

4.35_V2.0 Flight Software Standard Patch H Optional Patch K

Last Revised: April 7, 2025

Filename: sw_stdhoptk

BRIEF FUNCTIONAL DESCRIPTION:

This procedure loads the standard H patches and six optional K patches. The changes from sw_stdhoptj consist of one updated optional patch. The text that describes the changes in the optional patch in this procedure follows below the italic note:

The set of standard release H patches is loaded into a common address space so that each optional patch can be loaded independently of the others, provided the load order defined in the patch combination certification is maintained.

The eventhist patch requires that smtimedlookup is also loaded.

The ACIS Flight SW team recommends that the optional patches be loaded together with the standard patches; therefore this procedure first removes any patches which may have been installed and then proceeds to load the standard patches followed by the optional patches.

This procedure loads “standard Rev. H” and “optional Rev. K”. Refer to the release notes for standard patches, optional patches, and patch combination certification (see references below).

This optional patch load updates the *txings* software to Revision C, which includes the computation of the framestore exposure time, principally affecting CCDs that are commanded to flush their image arrays in order to achieve shorter exposure times. Revision C performs a more precise estimate of ACIS exposure times and flux rates, including all possible ACIS observing modes.

This procedure will change the flight software version from 60 to version 61. Ground software should be changed to reflect the version change once this procedure is executed.

The FOT should implement the loading of the patches (steps 3.1 through step 10.1) as eight real-time command loads in order to maximize the uplink efficiency. The command system should be configured with a blocking factor of 90 and a minimum time delay of 3 s.

The following procedure loads the Standard H and smtimedlookup / cc3x3 / eventhist / compressall / txings / deahktrip optional set of patches into the ACIS instrument, as well as the new version number patch, and dumps the load to the ground for verification. It then executes a warm boot and loads and starts DEA housekeeping.

This procedure implements the following basic operations:

1. Confirm the current state of ACIS by verifying BEP HW and SW LEDs
2. Reset the contents of the patch list to remove any existing patches, dump the contents of the patch list to verify that the list is empty
3. Load the “standard Rev. H” patch load
4. Load the smtimedlookup patch (part of “optional Rev. K”)
5. Load the cc3x3 patch (part of “optional Rev. K”)

6. Load the eventhist patch (part of “optional Rev. K”)
7. Load the compressall patch (part of the “optional Rev. K”)
8. Load the txings patch (part of the “optional Rev. K”)
9. Load the deahktrip patch (part of the “optional Rev. K”)
10. Load the patch load version number (61)
11. Dump the contents of the patch list to verify the load
12. Warm boot the BEP to activate the new load and verify proper BEP boot
13. Start the DEA housekeeping and verify proper reporting

Refer to ECO 36-1066 for the contents and review status of the patch load, and to ECO 36-1067 for the certified combinations of optional patches. The ECO’s for each new or updated standard patch are: ECO 36-1065 (*txings*).

The telemetry verifiers for the procedure will be:

1. ACIS Ops will confirm the current status of the BEP
2. A command echo for the reset patch list command
3. A command echo for the 1st dumpPatchlist command
4. A single bepReadReply packet for the 1st empty dump
5. A series of command echoes for the addPatch commands. The SOT will verify that each Result field of each commandEcho packet has a value of 1.
6. A command echo for the dumpPatchlist command
7. A series of bepReadReply packets for the dump command
8. A comparison of the dumped patchlist to expected values.
9. A bepStartupMessage packet with a modified “version = 61” field plus several other bepStartupMessage packet fields.
10. A verification that DEA housekeeping is being reported.
11. ACIS flight software personnel will review the contents of the patchlist dump while the procedure is running.

ASSUMED INSTRUMENT STATE:

This assumes that DPA-A and/or DPA-B is on and the flight SW is running on either BEP-A or BEP-B.

SPECIAL INITIAL CONDITIONS:

The OCC command system must be configured with “Minimum Time Delay” of 3 s and a “Blocking Factor” of 90.

Spacecraft telemetry should be in Format 2 when the patches are loaded in order to ensure that all command verifiers can be included in the telemetry stream.

OPERATIONAL CONSTRAINTS/CAUTIONS:

In order to avoid truncating a dump, each dumpPatchlist command must be followed by at least a 30 second delay.

The warmboot will set the parameters of the *txings* patch to their defaults. Immediately upon completion of this SOP, the optimal parameters should be uploaded via a CAP.

As each patch is uploaded, 1STAT7ST will switch from 0 to 1 and then back to 0 as the BEP input FIFO is filled and then cleared. Some versions of PMON will show 1STAT7ST=1 in red, and some software may send alerts. It is best to wait for 1STAT7ST to go back to zero between steps. If it does not clear after a reasonable period, see the contingency plans for how to clear a stuck FIFO.

Note that very small uploads like the flight software version number update may clear sufficiently fast that FIFO-full status might not be seen. If in doubt and there is sufficient time, waiting for one or two software housekeeping cycles (64s interval) between steps is advised but not required.

CONTINGENCY PLANS:

In case of a problem that may arise during the procedure, the following contingencies may be followed:

1. If there is a failure to confirm a telemetry verifier, ACIS flight software personnel will visually determine, via bi-levels, if the ACIS FIFO needs to be cleared (1STAT7ST = 1, FIFO Not Empty). If it does, the FIFO will be cleared via step 14. If the FIFO does not need to be cleared, ACIS Ops has the discretion to restart the procedure at step 2, or to continue on from this point.

Should the FIFO clear procedure be executed and is successful, the ACIS operator will observe the following responses. First, in PMON, the operator will see the correct command echo from the stuck command. Next, also in PMON, the “Serial Command” column will show “UNUSED”, and the “Result Code” column will show “NO_HANDLER”. Lastly, the bilevels will return to their nominal values. 1STAT7ST will read 0 indicating FIFO Empty, and 1STAT6ST will read 1, indicating FIFO Not Full.

If the FIFO does not need to be cleared and the problem cannot be determined, a full ACIS system dump will be executed, using SOP_ACIS_FSW_DUMP to obtain the ACIS diagnostic information. The patchlist will be cleared, if necessary, and the present version of software will continue to run. Should ACIS reboot, however, it will revert to Version 11 of the ACIS software.

2. If there is a failure to confirm the patch list dump (step 11), first repeat step 11, dumping the patch list, to confirm that there wasn't a downlink corruption. If the list is confirmed, continue to step 12, otherwise, restart from step 2 and reload the patches. If SOT cannot confirm telemetry verifiers for reasons other than telemetry corruption, run SOP_ACIS_FSW_DUMP (SOT Procedure 1.10_V2.2, sw_dump) to obtain ACIS diagnostic information and then run SOP_ACIS_SW_STDHOPTJ to reload version 60 patches (SOT Procedure 4.34_V2.1, sw_stdhoptj).
3. If the warm boot of the BEP fails (step 12), retry the reboot (step 12). If this continues to fail, run SOP_ACIS_FSW_DUMP to dump additional information for diagnostic purposes (SOT Procedure 1.10_V2.2, sw_dump) and SOP_ACIS_SW_STDHOPTJ to reload version 60 patches (SOT Procedure 4.34_V2.1, sw_stdhoptj).
4. If there is a comm loss during the procedure, request a new comm. The time at which the new comm is needed depends on the point of loss of signal. The only vulnerability would occur if

comm was dropped before the complete patch set was loaded (completion of step 10). If the BEP then rebooted spontaneously, it would return to version 11 flight software.

REFERENCES:

1. MIT 36-58010 Rev H (ECO 36-1066) Flight Software Standard Patch Release H.
<https://acisweb.mit.edu/axaf/eco/eco-1066.pdf>
2. MIT 36-58020 Rev K (ECO 36-1066) Flight Software Optional Patch Release K.
<https://acisweb.mit.edu/axaf/eco/eco-1066.pdf>
3. MIT 36-58021.04 Rev L (ECO 36-1067) Flight Software Patch Release H-K-L Certification.
<https://acisweb.mit.edu/axaf/eco/eco-1067.pdf>
4. MIT 36-58030.33 Rev C (ECO 36-1065) *txings* Flight Software Optional Patch Release C (to report high background radiation levels).
<https://acisweb.mit.edu/axaf/eco/eco-1065.pdf>

CHANGE HISTORY:

V0.1

- Initial version revised from 4.34_V2.1 Flight Software Standard Patch H Optional Patch J.

V1.0

- First pass-through of reviews complete; ready to send to full ACIS team.

V2.0

- Text edits after team review and update to the patch-dump reference file.

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Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 1)

Step #	Title (Revision 4.35_V2.0)	Time Req	Command Description	Command Mnemonic	Telemetry Description	Telemetry Mnemonic	Expected Value
1	Verify current ACIS status						
1.1	Verify HW LEDs	2.0			BEP Select BEP Not in Reset BEP FIFO Not Full BEP FIFO Not Empty	1STAT4ST 1STAT5ST 1STAT6ST 1STAT7ST	0 or 1 1 1 0
1.2	Verify SW LEDs	2.0			BEP is running Science run status Watchdog boot BEP initialization	1STAT0ST 1STAT1ST 1STAT2ST 1STAT3ST	0 or 1 1 1 0
2	Reset the Patchlist						
2.1	Empty the Patchlist	1	removePatches	AUALLPATCH			
2.2	Read the empty Patchlist	1	dumpPatchlist	RU_0000001			
3	Load Standard Patches						
3.1	Load standard Rev. H patches	5	addPatch	WUSTANDH01 WUSTANDH02 WUSTANDH03 WUSTANDH04 WUSTANDH05 WUSTANDH06 WUSTANDH07 WUSTANDH08 WUSTANDH09 WUSTANDH10			

Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 1)

Step #	Units	Telemetry EGSE	Other Verifier	Crit	Description	Notes	RT Con	TIm Fmt	Min Alt	SIM Pos
1										
1.1				2 2 2 2	0/1 indicates BEP A/B is selected 1 means BEP not in reset 1 means FIFO not full 0 means FIFO empty		Y	2		
1.2				2 2 2 1	this bit toggles to indicate BEP is running 1 means science idle 1 means no watchdog boot 0 means BEP SW is running		Y	2		
2										
2.1		Verify cmdResult == 1 commandEcho 326		A			Y	2		
2.2		Verify cmdResult == 1 commandEcho 65		B	bepReadReply, ACIS EGSE verifies single packet reply		Y	2		
3										
3.1		commandEcho 19197 commandEcho 19198 commandEcho 19200 commandEcho 19203 commandEcho 19205 commandEcho 19206 commandEcho 19209 commandEcho 19210 commandEcho 19212 commandEcho 19215		A A A A A A A A A A	Expect to send 43 packets. Total load size: 5032 bytes. Verify cmdResult == 1 for each packet.		Y	2		

Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 2)

Step #	Title (Revision 4.35_v2.0)	Time Req	Command Description	Command Mnemonic	Telemetry Description	Telemetry Mnemonic	Expected Value
				WUSTANDH11			
				WUSTANDH12			
				WUSTANDH13			
				WUSTANDH14			
				WUSTANDH15			
				WUSTANDH16			
				WUSTANDH17			
				WUSTANDH18			
				WUSTANDH19			
				WUSTANDH20			
				WUSTANDH21			
				WUSTANDH22			
				WUSTANDH23			
				WUSTANDH24			
				WUSTANDH25			
				WUSTANDH26			
				WUSTANDH27			
				WUSTANDH28			
				WUSTANDH29			
				WUSTANDH30			
				WUSTANDH31			
				WUSTANDH32			
				WUSTANDH33			
				WUSTANDH34			
				WUSTANDH35			
				WUSTANDH36			
				WUSTANDH37			

Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 2)

Step #	Units	Telemetry EGSE	Other Verifier	Crit	Description	Notes	RT Con	Tlm Fmt	Min Alt	SIM Pos
		commandEcho 19217		A						
		commandEcho 19218		A						
		commandEcho 19220		A						
		commandEcho 19223		A						
		commandEcho 19224		A						
		commandEcho 19227		A						
		commandEcho 19229		A						
		commandEcho 19230		A						
		commandEcho 19233		A						
		commandEcho 19234		A						
		commandEcho 19236		A						
		commandEcho 19240		A						
		commandEcho 19243		A						
		commandEcho 19245		A						
		commandEcho 19246		A						
		commandEcho 19248		A						
		commandEcho 19251		A						
		commandEcho 19253		A						
		commandEcho 19254		A						
		commandEcho 19257		A						
		commandEcho 19258		A						
		commandEcho 19260		A						
		commandEcho 19263		A						
		commandEcho 19265		A						
		commandEcho 19266		A						
		commandEcho 19268		A						
		commandEcho 19271		A						

Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 3)

Step #	Title (Revision 4.35_v2.0)	Time Req	Command Description	Command Mnemonic	Telemetry Description	Telemetry Mnemonic	Expected Value
				WUSTANDH38 WUSTANDH39 WUSTANDH40 WUSTANDH41 WUSTANDH42 WUSTANDH43			
4	Load smtimedlookup patch						
4.1	Load opt_smtl patches part of optional Rev. K	5	addPatch	WUSTMLUK01 WUSTMLUK02 WUSTMLUK03 WUSTMLUK04 WUSTMLUK05 WUSTMLUK06 WUSTMLUK07 WUSTMLUK08 WUSTMLUK09 WUSTMLUK10 WUSTMLUK11 WUSTMLUK12			

Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 3)

Step #	Units	Telemetry EGSE	Other Verifier	Crit	Description	Notes	RT Con	TIm Fmt	Min Alt	SIM Pos
		commandEcho 19272 commandEcho 19275 commandEcho 19277 commandEcho 19278 commandEcho 19280 commandEcho 19283		A A A A A A						
4										
4.1		commandEcho 20140 commandEcho 20143 commandEcho 20145 commandEcho 20146 commandEcho 20148 commandEcho 20151 commandEcho 20152 commandEcho 20155 commandEcho 20157 commandEcho 20158 commandEcho 20160 commandEcho 20163		A A A A A A A A A A A A A	Expect to send 12 packets. Total load size: 3696 bytes. Verify cmdResult == 1 for each packet.		Y	2		

Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 4)

Step #	Title (Revision 4.35_v2.0)	Time Req	Command Description	Command Mnemonic	Telemetry Description	Telemetry Mnemonic	Expected Value
5	Load cc3x3 patch						
5.1	Load opt_cc3x3 patches part of optional Rev. K	5	addPatch	WUCC3X3K01 WUCC3X3K02 WUCC3X3K03 WUCC3X3K04 WUCC3X3K05 WUCC3X3K06 WUCC3X3K07 WUCC3X3K08 WUCC3X3K09 WUCC3X3K10 WUCC3X3K11 WUCC3X3K12 WUCC3X3K13			
6	Load eventhist patch						
6.1	Load opt_eventhist patches part of optional Rev. K	5	addPatch	WUEVHSTK01 WUEVHSTK02 WUEVHSTK03 WUEVHSTK04 WUEVHSTK05 WUEVHSTK06 WUEVHSTK07 WUEVHSTK08 WUEVHSTK09 WUEVHSTK10 WUEVHSTK11 WUEVHSTK12 WUEVHSTK13 WUEVHSTK14 WUEVHSTK15			

Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 4)

Step #	Units	Telemetry EGSE	Other Verifier	Crit	Description	Notes	RT Con	Tlm Fmt	Min Alt	SIM Pos
5										
5.1		commandEcho 20166 commandEcho 20169 commandEcho 20170 commandEcho 20172 commandEcho 20175 commandEcho 20177 commandEcho 20178 commandEcho 20180 commandEcho 20183 commandEcho 20184 commandEcho 20187 commandEcho 20189 commandEcho 20190		A A A A A A A A A A A A A	Expect to send 13 packets. Total load size: 4620 bytes. Verify cmdResult == 1 for each packet.		Y	2		
6										
6.1		commandEcho 20194 commandEcho 20196 commandEcho 20199 commandEcho 20200 commandEcho 20203 commandEcho 20205 commandEcho 20206 commandEcho 20208 commandEcho 20211 commandEcho 20213 commandEcho 20214 commandEcho 20217 commandEcho 20218 commandEcho 20220 commandEcho 20223		A A A A A A A A A A A A A A	Expect to send 15 packets. Total load size: 5892 bytes. Verify cmdResult == 1 for each packet.		Y	2		

Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 5)

Step #	Title (Revision 4.35_v2.0)	Time Req	Command Description	Command Mnemonic	Telemetry Description	Telemetry Mnemonic	Expected Value
7	Load compressall patch						
7.1	Load opt.compressall patches part of optional Rev. K	5	addPatch	WUCMPRSK01 WUCMPRSK02 WUCMPRSK03 WUCMPRSK04 WUCMPRSK05 WUCMPRSK06 WUCMPRSK07 WUCMPRSK08			
8	Load txings patch						
8.1	Load opt.txings patches part of optional Rev. K	5	addPatch	WUTXINGK01 WUTXINGK02 WUTXINGK03 WUTXINGK04 WUTXINGK05 WUTXINGK06 WUTXINGK07 WUTXINGK08 WUTXINGK09 WUTXINGK10 WUTXINGK11 WUTXINGK12 WUTXINGK13 WUTXINGK14 WUTXINGK15			

Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 5)

Step #	Units	Telemetry EGSE	Other Verifier	Crit	Description	Notes	RT Con	Tlm Fmt	Min Alt	SIM Pos
7										
7.1		commandEcho 20226 commandEcho 20228 commandEcho 20231 commandEcho 20232 commandEcho 20235 commandEcho 20237 commandEcho 20238 commandEcho 20240		A A A A A A A A	Expect to send 8 packets. Total load size: 2352 bytes. Verify cmdResult == 1 for each packet.		Y	2		
8										
8.1		commandEcho 20245 commandEcho 20246 commandEcho 20249 commandEcho 20250 commandEcho 20252 commandEcho 20255 commandEcho 20256 commandEcho 20259 commandEcho 20261 commandEcho 20262 commandEcho 20265 commandEcho 20266 commandEcho 20268 commandEcho 20271 commandEcho 20273		A A A A A A A A A A A A A A A A	Expect to send 15 packets. Total load size: 4176 bytes. Verify cmdResult == 1 for each packet.		Y	2		

Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 6)

Step #	Title (Revision 4.35_v2.0)	Time Req	Command Description	Command Mnemonic	Telemetry Description	Telemetry Mnemonic	Expected Value
9	Load deahktrip patch						
9.1	Load opt.deahktrip patches part of optional Rev. K	5	addPatch	WUDHKTPK01 WUDHKTPK02 WUDHKTPK03 WUDHKTPK04 WUDHKTPK05 WUDHKTPK06 WUDHKTPK07			
10	Patch the version number						
10.1	Load the version number patch	1	addPatch	WUFSV0003D			
11	Dump Installed Patches						
11.1	Dump Patchlist	1	dumpPatchlist	RU_00000001			
12	Activate Patches						
12.1	Set Boot Modifier off	0.1	DPA FS Boot Mod.	1BMODIBM(0)			
12.2	Set Warm Boot Flag on	0.1	DPA Warm Boot	1WRMBTSB(1)			
12.3	Halt BEP	0.1	Halt BEP	1RSETIRT(1)			
12.4	Restart BEP	1	Restart BEP	1RSETIRT(0)			

Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 6)

Step #	Units	Telemetry EGSE	Other Verifier	Crit	Description	Notes	RT Con	TIm Fmt	Min Alt	SIM Pos
9										
9.1		commandEcho 20276 commandEcho 20279 commandEcho 20280 commandEcho 20283 commandEcho 20285 commandEcho 20286 commandEcho 20288		A A A A A A A	Expect to send 7 packets. Total load size: 1924 bytes. Verify cmdResult == 1 for each packet.		Y	2		
10										
10.1		Verify cmdResult == 1 commandEcho 20293			Expect to send 1 packet. Total load size 16 bytes. Sets the version number to 61.		Y	2		
11										
11.1		Verify cmdResult == 1 commandEcho 65			bepReadReply ACIS EGSE verifies reply against file /home/jennyg/Data/Reference/PatchDumps/ wuhkl_bcom_compare.dumpedPatches.1.dat		Y	2		
12										
12.1					disables uplink boot		Y	2		
12.2							Y	2		
12.3							Y	2		
12.4		bepStartupMessage			ACIS EGSE verifies “version” field == 61 decimal		Y	2		

Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 7)

Step #	Title (Revision 4.35_v2.0)	Time Req	Command Description	Command Mnemonic	Telemetry Description	Telemetry Mnemonic	Expected Value
12.5	Verify BEP Boot	2.0					
12.6	Verify HW LEDs	2.0			BEP Select BEP Not in Reset BEP FIFO Not Full BEP FIFO Not Empty	1STAT4ST 1STAT5ST 1STAT6ST 1STAT7ST	0 or 1 1 1 0
12.7	Verify SW LEDs	2.0			BEP is running Science run status Watchdog boot BEP initialization	1STAT0ST 1STAT1ST 1STAT2ST 1STAT3ST	0 or 1 1 1 0
13.0	Execute DEA HK run						
13.1	Load Board 11 DEA HK	1	loadDeaBlock	WD00001024			
13.2	Start DEA Hkp run	1	startDEA	XDZ00000005			

Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 7)

Step #	Units	Telemetry EGSE	Other Verifier	Crit	Description	Notes	RT Con	TIm Fmt	Min Alt	SIM Pos
12.5		Check bepStartupMessage: bepTickCounter < 10; version=61; watchdogFlag = 0 patchValidFlag =1 warmbootFlag = 1 Check swHousekeeping messages: startingBepTickCounter < 10; endingBepTickCounter= startingBepTickCounter+ ~645; version = 61		A A A A A B B A			Y	2		
12.6				2 2 2 2	0/1 indicates BEP A/B is selected 1 means BEP not in reset 1 means FIFO not full 0 means FIFO empty		Y	2		
12.7				2 2 2 1	this bit toggles to indicate BEP is running 1 means science idle 1 means no watchdog boot 0 means BEP SW is running		Y	2		
13.0										
13.1		Verify cmdResult == 1 commandEcho 225		B	Load Fullhouse DEA housekeeping parameter block into slot 4			1or2		
13.2		Verify cmdResult == 1 commandEcho 18 confirm DEAhk values		B				1or2		

Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 8)

Step #	Title (Revision 4.35_v2.0)	Time Req	Command Description	Command Mnemonic	Telemetry Description	Telemetry Mnemonic	Expected Value
14	Contingency FIFO Clear						
14.1-C	Fix FIFO Command	1	clearFIFO	FF_FIXFIFO			
14.2-C	Verify HW LEDs	2.0			BEP FIFO Not Full BEP FIFO Empty	1STAT6ST 1STAT7ST	1 0
	Total Time:	51.3					

Table 1: ACIS Flight Software Standard Patch H Optional Patch K (Page 8)

Step #	Units	Telemetry EGSE	Other Verifier	Crit	Description	Notes	RT Con	Tlm Fmt	Min Alt	SIM Pos
14										
14.1-C		Verify: cmdResult = NO_HANDLER commandEcho 0 UNUSED		A 2 2	Expect to send 1 packet of 512 bytes		Y Y Y	2 2 2		
14.2-C				2 2	1 means FIFO not full 0 means FIFO empty					