5.9_V2.4 SWITCH FROM DEA A TO DEA B

Last Revised: August 14, 2018
Filename: switch_deaa_b

BRIEF FUNCTIONAL DESCRIPTION:

This is a contingency procedure to switch from powering the DEA from the side A power supply board to the side B power supply board inside the PSMC. After switching DEA input power and reestablishing control of the focal plane heaters, the magnetic relays that control pairs of video boards are thrown one at a time, and those two video boards are powered up separately, while verifying that DEA-B doesn't power down, indicating a current or voltage overflow.

Once 10 video boards have been powered up, power up 6 FEPs and execute bias-only runs in the ACIS-I and ACIS-S configurations to generate accurate video-board housekeeping. Once finished, power down all FEPs and video boards.

The sequence of actions will be:

- Power down the video boards (skip if not powered)
- Turn off and disable the DEA side A power supply (skip if not enabled and on)
- Verify that DEA side A is off and disabled
- Verify that all DEA side B heaters are off and disabled
- Verify that DEA B is receiving power from the spacecraft
- Enable and turn on the DEA side B power supply
- Verify that DEA side A is off and disabled
- Perform a warm boot of the active BEP
- Start DEA interface housekeeping
- Enable DEA-B to assume control of the focal plane temperature by commanding it to $-122°$ C and then to $-120°$ C
- Switch the video board relays one at a time, wait for PSMC telemetry verifiers to refresh, and verify that DEA-B hasn't powered down due to an overcurrent or overvoltage condition
- After switching each pair of video boards, power up each of the two boards, waiting for PSMC telemetry verifiers to refresh, and verifying that DEA-B hasn't powered down due to an overcurrent or overvoltage condition
- Power up 6 FEPs
- Execute a bias-only CC science run in the ACIS-I configuration (may be skipped).
- Execute a bias-only CC science run in the ACIS-S configuration (may be skipped).
- If there is enough time in the comm, execute a bias-only TE science run in the ACIS-I configuration.
- If there is enough time in the comm, execute a bias-only TE science run in the ACIS-S configuration.
- Power down all FEPs and video boards
- Dump the system configuration table

ASSUMED INSTRUMENT STATE:

- Assumes that DPA A and DPA B are on, the flight SW is running and no science run is in progress.

SPECIAL INITIAL CONDITIONS:

- Assumes that telemetry is in Format 2.
- Assumes that neither the bakeout heater nor the detector housing heater is being powered by DEA-B. If they are, switch them off and, if the procedure ends with the DEA powered from DEA-B, consider enabling and turning them on again on DEA-A.

OPERATIONAL CONSTRAINTS/CAUTIONS:

This SOP should be run starting from step 1 and continuing through all the steps until completion (unless the telemetry fails to verify at a given step). It is not recommended to start this SOP at an intermediate step while skipping the previous steps.

In normal operations, only one side of the DEA should be powered on (a) to prevent conflict for control of the focal plane temperature controller, (b) to avoid excess current draw from the spacecraft,(c) to avoid over-heating within the PSMC, and (d) to avoid placing a board 11 or 12 relay into the "magnetic neutral position".

The DEA power status is normally indicated by the values of the 1DEPSA and 1DEPSB flags, which should not both be 1 simultaneously. Before sending the command to power on DEA B, the DEA Input Voltage B 1DE28BVO should be checked to make sure that DEA B is receiving power from the spacecraft.

The DEA input current monitors (1DEIC[AB]CU) are noisy. To give an indication of what variation may be expected, figures 1 and 2 show the behavior of the A-side DEA current with a ten-sample running average for two situations in which all video boards were powered down. Note that when either side of the DEA is unpowered, the corresponding current monitor, 1DEICACU for side A, or 1DEICBCU for side B, will be unreliable. They will read 16–18 A when unpowered, as of Telemetry Database (TDB) v14. This is expected and not a problem.

If the DEA powers off unexpectedly during a bakeout, the FP bakeout heater will lose power and this heater will NOT be re-enabled when the DEA side B power is restored. Additional SW commands are necessary to activate the FP bakeout heater. The DH bakeout heater is unaffected by a power loss to the DEA and will therefore still be executing a bakeout if power is lost to the DEA.

The WSPOW commands in Step 8 of this procedure sequentially power up more and more video boards. Under some circumstances (e.g. looking for a board that may have a short or other anomaly), we may wish to skip one or more boards (e.g. suspected short circuit or other problem on one board). Skipping one or more boards in the power up sequence would require different WSPOW commands than are currently in this procedure.

Should any of the parts of step 8 fail or be intentionally skipped, so that less than 10 video boards remain powered up at the start of step 9, it will not be possible to obtain correct housekeeping from any of the video boards, so steps 9-12 should be omitted. The ACIS Ops team should consult with the instrument team on the current status of the instrument and develop an appropriate contingency plan.

For more information about the relays, the DEA relays memo at `http://cxc.cfa.harvard.edu/acis/memos/DEA_Relay_Summary.html` should be consulted.

The parameters for the threshold crossings patch, txings, will revert to defaults when this is run. They should be restored to their desired values.

After successful execution, *the FP temperature control will be regulated at -119.7 °C (if the spacecraft thermal environment allows), and DEA interface A/D will be in high-resolution mode.*

CHANGE HISTORY:

Version 1.2

- added a new step 1 to start a DEA HKP run if necessary
- changed HW TLM verifiers to check state of DEA A and DEA B in steps 2.1 and 3.2
- added a new step 5 to warmboot the active BEP
- added a command in step 6 to set the focal plane temperature to $-120°$ C
- added operational constraint/caution that the B side does not produce the telltales to verify the state of the relays

Version 2.0

- ACIS Team signed-off version
- changed expected value of "1STAT7ST" in step 5.6

Version 2.1

- changed comment in step 1.2 to read "check FP temp"
- changed telemetry verified in step 5.5 to read "version=??" and changed comment to read "version # depends on loaded patches, if any"
- changed expected value of "1STAT7ST" in step 5.6
- changed command in step 6.2 to WSFTNEG121
- added to "Assumed Instrument State", "Assumes DEA A is on"

Version 2.2

- added explicit steps to verify that DEA side A is off after sending the disable and power off commands to side A and after DEA B is powered on
- added explicit step to verify that the side B DH heater and the side B DH Bakeout heater are off before powering DEA-B
- replaced command to switch all 5 relays simultaneously with 5 sets of 3 commands: a command to switch one of the relays, followed by a pair of commands to power up each of the two boards controlled by that relay
- added command to power up 6 FEPs
- added CC-mode and TE-mode bias-only runs for ACIS-I and ACIS-S to acquire housekeeping data
- added command to power down all video boards
- added figures showing behavior of 1DEICACU
- updated operational constraints and cautions text

Version 2.3

- added a comment stating that this SOP should be executed from the beginning without skipping any steps.
- removed abort comment from step 8.

Version 2.4

- Added a step to verify that DEA-B is receiving power before turning it on
- We now assume that both sides of the DPA are on

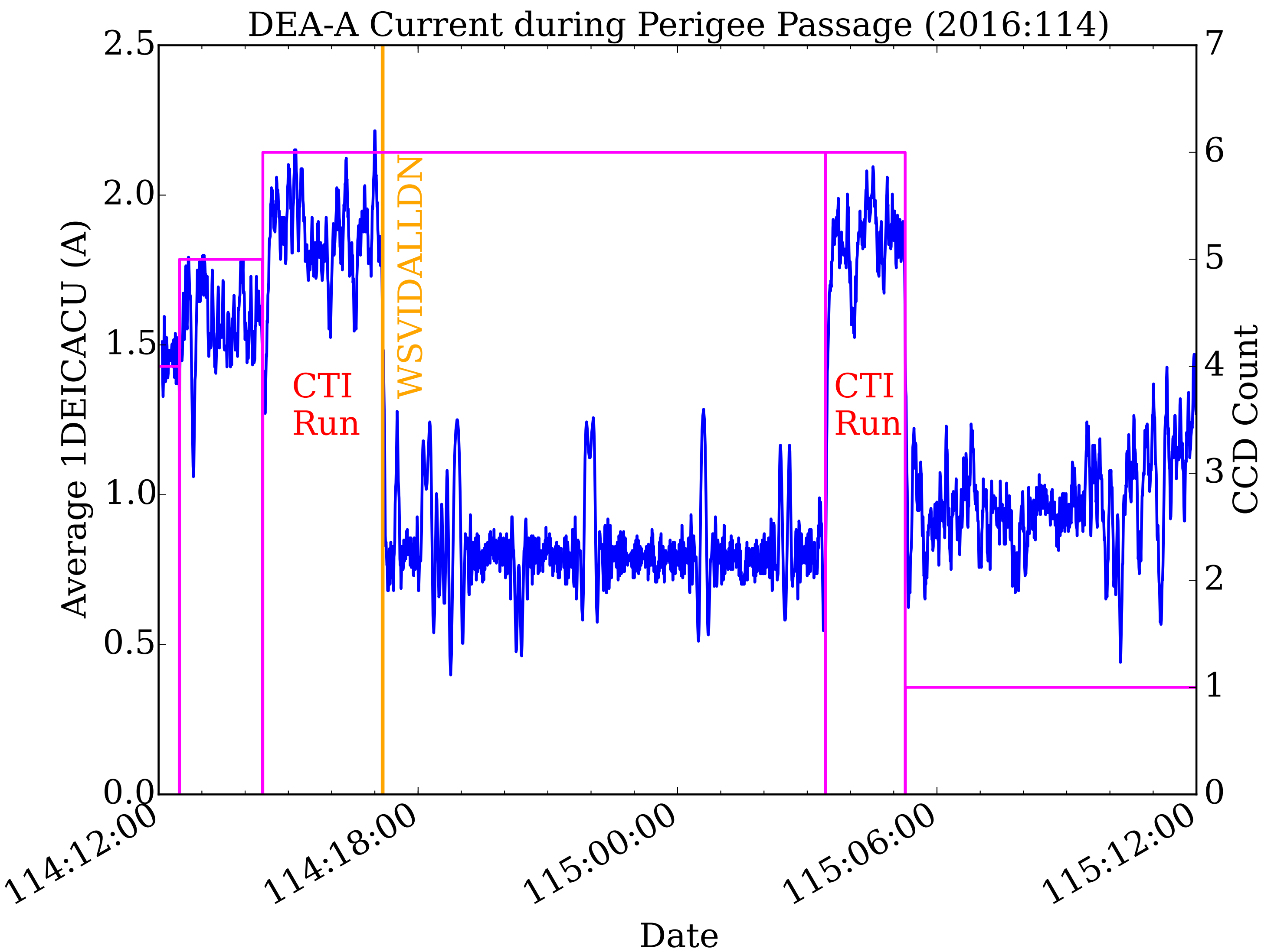

Figure 1: Average behavior of 1DEICACU during a perigee passage. All video boards are powered off after the issuing of the WSVIDALLDN command, which is marked by the orange line in the plot.

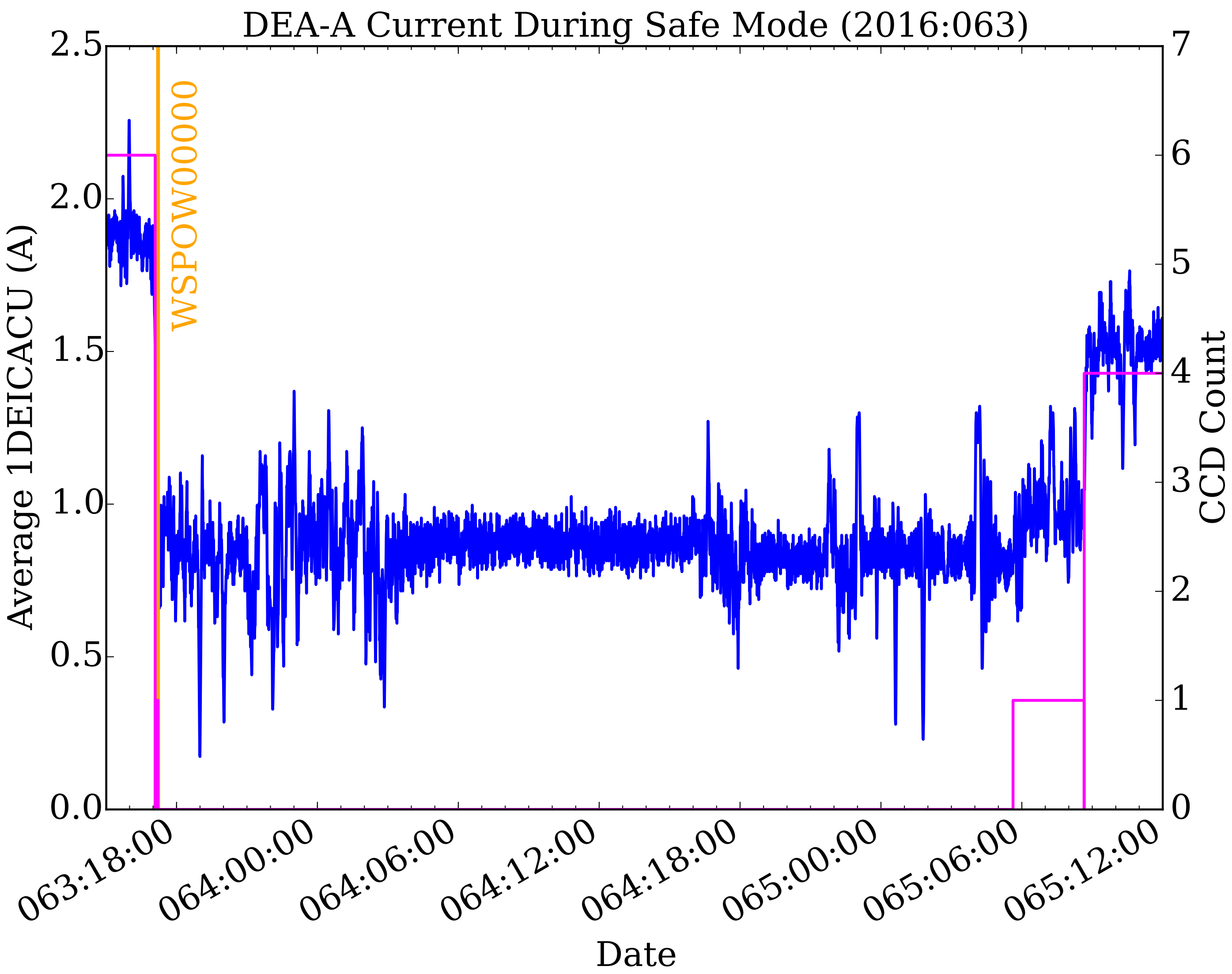

Figure 2: Average behavior of 1DEICACU during a safe mode. All video boards are powered off after the issuing of the WSPOW00000 command, which is marked by the orange line in the plot.

Table 1: **SWITCH FROM DEA A TO DEA B(Page 1)**

0 #	**Title (Revision 5.9_V2.4)**	**Time (mins)**	**Command Description**	**Command Mnemonic**	**Telemetry Description**	**Telemetry Mnemonic**	**Expected Value**
1	**Power down all video boards**						
1.1	Power down all video boards	1	changeConfigSetting	WSVIDALLDN			
2	**Turn off DEA A**						
2.1	DEA Power A Off	1	DEA PS Off A	1DEPSAOF	DEA A ON/OFF	1DEPSA	OFF
					DEA Input V A	1DE28AVO	25.0–34.0
					DEA +28 V A	1DEP3AVO	0.0 ± 0.5
					DEA +24 V A	1DEP2AVO	0.0 ± 0.5
					DEA +15 V A	1DEP1AVO	0.0 ± 0.5
					DEA +6 V A	1DEP0AVO	0.0 ± 0.5
					DEA -6 V A	1DEN0AVO	0.0 ± 0.5
					DEA -15 V A	1DEN1AVO	0.0 ± 0.5
2.2	Disable DEA PS A	1	DEA PS A Dis	1DEPSADS	DEA A Dis	1DEPSAX	DIS
2.3	Verify DEA A is off					1DEPSAX	DIS
						1DEPSA	OFF
					DEA Input V A	1DE28AVO	25.0–34.0
					DEA +28 V A	1DEP3AVO	0.0 ± 0.5
					DEA +24 V A	1DEP2AVO	0.0 ± 0.5
					DEA +15 V A	1DEP1AVO	0.0 ± 0.5
					DEA +6 V A	1DEP0AVO	0.0 ± 0.5
					DEA -6 V A	1DEN0AVO	0.0 ± 0.5
					DEA -15 V A	1DEN1AVO	0.0 ± 0.5

Table 1: **SWITCH FROM DEA A TO DEA B(Page 1)**

0 #	Units	Telemetry EGSE	Other Verifier	Crit	Description	Notes	RT Con	Tlm Fmt	Min Alt	SIM Pos
1					Skip if video boards off					
1.1		Check cmdResult==OK commandEcho==1541		B			Y	1,2	60k	
			pmon	B	10 DEACCD POWEROFF messages					
2					Skip if DEA-A unpowered & disabled					
2.1					Ignore if DPA unpowered			1,2,4,6		
	V			2						
	V			2						
	V			1						
	V			2						
	V			2						
	V			2						
	V			2						
2.2					Ignore if DPA unpowered			1,2,4,6		
2.3					Ignore if DPA unpowered			1,2,4,6		
					Ignore if DPA unpowered					
	V									
	V									
	V									
	V									
	V									
	V									
	V									

Table 1: **SWITCH FROM DEA A TO DEA B(Page 2)**

0 **#**	**Title** **(Revision 5.9_V2.4)**	**Time** **(mins)**	**Command** **Description**	**Command** **Mnemonic**	**Telemetry** **Description**	**Telemetry** **Mnemonic**	**Expected** **Value**
3	**Heater states**						
3.1	Verify heaters are not powered on side B	1			DA HTR ON/OFF B DA HTR EN/DIS B DA BAKE OUT ON/OFF B DA BAKE OUT EN/DIS B	1DAHTBON 1DAHTBEN 1DABOBON 1DABOBEN	OFF DIS OFF DIS
4	**Turn on DEA-B input power**						
4.1	Verify DEA B is receiving power				DEA Input V B	1DE28BVO	25.0–34.0
4.2	Enable DEA PS B	1	DEA PS B En	1DEPSBEN	DEA B ENB/DIS	1DEPSBX	ENB
4.3	DEA Power B On	1	DEA PS On B	1DEPSBON	 DEA Input V B DEA +28 V B DEA +24 V B DEA +15 V B DEA +6 V B DEA -6 V B DEA -15 V B DEA Input I B	1DEPSB 1DE28BVO 1DEP3BVO 1DEP2BVO 1DEP1BVO 1DEP0BVO 1DEN0BVO 1DEN1BVO 1DEICBCU	ON 25.0–34.0 > 26.0 24.0–26.0 15.0–17.0 5.6–6.7 -7–-5.7 -17–-15 0.7–0.9
4.4	Verify DEA A is off				 DEA Input V A DEA +28 V A DEA +24 V A DEA +15 V A DEA +6 V A DEA -6 V A DEA -15 V A	1DEPSAX 1DEPSA 1DE28AVO 1DEP3AVO 1DEP2AVO 1DEP1AVO 1DEP0AVO 1DEN0AVO 1DEN1AVO	DSAB OFF 25.0–34.0 0.0 ± 0.5 0.0 ± 0.5 0.0 ± 0.5 0.0 ± 0.5 0.0 ± 0.5 0.0 ± 0.5

Table 1: **SWITCH FROM DEA A TO DEA B(Page 2)**

0 #	Units	Telemetry EGSE	Other Verifier	Crit	Description	Notes	RT Con	Tlm Fmt	Min Alt	SIM Pos
3										
3.1				1	Verify housing heater is off			1,2,4,6	60k	
				2	Verify housing heater disabled					
				1	Verify bakeout heater is off					
				2	Verify bakeout heater disabled					
4										
4.1	V			1						
4.2				2	Ignore if DPA unpowered			1,2,4,6		
4.3				2	Ignore if DPA unpowered			1,2,4,6		
	V			2	Expect DEA side B power					
	V			2	24 ± 4 W, current is noisy					
	V			1	so average needed (see Figures).					
	V			2						
	V			2						
	V			2						
	V			2						
	A			2						
4.4					Ignore if DPA unpowered			1,2,4,6		
					Ignore if DPA unpowered					
	V									
	V									
	V									
	V									
	V									
	V									
	V									

Table 1: **SWITCH FROM DEA A TO DEA B(Page 3)**

0 #	Title (Revision 5.9_V2.4)	Time (mins)	Command Description	Command Mnemonic	Telemetry Description	Telemetry Mnemonic	Expected Value
5	**Warm boot BEP**						
5.1	Set Boot modifier off		DPA FS Boot Modifier	1BMODIBM(0)			
5.2	Set warm boot flag		DPA Warm Boot	1WRMBTSB(1)			
5.3	Halt active BEP		Halt BEP	1RSETIRT(1)			
5.4	Restart active BEP		Restart BEP	1RSETIRT(0)			
5.5	Check BEP Boot	2					
5.6	Check HW LEDs	1			BEP Select BEP FIFO Not Full BEP FIFO Not Empty	1STAT4ST 1STAT6ST 1STAT7ST	0or1 1 0
5.7	Check SW LEDs	1			BEP initialization Watchdog boot Science run status	1STAT3ST 1STAT2ST 1STAT1ST 1STAT0ST	0 1 1 0or1
6	**Start DEA Interface Housekeeping**						
6.1	Load Board 12 DEA Hkp	1	loadDeaBlock	WD00001024			
6.2	Start DEA Hkp run	1	startDea	XDZ0000005			

Table 1: **SWITCH FROM DEA A TO DEA B(Page 3)**

0 \#	Units	Telemetry EGSE	Other Verifier	Crit	Description	Notes	RT Con	Tlm Fmt	Min Alt	SIM Pos
5										
5.1					disables boot from uplink	LF 4.4.1		1,2,4,6		
5.2					Warm boot active BEP	LF 4.4.1		1,2,4,6		
5.3					Hold active BEP reset line	LF 4.4.1		1,2,4,6		
5.4					Release BEP reset line			1,2,4,6		
5.5		Check bepStartupMessage: bepTickCounter $<$ 10; version =??; warmbootFlag = 1, patchValidFlag =1 Check swHousekeeping messages: startingBepTickCounter $<$ 10; endingBepTickCounter= =startingbeptickcounter+640 version =??		A A A B B A	 version # depends on loaded patches (if any) **DEA Interface A/D** **in high-res mode**			1,2,4,6		
5.6				2 2 2	0/1 indicates BEP A/B selected 1 means FIFO not full 1 means FIFO not empty			1,2,4,6		
5.7				2 2 2 2	0 means BEP SW is running 1 means no watchdog boot 1 means science idle bit toggles ⇒ BEP is running			1,2,4,6		
6										
6.1		Check cmdResult==OK commandEcho==225		B	Monitor FP temp and DEA voltages		Y	1,2	60k	
6.2		Check cmdResult==OK commandEcho==18		B			Y	1,2	60k	

Table 1: **SWITCH FROM DEA A TO DEA B(Page 4)**

0 #	**Title (Revision 5.9_V2.4)**	**Time (mins)**	**Command Description**	**Command Mnemonic**	**Telemetry Description**	**Telemetry Mnemonic**	**Expected Value**
7	**Start FP temperature control**						
7.1	set FP temp to −122°C	1	changeConfigSetting	WSFTNEG123			
7.2	set FP temp to −120°C	2	changeConfigSetting	WSFTNEG121			
8	**Power vid boards from DEA-B cumulatively**						
8.1a	Set I0,S0 relays to DEA-B	1	changeConfigSetting	WS_RELAY_0			
8.1b	Power up I0	1	changeConfigSetting	WSPOW00100			
8.1c	Power up S0	1	changeConfigSetting	WSPOW01100			
8.2a	Set I1,S1 relays to DEA-B	1	changeConfigSetting	WS_RELAY_1			
8.2b	Power up I1	1	changeConfigSetting	WSPOW01300			
8.2c	Power up S1	1	changeConfigSetting	WSPOW03300			
8.3a	Set I2,S3 relays to DEA-B	1	changeConfigSetting	WS_RELAY_2			
8.3b	Power up I2	1	changeConfigSetting	WSPOW03700			
8.3c	Power up S3	1	changeConfigSetting	WSPOW0B700			

Table 1: **SWITCH FROM DEA A TO DEA B(Page 4)**

0 #	**Units**	**Telemetry EGSE**	**Other Verifier**	**Crit**	**Description**	**Notes**	**RT Con**	**Tlm Fmt**	**Min Alt**	**SIM Pos**
7										
7.1		Check cmdResult==OK commandEcho==6365		A			Y	1,2	60k	
7.2		Check cmdResult==OK commandEcho==1220		A			Y	1,2	60k	
8										
8.1a		Check cmdResult==OK commandEcho==14429	1DEPSB	A	Wait 60 secs, then check that 1DEPSB=ON		Y	1,2	60k	
8.1b		Check cmdResult==OK commandEcho==14439	1DEPSB	A	Wait 60 secs, then check that 1DEPSB=ON		Y	1,2	60k	
8.1c		Check cmdResult==OK commandEcho==14440	1DEPSB	A	Wait 60 secs, then check that 1DEPSB=ON		Y	1,2	60k	
8.2a		Check cmdResult==OK commandEcho==14430	1DEPSB	A	Wait 60 secs, then check that 1DEPSB=ON		Y	1,2	60k	
8.2b		Check cmdResult==OK commandEcho==14443	1DEPSB	A	Wait 60 secs, then check that 1DEPSB=ON		Y	1,2	60k	
8.2c		Check cmdResult==OK commandEcho==14445	1DEPSB	A	Wait 60 secs, then check that 1DEPSB=ON		Y	1,2	60k	
8.3a		Check cmdResult==OK commandEcho==14433	1DEPSB	A	Wait 60 secs, then check that 1DEPSB=ON		Y	1,2	60k	
8.3b		Check cmdResult==OK commandEcho==14446	1DEPSB	A	Wait 60 secs, then check that 1DEPSB=ON		Y	1,2	60k	
8.3c		Check cmdResult==OK commandEcho==14448	1DEPSB	A	Wait 60 secs, then check that 1DEPSB=ON		Y	1,2	60k	

Table 1: **SWITCH FROM DEA A TO DEA B(Page 5)**

0 #	**Title (Revision 5.9_V2.4)**	**Time (mins)**	**Command Description**	**Command Mnemonic**	**Telemetry Description**	**Telemetry Mnemonic**	**Expected Value**
8.4a	Set I3,S2 relays to DEA-B	1	changeConfigSetting	WS_RELAY_3			
8.4b	Power up I3	1	changeConfigSetting	WSPOW0BF00			
8.4c	Power up S2	1	changeConfigSetting	WSPOW0FF00			
8.5a	Set S4,S5 relays to DEA-B	1	changeConfigSetting	WS_RELAY_4			
8.5b	Power up S4	1	changeConfigSetting	WSPOW1FF00			
8.5c	Power up S5	1	changeConfigSetting	WSPOW3FF00			
9	**Power up FEPs**						
9.1	Power up all FEPs	2	changeConfigSetting	WSFEPALLUP	DPA Input I A DPA Input I B	1DPICACU 1DPICBCU	1.1–1.6 1.1–1.6
9.2	Dump System Config.	1	dumpSysConfig	RS_0000001			

Table 1: **SWITCH FROM DEA A TO DEA B(Page 5)**

0 #	**Units**	**Telemetry EGSE**	**Other Verifier**	**Crit**	**Description**	**Notes**	**RT Con**	**Tlm Fmt**	**Min Alt**	**SIM Pos**
8.4a		Check cmdResult==OK commandEcho==14434	1DEPSB	A	Wait 60 secs, then check that 1DEPSB=ON		Y	1,2	60k	
8.4b		Check cmdResult==OK commandEcho==14451	1DEPSB	A	Wait 60 secs, then check that 1DEPSB=ON		Y	1,2	60k	
8.4c		Check cmdResult==OK commandEcho==14453	1DEPSB	A	Wait 60 secs, then check that 1DEPSB=ON		Y	1,2	60k	
8.5a		Check cmdResult==OK commandEcho==14436	1DEPSB	A	Wait 60 secs, then check that 1DEPSB=ON		Y	1,2	60k	
8.5b		Check cmdResult==OK commandEcho==14454	1DEPSB	A	Wait 60 secs, then check that 1DEPSB=ON		Y	1,2	60k	
8.5c		Check cmdResult==OK commandEcho==14457	1DEPSB	A	Wait 60 secs, then check that 1DEPSB=ON		Y	1,2	60k	
9										
9.1		Verify cmdResult==OK commandEcho 89		A	Messages:		Y	1,2	60k	
			pmon	A	30 FEP_WRITEMEM					
			pmon	A	6 FEP_EXECMEM					
			pmon	A	6 FEPMAN_POWERON					
			pmon	A	6 FEPMAN_STARTLOAD					
			pmon	A	6 FEPMAN_ENDLOAD					
	A				Should be valid for BEP A or B					
	A				Should be valid for BEP A or B					
9.2		Verify cmdResult==OK commandEcho 66		B			Y	1,2	60k	

Table 1: **SWITCH FROM DEA A TO DEA B(Page 6)**

0 #	Title (Revision 5.9_V2.4)	Time (mins)	Command Description	Command Mnemonic	Telemetry Description	Telemetry Mnemonic	Expected Value
10	**CC Science run on ACIS-I**						
10.1	Load Faint CC pblock	1	loadCcBlock	WC0015A014			
10.2	Start bias-only run	10	startScience	X1Z0000005			
11	**CC Science run on ACIS-S**						
11.1	Load Faint CC pblock	1	loadCcBlock	WC00110024			
11.2	Start bias-only run	10	startScience	X1Z0000005			
12	**TE Science run on ACIS-I**						
12.1	Load Faint TE pblock	1	loadTeBlock	WT007AC024			
12.2	Start bias-only run	25	startScience	X2Z0000005			
13	**TE Science run on ACIS-S**						
13.1	Load Faint TE pblock	1	loadTeBlock	WT007AE024			

Table 1: **SWITCH FROM DEA A TO DEA B(Page 6)**

0 #	Units	Telemetry EGSE	Other Verifier	Crit	Description	Notes	RT Con	Tlm Fmt	Min Alt	SIM Pos
10					Skip if any of the video boards failed to power on in step 8.					
10.1		Verify cmdResult==OK commandEcho 15235		A			Y	1,2	60k	
10.2		Verify cmdResult==OK commandEcho 29	scienceReport	A	Verify terminationCode==2 in scienceReport Wait for completion of science run.		Y	1,2	60k	
11					Skip if any of the video boards failed to power on in step 8.					
11.1		Verify cmdResult==OK commandEcho 11461		A			Y	1,2	60k	
11.2		Verify cmdResult==OK commandEcho 29	scienceReport	A	Verify terminationCode==2 in scienceReport Wait for completion of science run.		Y	1,2	60k	
12					Skip if any video boards unpowered/not enough comm time.					
12.1		Verify cmdResult==OK commandEcho 11644		A			Y	1,2	60k	
12.2		Verify cmdResult==OK commandEcho 48	scienceReport	A	Verify terminationCode==2 in scienceReport Wait for completion of science run.		Y	1,2	60k	
13					Skip if any video boards unpowered/not enough comm time.					
13.1		Verify cmdResult==OK commandEcho 11648		A			Y	1,2	60k	

Table 1: **SWITCH FROM DEA A TO DEA B(Page 7)**

0 **#**	**Title** **(Revision 5.9_V2.4)**	**Time** **(mins)**	**Command** **Description**	**Command** **Mnemonic**	**Telemetry** **Description**	**Telemetry** **Mnemonic**	**Expected** **Value**
13.2	Start bias-only run	25	startScience	X2Z0000005			
14	**Power down all boards**						
14.1	Power down all video boards and FEPs	1	changeConfigSetting	WSPOW00000			
					DEA Input I B	1DEICBCU	0.7–0.9
					DPA Input I A	1DPICACU	0.4–0.6
					DPA Input I B	1DPICBCU	0.4–0.6
14.2	Dump System Config.	1	dumpSysConfig	RS_0000001			
	Total time:	109					

Table 1: **SWITCH FROM DEA A TO DEA B(Page 7)**

0 #	**Units**	**Telemetry EGSE**	**Other Verifier**	**Crit**	**Description**	**Notes**	**RT Con**	**Tlm Fmt**	**Min Alt**	**SIM Pos**
13.2		Verify cmdResult==OK	scienceReport	A	Verify terminationCode==2		Y	1,2	60k	
		commandEcho 48			in scienceReport					
					Wait for completion					
					of science run.					
14										
14.1		Verify cmdResult==OK		A			Y	1,2	60k	
		commandEcho 773								
	A			2	Noisy current; average needed					
					Messages:					
			pmon	A	10 DEACCD_POWEROFF					
			pmon	A	6 FEPMAN_POWEROFF					
	A									
	A									
14.2		Check cmdResult==OK		B			Y	1,2	60k	
		commandEcho==66								