

## **SMEI Instrument Onboard Data Update Procedure**

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## **1. Introduction**

During SMEI thermal testing with the Coriolis spacecraft in April and May 2002 at Naval Research Labs in Washington DC, a number of calibration observations were taken. The images produced have been analysed at the University of San Diego, and a number of updates to the onboard image flat fielding tables generated

These updates have been processed at Birmingham into 3 patch files, suitable for updating the SMEI E<sup>2</sup>PROM non-volatile store.

The compression parameters in the SMEI onboard observation configuration tables were also optimised during the cold testing at NRL. An updated data table has been produced with these updated values.

This procedure lays out the steps required to update the onboard flat field tables and the onboard observation default configurations.

## 2. Flat Field Table Updates

Listed here are the updates to the primary flat field tables which are applied in this update. These were applied in accordance with the email from Andy Buffington on 13<sup>th</sup> June 2002.

Cam	X	Y	Old	New
1	721	108	-0.00537	0.00302
1	721	109	0.00000	-0.00348
1	684	111	0.00111	0.00300
1	685	110	-0.00063	0.00064
1	685	111	0.00000	-0.00486
1	796	120	-0.00171	-0.00038
1	796	121	0.00000	-0.00294
1	714	136	0.00412	0.00152
1	714	137	0.00000	0.00388
1	715	137	0.00195	-0.00032
1	750	141	0.00000	0.00146
1	751	141	-0.00210	-0.00428
1	846	144	-0.00030	-0.00617
1	846	145	-0.00092	0.00323
1	847	144	0.00000	-0.00463
1	847	145	-0.00685	-0.00419
1	848	145	-0.00346	0.00128
2	414	100	0.00316	-0.00180
2	414	102	0.00168	-0.00162
2	415	100	0.00000	-0.00229
2	415	101	0.00718	0.00452
2	415	102	-0.00203	-0.00325
2	415	103	0.00019	0.00149
2	416	100	-0.00057	-0.00392
2	416	103	-0.00389	-0.00100
2	417	101	0.00031	0.00229
2	417	102	-0.00689	-0.00240
2	417	103	-0.00278	0.00277
2	558	113	-0.00270	-0.00514
2	558	114	-0.00168	-0.00312
2	558	115	0.00474	0.00270
2	560	112	-0.00188	0.00006
2	560	114	0.00000	0.00338
2	560	115	-0.00160	-0.00286
2	561	114	0.00101	0.00210
2	561	115	-0.00254	-0.00030
2	346	129	0.00026	0.00423
2	347	128	-0.00095	-0.00249
2	347	129	-0.00386	0.00101
2	348	128	0.00000	0.00533
2	349	128	-0.00329	-0.00075
2	349	129	0.00405	-0.00009
2	792	128	0.00218	-0.00021
2	792	129	-0.00785	-0.00309
2	793	129	0.00000	-0.00437
2	414	136	0.00050	-0.00282
2	414	137	-0.00325	0.00107
2	414	138	0.00458	0.00145
2	414	139	0.00420	-0.00132
2	415	137	-0.00412	0.00214
2	415	138	0.00769	0.00314
2	415	139	0.00000	-0.00125
2	416	136	-0.00285	0.00225
2	416	137	-0.00160	0.00222
2	416	138	-0.00064	-0.00312
2	416	139	0.00205	0.00081
2	417	136	-0.00381	0.00065
2	417	137	-0.00496	-0.00080
2	417	138	0.00177	-0.00297
2	417	139	0.00360	0.00122
2	1006	136	0.00000	-0.00349
2	1006	137	-0.00448	-0.00174

2	1006	138	-0.00446	0.00391
2	1007	136	0.00454	0.00083
2	271	156	-0.00285	0.00047
2	272	156	0.00000	0.00192
2	273	156	-0.00463	-0.00110
2	914	164	0.01092	0.00715
2	914	165	0.00041	-0.01041
2	915	164	0.00000	0.00448
2	915	165	0.00709	-0.00124
2	1098	192	-0.00166	-0.00361
2	1098	193	0.00000	0.00360
2	1099	193	-0.00180	-0.00012
2	1111	198	0.00031	-0.00131
2	1112	197	-0.00037	0.00219
2	1112	198	0.00000	-0.00324
2	1188	247	-0.00439	-0.00315
2	1189	247	0.00000	0.00144
2	1156	254	0.00335	0.00129
2	1157	253	-0.01120	-0.00192
2	1157	254	0.00145	0.00544
2	1157	255	0.00000	-0.00624
3	430	104	-0.00179	0.00144
3	430	105	0.00000	-0.00137
3	431	105	-0.00134	-0.00357
3	974	138	0.00110	0.00260
3	974	139	0.00596	0.00134
3	974	140	-0.00180	-0.00514
3	975	138	0.00080	-0.00074
3	975	139	0.00095	-0.00236
3	975	140	0.00733	0.00155
3	975	141	0.00482	0.00267
3	976	138	0.00297	-0.00059
3	976	139	0.00078	-0.00363
3	976	140	0.00704	0.00017
3	976	141	0.00403	-0.00111
3	977	138	0.00800	0.00288
3	977	139	0.00513	0.00082
3	977	140	0.00545	-0.00139
3	977	141	-0.05453	0.00075
3	218	198	0.00251	0.00469
3	219	199	0.00000	-0.00327
3	169	211	0.00002	0.00550
3	169	212	0.00000	-0.00345
3	169	213	-0.00547	-0.00192
3	64	243	0.00282	0.00051
3	64	244	0.00105	-0.00215
3	65	243	0.00000	-0.00356
3	65	244	0.00680	0.00293

### 3. Observation Table Compression Parameter Updates

The changes made to the pre-defined observation modes by this update are shown in the following table.

<b><i>Mode</i></b>	<b><i>Old N</i></b>	<b><i>Old Fmax</i></b>	<b><i>New N</i></b>	<b><i>New Fmax</i></b>
8 - Eng, Low Cal	4	8	7	8
9 - Eng, Med Cal	4	8	8	8
10 - Eng, High Cal	4	8	8	8
11 - Eng, Low Cal	4	8	7	8
12 - Eng, Med Cal	4	8	8	8
13 - Eng, High Cal	4	8	8	8
15 - Eng, High Cal	4	8	8	8

*Table 1. Compression Parameter Changes*

#### 4. Data E<sup>2</sup>Prom Update

SMEI contains 512 kilowords of non-volatile data storage space. This area is divided into 32 16 kiloword pages, used as described in the table below.

<b>Page Selector</b>	<b>Usage</b>	<b>Patch File</b>
0x40	Command Interpreter Tables, Region of Interest Tables, S-Band Pixel Sample Maps, 1553 Hybrid Configuration Table (Legacy)	
0x41	Camera Waveform Generator ASIC Tables	
0x42	Flight Software Patch Storage Page	
0x43	Pre-defined Camera Observation Mode Tables	page43.pat
0x44	Spare / Temporary Boot Area Storage Space	
0x45	Spare	
0x46	1553 Hybrid Configuration Table (Redundant Copy 1)	
0x47	1553 Hybrid Configuration Table (Redundant Copy 2)	
0x48 - 0x4F	Camera 1 Flat Fielding Data Tables	apply0.pat
0x50 - 0x57	Camera 2 Flat Fielding Data Tables	apply1.pat
0x58 - 0x5F	Camera 3 Flat Fielding Data Tables	apply2.pat

*Table 2. SMEI DHU Data Memory Pages*

A number of patch files are supplied for the August 2002 update, and each one provides updates the corresponding 16 kiloword data page. Each patch is in the patch file format specified in Appendix A.

To apply a patch file, SMEI should be turned on, and running nominally in configuration mode.

The patch files will transfer SMEI into patch mode, then upload and commit the data to the data e<sup>2</sup>proms. Once all the data is committed, SMEI will be returned to configuration mode.

The SMEI DHU can accept patch upload commands at the maximum supported commanding rate of the spacecraft, ie upto 5 commands per second.

Any increase in the rejected command counter returned from SMEI must suspend transmission of any remaining commands in the patch file, pending user input.

Perform the following procedure for both DHU A and DHU B.

1. Switch on SMEI, and enter configuration mode by issuing SM\_DHU\_COLD.
2. Upload the apply0.pat patch file to SMEI. Verify the command count is 26 when complete.
3. Upload the apply1.pat patch file to SMEI. Verify the command count is 89 when complete.
4. Upload the apply2.pat patch file to SMEI. Verify the command count is 118 when complete.
5. Upload the page43.pat patch file to SMEI. Verify the command count is 181 when complete.
6. Reset the SMEI DHU, and enter configuration mode by issuing SM\_DHU\_COLD. This causes the checksum page to be recalculated immediately.
7. Check the SMEI checksums page is displaying the correct values shown in the table overleaf.
8. Issue the SM\_CAMx\_CONFIG command for each camera to select the 16 sets of parameters in turn, and verify the changes to rice compression parameters shown in section 3.
9. If required, run a post-update IST.
10. If required, switch off SMEI.

<b>Bank</b>	<b>Camera 1 (Pre)</b>	<b>Camera 2 (Pre)</b>	<b>Camera 3 (Pre)</b>	<b>Camera 1 (Post)</b>	<b>Camera 2 (Post)</b>	<b>Camera 3 (Post)</b>
1	0x04EA	0x052C	0x6840	0x04EA	0x05C2	0x6840
2	0x75CE	0x723A	0x7886	0x7461	0x0D90	0x07D1
3	0x7996	0x0776	0x7B8E	0x06E8	0x78A3	0x7B8E
4	0x7D46	0x7520	0x6C56	0x7D25	0x7419	0x1846
5	0x7FEF	0x707F	0x71BA	0x7FEF	0x0F72	0x71BA
6	0x067D	0x05D1	0x754D	0x067D	0x7AB6	0x7586
7	0xB95B	0xDCB6	0xB47F	0xB95B	0xA34C	0xCA24
8	0xC476	0xBC40	0xBF2C	0xC476	0xBEDA	0xBF2C

*Table 3. Camera Flat Field Checksums*

<b>Checksum</b>	<b>Old</b>	<b>New</b>
Camera Configuration	0xFFFFA	0xFFFF6

*Table 4. Other Checksum Changes*



## A. SMEI Patch File Format And Handling

The patch files for this update are in a simple ASCII format as specified below.

- Commands are represented by 32 16-bit hexadecimal words separated by a single space
- Comment lines start with the # character in the first column
- Automated 5 second (minimum) delays are represented as a command with all 32 words set to 0000.
- SM\_PATCH\_CMT commands must present the operator with a confirmation dialog before issuing the command if the rejected command count is not zero. These can be identified as the first word of the command is ff44.

Shown below is an extract of a patch file. Note that the command lines have wrapped in this document, but do not in the patch file. I have used three dots to indicate a skipped section of the file.

```
# Patch Configuring Page 0x40 (Commands, ROI, Spans)
#
# On (Y-M-D) 2001-10-08 at 12:00:00 UCT
#
# Enable patch mode
ff02 34ff 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
# Goto patch mode
ff03 4343 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
# Upload 0x1000 words to patch buffer offset 0000
ff43 7994 0000 0001 0002 0003 0004 0000 0015 0000 0015 0013 0014 0000 0000 0000 0000 0016 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0043 0620 001d 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0143 e274 003a 0000 0000 0000 0000 0000 0000 001a 0000 0000 0015 0015 0000 0015 0015 0015 0000 0000
0000 0000 0000 0000 0000 0000 0015 0015 0015 0015 0015 0015
0243 9e7c 0057 0015 0000 0015 0000 0015 0000 0015 0000 0000 0000 0015 0015 0015 0015 0015 0015 0015 0015
0000 0015 0000 0015 0000 0015 0000 0000 0000 0015 0015 0015
0343 eaf3 0074 0015 0015 0015 0015 0000 0015 0000 0015 0000 0015 0000 0000 0001 0002 0003 0004 0000
0015 0000 0006 0013 0014 001f 0000 0000 0000 0016 0000 0000
.
.
.
# Commit 0x1000 words to bank:offset 40:0000
ff44 71a6 0000 1000 0040 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
# Pause for 5 seconds for the commit to complete
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
.
.
.
# Goto config mode
ff05 7ada 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
```