6. IN-FLIGHT DATA ACQUISITION RECOMMENDATIONS AND GUIDELINES

6.1 RECOMMENDED IN-FLIGHT CALIBRATIONS

6.1.1 DARK CURRENT DATA FOR UNTESTED MODES

During ISS flight calibration thermal vacuum testing, dark current data was taken only at the fastest data rate (48 packets / sec) in the 1x1 summation mode in gain state 3 with antiblooming on/off and lightflood on/off for most of the available exposure times. Since dark current is affected by *temperature(Gain State 3 only), data rate, summation mode, gain state, integration time, simultaneous pairs imaging mode, and lightflood*, **an in-flight dark current calibration test is recommended for all the applicable, various, untested modes that will be used for science imaging.**

Note the following :

1) There was no appreciable difference noted between the antiblooming on and off data, so it is not necessary to run in-flight dark current calibration tests for both modes.

2) Normal operation of the camera would have the lightflood on. However a noticeable difference was observed between lightflood on and off dark current data : the dark current appeared to get worse with increasing exposure index/time with lightflood on (due to RBI effects), whereas with the lightflood off, there was no appreciable increase with dark current due to the increase in exposure index/time; also the mean DN dark current level was lower with lightflood off versus with lightflood on.

3) The more extensive dark current data was taken during subsystem thermal vac testing where only individual cameras were tested. A less extensive set of dark current data for simultaneous pairs of images (both cameras shuttering simultaneously) was taken during spacecraft solar thermal vacuum testing at the lowest data rate available to ISS (8 packets/sec). The simultaneous pairs of images had the WAC image readout after the NAC image; this configuration is the default mode (although the software can specify to have the WAC image readout first). A notable 10 DN offset in the dark current values was noted for the WAC images starting at approximately line 337 for a 1x1 image. This offset has to do with the limitation in the amount of RAM available when storing 1x1 simultaneous images (or a second 1x1 image taken soon after a 1x1 image and storing to RAM before the first image has been readout). The unstored portion of the second image is still integrating dark current until RAM is available. Note that this data was taken at ISS' lowest available data rate, and we would expect less of an offset at higher data rates (less integration time on the second image waiting for the first image to readout).

4) A temperature dependence was noted with gain state 3 which appears to be electronics-related, but, of course, this affects the dark current readings. Gain state 3 dark current images show an increase in DN with a decrease in Sensor Head Chassis temperature (this temperature is reported via spacecraft telemetry, not ISS telemetry).

5) The overclock pixel values found in the science packets indicate the bias level (offset) values. Note that some data indicated a integration time dependence for this value.

6.2 RECOMMENDED DATA ACQUISITION

6.2.1 OBTAIN DARK FRAMES BEFORE EACH DATA SET

Due to all the variables involved with dark current data (*temperature(Gain State 3 only), data rate, summation mode, gain state, integration time, simultaneous pairs imaging mode, and lightflood*), it is recommended that dark frames be taken before each in-flight data set for all associated variables in that sequence of data.

6.3 THINGS TO BE AWARE OF

6.3.1 ANOMALOUS DATA / DEPENDENT PARAMETERS

Reference Section 1.0 for anomalous results found during calibration analysis, and Appendix B for the dependent parameters summary.

6.3.2 PC VOLTAGE EFFECTS ON FULL-WELL CAPACITY

Testing to determine the effects of parallel clock voltage (PCV) on full-well capacity was performed. The most complete data set was in the 1x1/Gain 2 imaging mode, from PCV=2 to PCV=14 in increments of 2. It was determined that the PCV did not effect full-well capacity for the PCV range of 4-12 (the recommended and calibration testing PCV setting was 9). A decrease in full-well capacity was observed for PCV=2 and PCV=14. The PCV parameter has a selection range from PCV=0 h (0.4 V) to PCV=F h (6.4 V). Each unit increase of the PCV hex setting is associated with an 0.4 V increase.

6.3.3 USE DARK FRAME WITH APPROPRIATE PARAMETERS WHEN CALIBRATING DATA

As noted throughout this report, but worth repeating, when removing dark current effects from image data, care must be taken to verify that the appropriate associated parameters are used, especially integration time when light flood is used.

6.3.4 OVERCLOCK PIXELS INDICATE BIAS VALUES

The overclock pixels indicates the video offset bias values.

6.3.5 NONLINEARITY

Nonlinearity (see Sections 5.1.11.1 and 5.1.11.2) was found to be most prevalent in Gains State 0, where the nonlinear behavior typically occurred above 1000 DN. The accuracy of values above the 1000 DN level will depend upon how well the interpolation schemes of Sections 5.1.11.3 and 5.1.11.4 (Nonlinear Response Terms) correct for the nonlinearity.