yes ☐ No ☒ CAP requires commanding in the load to be executed to ensure success

Yes ☐ No ☒ Daily load requires the CAP to be completed to ensure success

Yes ☒ No ☐ CAP uses SCS slots. If yes, performs SCS cleanup

**Comments:**

- The CAP makes use of SCS 135 and SCS 184. The CAP includes instructions to clear and disable SCS 135 and SCS 184
- Commands exist in the daily loads for transmitter turn-on at 244:19:30

**Initial Conditions/Spacecraft Configuration:**

The CAP assumes that the side A +5 V LVPS has been commanded off. If the HRC team determines that the +5V LVPS is powered on, then SCS 41 should be run, in order to perform a controlled power down of the side A electronics.

**CAP depends upon or changes the state of:**

<input type="checkbox"/> Telemetry Format	<input type="checkbox"/> SIM Table Position
<input type="checkbox"/> Safing Monitor En\Dis State (inc. RadMon)	<input type="checkbox"/> Grating Positions
<input type="checkbox"/> OBSID	<input type="checkbox"/> SI Mode
<input type="checkbox"/> Momentum State	<input checked="" type="checkbox"/> ACIS Parameter Blocks
<input type="checkbox"/> Attitude	<input checked="" type="checkbox"/> HRC Configuration
<input type="checkbox"/> PCAD Mode	<input checked="" type="checkbox"/> SCS States or Contents
<input type="checkbox"/> S/C Unit Configuration (H/W or S/W)	<input type="checkbox"/> Dither State
<input type="checkbox"/> Ground System Configuration/Settings	<input type="checkbox"/> FSW Element
<input type="checkbox"/> S/C Clock (VCDU)	

**Comments:**

- The CAP loads commands to set HRC instrument HV to OFF and HRC-I default settings into SCS 135
- The CAP loads commands to configure the HRC for side B electronics into SCS 184
- The CAP sends commands to switch to FMT2. The commands for format change are to ensure a FIFO reset to sync the HRC telemetry to the S/C.
- The CAP switches the HRC primary bus to the redundant bus
- The CAP changes the HRC configuration from CEA A to CEA B
- If successful, the CAP will leave the HRC in a state that is safe for RADZONE entry
- If not successful, the CAP will leave the HRC in a state that is safe for RADZONE entry
- The CAP makes use of SCS 41 for contingency steps
- The CAP sets PMT#2 to the side B pre-amps (2PRB2SL) and PMT#1 to the side A pre-amps (2PRA1SL).
- As part of configuring for HRC-I, the CAP sends commands via command loads to tie HRC-I to CEA-B (2PRBISL) and HRC-S to CEA-A (2PRASSL)

**Risk/Comm. Loss/Worst Case Scenario:****What happens if comm. is lost during CAP execution?**

The HRC may be left in a partially reconfigured state. The CAP will be resumed when comm. is restored. HRC components will remain in a state safe to enter the radzone.

**What is the worst case scenario for CAP execution? (Assuming the CAP is executed correctly)** There is a risk that one or more relays will fail to operate, leaving significant parts of the HRC disconnected from any power supply and nonfunctional. There is also risk that components of the side B electronics will fail to operate nominally. In either case we will recommend to end the CAP.

**Required Products (Scripts, Displays, SOPs, etc.):**

Product Name	Version	On-Conso
O_PROT_SCSCCTRL.ssc	3.2	<input type="checkbox"/>
O_SCSCCTRL.ssc	3.4	<input type="checkbox"/>
T_3FA6PADS.ssc	3.1	<input type="checkbox"/>
F_HRC_ALL.dec	2.1	<input type="checkbox"/>
I_HRC_SOH.dsp	3.10	<input type="checkbox"/>
EHS_E_EDL.dec	2.0	<input type="checkbox"/>

Command Load Name	Checksum (if applicable)	In ODB
2A_G0034_184.CLD	E81C0D4	<input type="checkbox"/>
2A_PWRUP_SET_135.CLD	3E9EB0F	<input type="checkbox"/>
2A_IDEFAULTB_135.CLD	CC9C248	<input type="checkbox"/>

## Instructions:

1. HRC Verify 2PS5AON=OFF
  - a. If telemetry is not verified, use script **O\_PROT\_SCSCTRL** to activate **SCS 41**

## TURN OFF PRIMARY AND REDUNDANT BUS POWER

2. Uplink Command **EHRCPPPOF**  
Verify EHRCPPWR=OFF
3. Uplink Command **EHRCRPOF**  
Verify EHRCRPWR=OFF

## CONFIGURE HRC POWER

4. Command EPS subformat
5. Uplink Command Load **2A\_G0034\_184.CLD**      Checksum = E81C0D4  
36 commands
6. Use script **O\_SCSCTRL** to Enable and Activate **SCS 184**
  - Verify 2FSMRST=DISA (Failsafe Master Relay)
  - Verify 2FSCAST=DISA (Failsafe Cal Source Relay)
  - Verify 2FSPYST=DISA (Failsafe +Y Shutter)
  - Verify 2FSNYST=DISA (Failsafe -Y Shutter)
  - Verify 2PS5AON=OFF (+5V LV Power Supply A)
  - Verify 2PS5BON=OFF (+5V LV Power Supply B)
  - Verify 2C1LVBS=BUSA (Bus Select, CEA A LVPS)
  - Verify 2C2LVBS=BUSB (Bus Select, CEA B LVPS)
  - Verify 2IMHVBS=BUSB (Bus Select, HRC-I HVPS)
  - Verify 2SPHVBS=BUSB (Bus Select, HRC-S HVPS)
  - Verify 2S1HVBS=BUSB (Bus Select Shield PMT#1 HVPS)
  - Verify 2S2HVBS=BUSB (Bus Select Shield PMT#2 HVPS)

## CONTINGENCY STEPS

If the HRC team does not or cannot verify that the bus relay switches have been properly configured, the following optional steps may be requested. Otherwise continue at step 9.

7. **(OPTIONAL)** Return to step 6, to Activate **SCS 184**
8. **(OPTIONAL)** If the HRC team is still unable to verify that the bus relay switches have successfully transitioned:  
skip to cleanup at Step 31

## **POWER UP HRC ON CEA B**

### **TURN ON REDUNDANT BUS POWER**

9. Uplink Command **EHRCRPON**  
Verify EHRCRPWR=ON

### **CONTINGENCY STEPS**

If the HRC team cannot verify that the HRC is connected to the S/C redundant power supply, the following steps are optional. Otherwise continue to step 12.

10. **(OPTIONAL)** Return to step 9, to uplink command **EHRCRPON**
11. **(OPTIONAL)** If the HRC team is still unable to verify that the redundant bus is powering the HRC:  
skip to cleanup at Step 31

### **TURN ON 5V POWER SUPPLY**

12. Uplink Command Load **2A\_PWRUP\_SET\_135.CLD**   Checksum = 3E9EB0F  
71 commands
13. On HRC Go: Uplink command **205VBON**  
HRC Verify 2PS5BON=ON  
WAIT for HRC to verify stable operation

### **CONTINGENCY STEPS**

If the HRC team cannot verify that the +5V side B power supply is on, the optional steps may be requested. If +5V operation is nominal, commanding will continue with step 16.

14. **(OPTIONAL)** On HRC Go: Uplink command **205VBON**  
HRC Verify 2PS5BON=ON  
WAIT for HRC to verify stable operation
15. **(OPTIONAL)** If the HRC team is still unable to verify that the +5V bus is powered on:  
skip to cleanup at Step 30

### **TURN OFF DETS, SHIELDS, MOTOR CONTROLS, AND SET STEPS TO ZERO**

16. Use script **C\_SET\_FORMAT** to re-command **FMT 2** and **EPS** ( FMT2 , EPS )  
Format commanding required to recycle HRC FIFO
17. Use script **O\_SCSCTRL** to Enable and Activate **SCS 135**

(takes ~ 9 minutes to complete)

### **TURN ON 15V POWER SUPPLY**

18. On HRC Go: Uplink command **215PCAON**  
HRC Verify 215PCAST=ON  
WAIT for HRC to verify stable operation

### **CONTINGENCY STEPS**

If the HRC team does not or cannot verify nominal operation of the 15V Power Supply, the following optional steps may be requested, otherwise continue with step 21.

19. **(OPTIONAL)** On HRC Go: Uplink command **215PCAON**  
HRC Verify 215PCAST=ON  
WAIT for HRC to verify stable operation
20. **(OPTIONAL)** On HRC Go: Use script **O\_PROT\_SCSCTRL** to Activate **SCS 41**  
skip to cleanup at step 30

### **TURN ON 24V POWER SUPPLY**

21. On HRC Go: Uplink command **224PCAON**  
HRC Verify 224PCAST=ON  
WAIT for HRC to verify stable operation

### **CONTINGENCY STEPS**

If the HRC team does not or cannot verify nominal operation of the 24V Power Supply, the following optional steps may be requested. Otherwise, continue to step 24.

22. **(OPTIONAL)** On HRC Go: Uplink command **224PCAON**  
HRC Verify 224PCAST=ON  
WAIT for HRC to verify stable operation
23. **(OPTIONAL)** On HRC Go: Use script **O\_PROT\_SCSCTRL** to Activate **SCS 41**  
skip to cleanup at step 30

### **CONFIGURE PMTs**

24. On HRC Go: Uplink command **2PRB2SL**  
HRC Verify 2ELEBSS=PMT2  
Ties PMT2 to Side B pre-amp
25. Uplink command **2PRA1SL**  
HRC Verify 2ELEASS=PMT1  
Ties PMT1 to side A pre-amp

## TURN OFF FA6 ABORT HEATER

26. (OPTIONAL) Use script **T\_3FA6PADS** to disable the Primary FA6 Abort Heater

## SET HRC-I DEFAULT CONFIGURATION

27. Use script **O\_SCSCTRL** to clear **SCS 135**

28. Uplink Command Load **2A\_IDEFAULTB\_135.CLD**      Checksum = CC9C248  
76 commands

29. Use script **O\_SCSCTRL** to Enable and Activate **SCS 135**

## CLEANUP

30. Use script **O\_SCSCTRL** to clear **SCS 135**

31. Use script **O\_SCSCTRL** to clear **SCS 184**

<b>SOT Manager/Lead:</b>	S. Wolk (verbal)		<b>Mission Planning Manager:</b>	J. Scott (verbal)	
<b>OC or Ops Manager:</b>	C. Mahon (verbal)		<b>FOM:</b>	S. Hurley (verbal)	
<b>Sys. Engineer:</b>	P. Viens (verbal)		<b>Flight Director:</b>		