ACTIVITY TITLE: STIS Modes and Data Interfaces

ID: STIS-01

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.1, L10.4.5.2, L10.4.5.11

DESCRIPTION: STIS will be transitioned into each of its four instrument states: Hold, Boot, Operate, and Observe. It will be transitioned to all detector states for the CCD [HOLD, STANDBY (PROTECT), Operate], and the NUV and FUV MAMAs [Hold, LVon, and HVon]. Finally, the STIS engineering data (telemetry) and science data (exposures only) interfaces will be verified. These requirements will be demonstrated during normal operations. No special test will be needed to reach these instrument and detector modes and verify the data interfaces.

IMPLEMENTATION METHOD: Stored commanding, special commanding, real-time commanding.

DEPENDENCIES: N/A

DURATION: 0

DATA REQUIREMENTS: Covered under other activities.

ANALYSES & EXPECTED RESULTS: Engineering data from all modes will be examined for all correct relay states, voltage, current, temperature, and logical values (such as positions and memory states). Science data will be examined for proper formatting and contents.

COMMENTS: This activity will be satisfied during the course of normal operations, and do not require a separate proposal. However, if it is desirable to include initial STIS turn-on procedures in a proposal, rather than simply including them in a standard recovery SMS, this activity would be the place to capture that.

AUTHOR/telephone/email: Charles Proffitt/410-338-4938/proffitt@stsci.edu

DATE: September 24, 2007
ACTIVITY TITLE: Load and Dump STIS Onboard Memory

ID: STIS-02

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.1.4

DESCRIPTION: This activity will repeat the Operate state portion of the activity implemented during SMOV-2 for proposal 7058.

This activity is a test and verification of the STIS dump of CS (Control Section) memory capability. Areas to dump include: EEPROM, PROM, EDAC RAM, and Buffer RAM with the CS in OPERATE mode. With the MAMA Interface Electronics (MIE) and CS both in OPERATE, perform a full dump of the CS EEPROM, PROM, and EDAC RAM. Then copy MIE data from MIE RAM and MIE PROM to CS Buffer RAM. Finally, dump the portion of the CS Buffer RAM containing the data as normal science images.

IMPLEMENTATION METHOD: Stored commanding

DEPENDENCIES: Successful recovery of STIS from safe mode following SM4.

DURATION: 20 minutes

DATA REQUIREMENTS: 35 Mbits

ANALYSES & EXPECTED RESULTS: The memory dumps will be checked for proper format, and the large images will be compared against images stared in the memory manager.

COMMENTS: Proposal 11347, PI Alan Welty.

AUTHOR/telephone/email: Alan Welty/410-338/4948/welty@stsci.edu

DATE: September 22, 2007
ACTIVITY TITLE: STIS Science Data Buffer Check with Self-test.

ID: STIS-03

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.1.5

DESCRIPTION: The STIS Science Buffer RAM is checked for bit flips during SAA passages. A Control Section (CS) self-test consisting of writing/reading a specified bit pattern from each memory location in Buffer RAM follows this. The CS Buffer RAM self-test as well as the bit flip tests are all done with the CS in Operate.

Using the set buffer memory macro, write zeros into CS Buffer RAM prior to passage into the SAA and then dump buffer memory to SSR after exit from the SAA to check for bit flips. Then use the CS self test macro to conduct a pattern test of CS Buffer RAM and check the memory fail counter after the test has completed.

IMPLEMENTATION METHOD: Stored commanding

DEPENDENCIES: Should be sequenced after STIS-02.

DURATION: 3600 s (2 Orbits internal parallel)

DATA REQUIREMENTS: 32 Mbits

ANALYSES & EXPECTED RESULTS: Comparisons of the memory dumps and exposures will be done with the expected images and against each other.

COMMENTS: proposal 11348, PI Alan Welty

AUTHOR/telephone/email: Alan Welty/410-338/4948/welty@stsci.edu

DATE: September 22, 2007
ACTIVITY TITLE: Mechanism Mini-Functional

ID: STIS-04

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.1.6

DESCRIPTION: All STIS mechanisms, with the exception of the corrector, will be initialized and then commanded through the full range of previous on-orbit motion to redistribute lubricant and verify operability. Normal engineering telemetry (5 samples of the mechanism's position) will be used to verify the commanded movements. The sequence is:

Initialize all mechanisms

External Shutter: Open and Close

EMC Mechanisms:
   a) Move calibration insert mechanism to Remove and Insert positions.
   b) Move echelle blocker to Block1 and Block2 positions
   c) Move Mode Isolation Shutter to Open and Close positions

Mode Select Mechanism: Move MSM to these positions.

<table>
<thead>
<tr>
<th>Optic</th>
<th>Lambda</th>
<th>Cylinder 1 Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>X140H</td>
<td>1487</td>
<td>10</td>
</tr>
<tr>
<td>E230H</td>
<td>2563</td>
<td>2562</td>
</tr>
<tr>
<td>X230H</td>
<td>2511</td>
<td>5734</td>
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<table>
<thead>
<tr>
<th>Optic</th>
<th>Lambda</th>
<th>Cylinder 3 Position</th>
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<td>E230H</td>
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<td>30</td>
</tr>
<tr>
<td>E140H</td>
<td>1598</td>
<td>2589</td>
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<tr>
<td>E230H</td>
<td>2812</td>
<td>3170</td>
</tr>
<tr>
<td>E230H</td>
<td>2063</td>
<td>5749</td>
</tr>
</tbody>
</table>

Four moves are required to avoid the "stop zone"

<table>
<thead>
<tr>
<th>Optic</th>
<th>Lambda</th>
<th>Cylinder 4 Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>G750M</td>
<td>7795</td>
<td>5</td>
</tr>
<tr>
<td>G230M</td>
<td>1769</td>
<td>2788</td>
</tr>
<tr>
<td>E230H</td>
<td>1763</td>
<td>5699</td>
</tr>
</tbody>
</table>

Stilt Wheel Mechanism: Move slit wheel from the home position, F28X50LP, through the sequences of slits S330X050, S31X050C, and back to F28X50LP. This provides a full range of motion around the Slit Wheel Avoidance Zone.

CCD Shutter Mechanism: Move CCD Shutter through two open and close cycles

IMPLEMENTATION METHOD: Stored commanding
DEPENDENCIES: To be done after STIS-02 and STIS-03 have been completed.

DURATION: 3600 s (one full internal orbit)

DATA REQUIREMENTS: No science data to SSR; engineering telemetry only.

ANALYSES & EXPECTED RESULTS: The telemetry and diagnostic data will be examined (voltages, currents, temperatures, motor status and position data) for agreement with predicted values and previous ground and on-orbit test data.

COMMENTS:

AUTHOR/telephone/email: Thomas Wheeler/410-338-4337/wheeler@stsci.edu

DATE: 09/27/07
ACTIVITY TITLE: CCD Anneal

ID: STIS-05

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.1.8

DESCRIPTION: This purpose of this activity is to repair hot pixel damage to the STIS CCD that results from cosmic ray induced radiation damage due to cosmic rays.

Radiation damage creates hot pixels in the STIS CCD Detector. Many of these hot pixels can be repaired by warming the CCD from its normal operating temperature near -83°C to the ambient instrument temperature (~ +5°C) for several hours. The number of hot pixels repaired is a function of annealing temperature. So although the CCD during Safing has been warmer (~ −5°C) than its normal operating temperature, the electronics have been off and the CCD has remained cooler than its temperature (+5°C) during anneal procedure.

Pre-anneal CCD characteristics are defined by a series of bias, dark and flat-field exposures (duration: 2 orbits). After these exposures execute, the CCD thermoelectric cooler (TEC) is turned off to allow the CCD detector temperature to rise (from ~ -80°C to +5°C). The CCD is left in the uncooled state for approximately 12 hours. At the end of this period, the TEC is turned back on and the CCD is cooled to its normal operating temperature. Since the CCD on Side-2 does not have a thermistor, at a minimum, a 3 hour period is necessary to ensure that the CCD is cool and stable. After the CCD has stabilized at its operating temperature, bias, dark and flat-field images are repeated to assess the post-anneal CCD performance (duration: 2 orbits). Flat field exposures permit evaluation of any window contamination acquired during the annealing period. The CCD window is coolest during the annealing period because the TEC is powered off. Under normal operations the TEC cools the CCD and the heat generated by the TEC power warms the CCD housing and the CCD window, which is attached to the housing.

IMPLEMENTATION METHOD: Stored commanding

DEPENDENCIES: Execute after STIS-04 and after the TEC has been on and cooling the CCD detector for a minimum of 3 hours. This permits acquisition of pre-anneal CCD performance data. There is no thermostat controlling the CCD temperature on Side-2. This activity needs to execute prior to all STIS SMOV4 activities requiring use of the CCD (e.g. STIS-06).

DURATION: 4 full internal orbits (15000 s) in addition to a 12 hour anneal period and a 3 hour (minimum) cool-down period.

DATA REQUIREMENTS: 0.5 Gbits.

ANALYSES & EXPECTED RESULTS: This activity will permit evaluation of the CCD performance after an extended period in SAFE mode and the effectiveness of the
standard CCD annealing procedure under these conditions. This activity is necessary to prepare the CCD for the measurement of its baseline CCD performance characteristics which will be established as the result of STIS-06, the CCD functional test.

**COMMENTS:** This activity comprises the first three visits of the STIS CCD Hot Pixel Annealing program for Cycle 17 and may be regarded as part of the Cycle 17 calibration program.

**AUTHOR/telephone/email:** Mary Elizabeth Kaiser/401-516-5088/kaiser@pha.jhu.edu

**DATE:** September 26, 2007
ACTIVITY TITLE:  STIS CCD Functional

ID:  STIS-06

APPLICABLE SMOV REQUIREMENTS:  L.10.4.5.1.9, 10.4.5.1.10

DESCRIPTION: This purpose of this activity is to measure the baseline performance and commandability of the CCD subsystem. This test assesses several CCD functions and performance characteristics, including: bias levels, read noise, dark current, CTE, and gain. Bias, dark, and flat field exposures are executed to achieve these goals. Full frame and binned (2 x 1, 1 x 2, and 2 x 2) observations are made. Biases are taken at gain=1 and read-out in subarray mode to support target acquisition and peakup modes. Only the primary amplifier (Amp D) is used. Dark exposures are made outside the SAA (as is standard). All exposures are internals

The visit structure outlined below has been constructed by filling the full orbit with internal exposures.

Visits 1 and 2 acquire bias frames and flats at the four commandable gain settings, 1, 2, 4, and 8 e/DN. At the available gain settings (gain=2,8) 31 bias frames are acquired for construction of a superbias with negligible readout noise. At the supported gain settings (gain=1,4) only 21 bias frames are acquired since the remaining frames necessary for construction of a superbias will be acquired as part of the Cycle 17 bias monitoring program. A pair of flats is acquired in camera mode at two signal levels (achieved by using the 50CCD and F25ND3 apertures) at each gain setting. The flats will be analyzed to (1) provide a rough confirmation of the nominal gain calibration and (2) determine if there have been changes in the number or position of cosmetic artifacts, such as the shadows of particles on the detector window.

Bias and internal lamp exposures are obtained for binned modes, with binning factors of 2 x 1, 1 x 2, and 2 x 2, for evaluation of read noise, bias level, and gain of the binned settings

Biases are acquired using a 100x100 and 1024x32 subarray readout (and gain=4) in support of downstream target acquisitions and peakups.

Visit 3 acquires dark frames and bias frames for evaluation of the mean dark current at the operating temperature of the CCD and the identification of hot pixels.

Visit 4 acquires spectral flat field data at three different signal levels, spanning a factor of 100 in signal intensity, for evaluation of charge transfer efficiency through the edge response method. In addition 29 biases are taken at gain=1 to enable the construction of superbias for each of the binned settings used in visit 2.

IMPLEMENTATION METHOD:  Stored commanding
DEPENDENCIES: Should be executed after the initial CCD anneal (STIS-05)

DURATION: 4 fully packed orbits (Internals)
If this activity was planned for occultation periods, it would require 12 orbits of
~1800 seconds duration each. This activity is a precursor to all other STIS CCD
activities.

DATA REQUIREMENTS: 3 Gbits.

ANALYSES & EXPECTED RESULTS: Provides baseline measurements of
CCD bias levels, gains, read noise, charge transfer efficiency, dark current levels, and
performance verification of binning and subarray readpout capabilities. Provides a rough
assessment of changes in flat field features due to dust motes or other particulates.
Numerous bias frames are taken to permit construction of "super bias" frames in which
the effects of read noise have been rendered negligible

This activity should execute after the STIS CCD anneal activity (STIS-05) and prior to
other activities using the STIS CCD.

COMMENTS:

AUTHOR/telephone/email: Mary Elizabeth Kaiser/401-516-5088/kaiser@pha.jhu.edu

DATE: September 28, 2007
ACTIVITY TITLE: STIS CCD Bias and Dark Monitor

ID: STIS-07

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.4.1

DESCRIPTION: This activity is the first in a series of measurements to characterize and monitor the CCD biases and darks. It is a combination of the Cycle 17 CCD bias monitor program and the Cycle 17 dark monitor program. Both the programs are continuations of Cycle 12 calibration programs to characterize and monitor CCD biases (Cy12 Cal 10019) and darks (Cy12 Cal 10017).

Bias program: This activity will take full-frame bias exposures in the 1x1, 1x2, 2x1, and 2x2 bin settings at gain=1, and 1x1 at gain = 4 to monitor the bias and to build up high-S/N superbiases and track the evolution of hot columns. At gain=1: 14 bias frames are acquired with 1x1 binning and 2 bias frames are acquired with 1x2, 2x1, and 2x2 binning. At gain=4: 3 bias frames are acquired with 1x1 binning. All exposures are internals and fit in occultation orbits. This program executes daily.

Dark program: This activity will obtain 1 long (1100s) and 2 short (60s) unbinned darks per visit at GAIN=1 to monitor CCD behavior and chart growth of hot and bad pixels. Acquiring dark exposures of different durations provides a test of low-level instrument noise over a wide range of observing conditions, provides high S/N calibration frames for Cycle 17 science, and permits hot pixel reference file updates on appropriate time scales. All exposures are internals, less than 1800 seconds long, and fit in occultation orbits. This program executes twice daily.

IMPLEMENTATION METHOD: Stored commanding

DEPENDENCIES: Should begin after STIS-06, the CCD functional test.

DURATION: 3 Orbits (Internal) and executes daily. The bias monitor is 1 internal orbit (<1800 seconds) and executes daily. The dark monitor is 1 internal orbit (<1800 seconds) per visit and executes twice daily.

DATA REQUIREMENTS: 0.5 Gbits/day.

ANALYSES & EXPECTED RESULTS: This SMOV4 activity comprises the initial visits of the Cycle 17 program that will produce weekly and biweekly superbias reference files. It will also produce weekly dark reference files and test for low for low level sources of noise.

COMMENTS: This activity is part of the Cycle 17 calibration program for daily monitoring of CCD biases and twice-daily monitoring of CCD darks.
**ACTIVITY TITLE:** STIS Aperture Wheel and Lamp Functional Tests

**ID:** STIS-08

**APPLICABLE SMOV REQUIREMENTS:** L.10.4.5.1.7, 10.4.5.3.2, 10.4.5.3.3

**DESCRIPTION:** Verify slit locations and slit wheel repeatability. Update PDB and onboard table if necessary.

This activity has five functions: verification of the aperture positions, verification of absolute optical position, verification of slit wheel repeatability, verification of lamp functionality, and verification of CCD imaging mode functionality.

Verification of the aperture positions: Determine the location of the slit positions, in pixel coordinates, on the STIS CCD detector for a representative subset of STIS acquisition apertures and slits. This will be accomplished by acquiring internal exposures using the tungsten lamp for illumination of the selected apertures. An image will be taken at each of eight nominal slit or aperture positions on the slit wheel. These apertures (52X0.05, 52X0.2, 52X0.1, 52X0.5, 52X2, 0.2X0.06, 0.2X0.09, and 0.2X0.2) were chosen to represent frequently used apertures and span the nominal range of selected aperture positions. All images will be taken with the acquisition mirror. Images of the 0.2X0.2 slit will be interspersed with these measurements to provide a reference position. The measured slit locations will be compared with the previous side-2 measurements of the slit positions.

A change in relative slit positions between side-1 and side-2 is not expected, although different thermal conditions and any resulting flexure of the STIS bench may cause an overall shift of how the slit images project onto the detector, and bench flexure during the course of the observations may cause these offsets to drift slightly during the course of these observations. Such thermal offsets will be measured and removed from both the new and the old data by monitoring the interspersed images of the 0.2X0.2 reference aperture.

Verification of absolute optical position: The first "used on orbit" slit above the avoidance zone (330X050 at encoder position 33699) and the last "used on orbit" slit above the avoidance zone (F28X50LP at encoder position 3824324) are imaged to check the absolute optical positions of these slits.

Verification of slit wheel repeatability: In addition to acquiring images at the nominal slit position, multiple images of three slits (52X0.05, 52X.1 and 52x0.2) will be taken after having moved the slit wheel to check for positioning repeatability.

Verification of lamp functionality: Spectra will be taken with each of the Pt/Cr-Ne emission line lamps (HITM1, HITM2, and LINE) at the two commonly used current settings (3.8mA and 10mA) to check lamp functionality for routine science operations. The lamps are used in imaging mode with the 0.2X0.2 slit and dispersed for comparison
of individual emission lines (G230LB with 52X.2). The lamp flux and location of the spectra on the detector will be compared to previous side-2 values.

Verification of CCD imaging mode functionality: This is accomplished when the slit is imaged on the CCD detector using the tungsten and HITM lamps.

IMPLEMENTATION METHOD: Stored commanding

DEPENDENCIES: Execute after the initial CCD functional test (STIS-06). This assumes that the CCD anneal (STIS-05) has also been performed.

While this activity may result in FSW and aperture table updates, it is not expected to be necessary. Consequently, subsequent STIS activities do not need to wait for the results of this activity before execution.

DURATION: 8000 s

DATA REQUIREMENTS: 1 Gbit.

ANALYSES & EXPECTED RESULTS: The slit/aperture centers relative to the reference target acquisition aperture(s) will be determined from the slit images. Comparison of the slit center positions taken before and after slit wheel motion will be used to measure the repeatability of the slit wheel. If there are changes in the relative slit/aperture positions then these changes will be more fully characterized by a measurement of each slit/aperture position.

Comparison of lamp fluxes at different currents will provide current setting and exposure time information for future use of the HITM2 lamp. This will enable redundancy for the 3.8mA current setting of the HITM1 lamp.

Both the on-board table of slit/aperture centers used for target acquisition and the aperture file in the PDB may be modified as a result of the analysis of the data. Changes may be made to the nominal slit encoder positions. However, it is not expected that any changes will be necessary, and SMOV planning should assume that no such updates will be needed as the result of this program.

COMMENTS:

AUTHOR/telephone/email: Mary Elizabeth Kaiser/401-516-5088/kaiser@pha.jhu.edu

DATE: September 25, 2007
ACTIVITY TITLE: STIS to FGS Alignment

ID: STIS-09

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.2.1

DESCRIPTION: This activity may be done in two parts. The first visit will be during the BEA period and will be used to verify that the alignment of STIS with the FGSs is good enough to allow subsequent SMOV activities to continue. Only a single astrometric target need be in the STIS CCD FOV. The second visit will be done using an astrometric star field such as NGC 188, and will attempt to measure the STIS to FGS alignment as accurately as possible; this field should be chosen so that multiple astrometric targets are visible in each image. If the SMOV sequence and BEA restrictions permit the second visit of this activity to be done sufficiently early, it may be used in place of the first visit.

In both cases STIS 50CCD imaging observations will be done at several dither positions, including significant offsets in the V2 and V3 directions. Each visit will end with a 50CCD ACQ exposure to verify the pointing and to measure the offset between the STIS aperture and STIS CCD detector planes.

Both the target stars and all guide stars used for each visit should, if possible, have positions known to 30 mas or better. For the first visit, sufficient targets will be specified to ensure that at least one is always available in the BEA. For the second visit the preferred target will be the same pointing in NGC 188 that was used for initial STIS-to-FGS alignment and for subsequent checks (programs 7065, 7133, 7660, 8503, etc.).

IMPLEMENTATION METHOD: Stored commanding.

DEPENDENCIES: This activity may execute any time after the CCD Functional Test STIS-06, but this program need not wait for downlink or analysis of that data.

DURATION: 2 Orbits (external)

DATA REQUIREMENTS: 0.7 Gbits.

ANALYSES & EXPECTED RESULTS: The stellar positions in the images will be determined with respect to the detector field of view, taking into account any MSM offset measured by the ACQ lamp image. The location of the STIS reference aperture in V2-V3 coordinates and the rotation angle with respect to the FGS reference frame will be determined. PDB and SIAF updates will be made as needed, but these updates may be deferred until after the data from the second visit of this program have been analyzed, unless it is determined that an earlier update is required to support SMOV operations. May require coordinating with TEL branch personnel to compute any table updates.

COMMENTS:
ACTIVITY TITLE: CCD Optical Format Verification

ID: STIS-10

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.3.3

DESCRIPTION: For each CCD spectral optical element in the MSM (G230LB, G230MB, G430L, G430M, G750L, and G750M), a HITM1 lamp spectrum will be taken to match selected observations that were done as part of the cycle 11 STIS/CAL program 9617. The new observations need only be done for one CENWAVE value of each grating. These observations will verify the optical paths and MSM positioning used for each of these modes, and will also allow a check of the spectral resolution. Note that the spectral format of CCD imaging modes will be verified by activity STIS-08 and STIS-09.

IMPLEMENTATION METHOD:Stored commanding

DEPENDENCIES: Should be sequenced after STIS-08, but if necessary can be done any time after the initial CCD anneal (STIS-05) is completed.

DURATION: 30 minutes (one 1800 s internal visit)

DATA REQUIREMENTS: 100 Mbits.

ANALYSES & EXPECTED RESULTS: For each lamp spectrum obtained, compare the position of the spectral lines and the locations masked by the aperture bars to corresponding observations from program 9617. Look for any unexpected or operationally significant shifts in how the spectrum is projected onto the detector. Also, compare the line profiles for selected spectral lines to check for any changes in spectral resolution or focus across the detector. Look especially for any changes that are significant enough to affect operations or science data quality, or which might require table or database updates.

COMMENTS: Program 9617 switched to using the HITM1 in place of the LINE lamp for CCD dispersion solution checks, because the HITM1 lamp gives much better illumination at the E1 aperture positions. Program 9617 was also executed after the switch to side-2 operations for STIS, and as such may provide a better comparison to SMOV4 data than would earlier programs. Suggested exposures are as follows. All use the 52X0.1 aperture and the HITM1 lamp at the medium setting. G230LB 214s; G430L 10s; G750L 6.2s; G230MB CENWAVE=2697 14s; G430M CENWAVE=4451 18s; G750M CENWAVE=7795 29s.

AUTHOR/telephone/email: Charles Proffitt/410-338-4938/proffitt@stsci.edu

DATE: September 7, 2007
ACTIVITY TITLE: STIS External Focus Check

ID: STIS-11

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.3.1

DESCRIPTION: Check STIS image quality using two tests. In the first test, use a dispersed light ACQ/PEAK with the G230LB grating to dither the 0.1x0.09 aperture across a point source to sample the PSF. Relative counts at different wavelengths give a measure of the PSF shape at different wavelengths. Also take a comparable ACCUM spectrum with the G230LB and a large aperture to provide a baseline flux for estimating the relative throughput of the 0.1x0.09 aperture. In the second test, image a point source onto the CCD through the F28x50OII filter. Compare the resulting PSF shape with the pre-repair PSF. Sufficient S/N in the O II image should be obtained to allow the use of phase retrieval techniques to estimate the focus position.

Sufficient point source targets should be selected to allow observations to be done any time during the BEA period. The default plan will be to use the targets selected for this purpose during SMOV3B, although different targets could be substituted. See proposal 8958 for details.

IMPLEMENTATION METHOD: Stored commanding

DEPENDENCIES: Should follow as soon as possible after the STIS to FGS Alignment Check STIS-09, but this program need not wait for downlink or analysis of that data.

DURATION: 3 Orbits (external). Note that using either of the two brightest targets defined for proposal 8958 will require only one orbit, but they are not always available in BEA.

DATA REQUIREMENTS: 119 Mbits

ANALYSES & EXPECTED RESULTS: The variation of the count rate with the offset position during the peakup exposures will be used as a measure of the PSF shape. The throughput vs. wavelength will be checked by comparing the count rate through the small 0.1x0.09 and large (52x2 or 50CCD) apertures. The O II image PSF will be examined and phase retrieval techniques will be used to estimate the STIS focus position. If there is evidence for a significant misalignment of STIS with respect to the HST optics, then one or more visits of the contingency program STIS-12, “Corrector and Focus Alignment” would be triggered. Requires support of TEL branch personnel to analyze some data.

COMMENTS:

AUTHOR/telephone/email: Charles Proffitt/410-338-4938/proffitt@stsci.edu

DATE: September 21, 2007
**ACTIVITY TITLE:** STIS Corrector and Focus Alignment Contingency

**ID:** STIS-12

**APPLICABLE SMOV REQUIREMENTS:** L.10.4.5.3.1

**DESCRIPTION:** This is a contingency activity that will only be needed if STIS-11 finds a significant problem with the STIS focus or optical alignment. Visits will be prepared to repeat the coarse alignment sweeps that were done during SMOV2 (program 7075), and the fine alignment sweeps that were prepared for SMOV3a/b (programs 8512/8966), and to repeat the checks done by STIS-11. Only those visits that are judged necessary will be executed. Coarse sweeps will be done by taking images of a bright star using the F28X50OII filter; phase retrieval techniques will then be used to analyze the focus and alignment. Fine sweeps will use the G230LB grating together with the 0.1x0.09 aperture, and the optimal focus and alignment will be defined as the settings that maximize the throughput for this combination. After the optimal corrector positions have been determined and set, the observations done by STIS-11 will be repeated to confirm the success of these procedures.

**IMPLEMENTATION METHOD:** Stored commanding & real-time commanding. Stepping of mechanism during sweeps and data acquisition can be done with stored commanding, but uplinks of updated mechanism position values will be done using planned real-time commanding.

**DEPENDENCIES:** The activity will not be done unless the analysis of data from STIS-11 shows a significant problem that can be fixed by adjustments of the STIS corrector mechanism. The beginning of this activity may also require waiting until the HST focus can be independently determined via measurements with other HST instruments.

**DURATION:** 16 Orbits (external). Coarse alignment: 3 orbits over 3 days. Fine alignment: 8 orbits (tip/tilt) followed 24 hours later by 4 orbits (tip/tilt). Final confirmation of throughput and image quality: 1 orbit.

**DATA REQUIREMENTS:** Coarse alignment 1.5 Gbit; fine alignment 1 Gbit.

**ANALYSES & EXPECTED RESULTS:** Coarse-alignment data will be analyzed using phase retrieval techniques to estimate desired tip, tilt, and focus values. Fine alignment data will be analyzed to determine the position that will maximize the throughput of the 0.1X0.09 aperture. If this activity is needed, most or all STIS external observations that executed before the final corrector settings had been determined and uplinked, may need to be repeated. Requires support of TEL branch personnel to analyze some data.

**COMMENTS:** The tip and tilt of the corrector should be set to within 1 step of their optimal values and focus should be set within about 250 steps of the position required to achieve maximal transmission through the 0.1x0.09 aperture.
**ACTIVITY TITLE:** CCD Spectroscopic Image Quality and ACQ Tests

**ID:** STIS-13

**APPLICABLE SMOV REQUIREMENTS:** L.10.5.2.2, 10.4.5.3.4

**DESCRIPTION:** Check image quality along the 52x0.1 slit in combination with the G230LB grating. The target star will be positioned at several positions along the slit including 52X0.1 (nominal center position), 52X0.1E1 (CTE position) and 51X0.1D1 (MAMA acquisitions near low background for FUV MAMA). Several other positions on the far side of the CCD detector will be included pending available observing time in the allocated two orbits. Positioning of the target will be done utilizing PATTERN and offsets of 0.1” between three positions. Sufficient targets will be selected, and contingency visits prepared, to allow this activity to occur any time during the BEA period.

**IMPLEMENTATION METHOD:** Stored commanding

**DEPENDENCIES:** Must execute after STIS-11 (after STIS-12 if corrector/focus alignment needed). Test should be deferred or repeated if significant change in the HST Focus and/or STIS corrector position is found to have been needed.

**DURATION:** 2 external orbits

**DATA REQUIREMENTS:** 0.4 Gbits

**ANALYSES & EXPECTED RESULTS:** Analysis will be with IDL tools in collaboration with Don Lindler. Plots will be made to compare centering from previous SMOV and calibration tests. Test may have to be repeated if HST focus significantly away from nominal.

**COMMENTS:** Old versions: SMOV3B-STIS02 8958 (but added E1 and D1 peakups), also subset of SMOV2-STIS18 7077. Note that current procedure utilizes CR-SPLIT=NO in order to get 8 three position measures along the slit. Could be changed to 4 five position measures.

**AUTHOR/telephone/email:** T. Gull/301-286-6184/Theodore.R.Gull@nasa.gov

**DATE:** September 28, 2007
**ACTIVITY TITLE:** STIS CCD CTI Check

**ID:** STIS-14

**APPLICABLE SMOV REQUIREMENTS:** L.10.4.5.4.2

**DESCRIPTION:** This activity is the first in a series of measurements that will be made to characterize the dependence of the CCD Charge Transfer Inefficiency (CTI) as a function of signal level, source position, and time. The remaining measurements will be conducted as part of the Cycle 17 calibration program to fully characterize the CTI. This activity, executed during the SMOV4 period, will enable measurement of the magnitude of the CTI for a limited parameter set and will provide a comparison of the current CTI performance with the CTI performance prior to the Side-2 failure.

For CCD detectors, the transfer of charge from one pixel to the next is not perfect. CTI measurements quantify the fraction of charge left behind after this charge transfer. The further the charge needs to be shifted before the read-out, the more charge it will lose.

These CTI measurements are made using an "internal sparse field test", along the parallel axis. This test utilizes the ability of the STIS CCD and its associated electronics to read out the image with any amplifier, i.e., by clocking the accumulated charge in either direction along both parallel and serial registers (Goudfrooij, et al. 2006). A sequence of nominally identical exposures is taken alternating the readout between amplifiers on opposite sides of the CCD. Amplifier D (the default) and amplifier B are used to check the parallel CTI at the default gain=1 setting. Comparison of the charge readout using the D and B amplifiers yields a measure of the CTI. If there were no CTI, then the ratio of the signals read out using the two different amplifiers for a source at the same position would be identically 1.

This activity consists of a series of bias images taken with amplifier D and amplifier B. This is followed by a series of 5 tungsten lamp exposures with the 0.05X31NDA slit in mode G430M at the 5471Å central wavelength setting. The image of the long-slit, 0.05X31NDA, lies along the dispersion direction and has a narrow (2 pixel FWHM) profile. Measurement of the CTI using a slit oriented in the dispersion direction presents a “worst case” since there is no background source (“sky”) to fill the charge traps on the CCD. This test is executed for a single signal level and a single slit image position on the detector. Subsequent executions of the internal sparse field CTI test will move the mode select mechanism over a range of MSM positions to vary the location of the slit image (and hence the number of parallel shifts) on the detector. The complete test, which spans a yearly calibration program, will also evaluate the CTI as a function of signal level.

**IMPLEMENTATION METHOD:** Stored commanding

**DEPENDENCIES:** Should be executed after STIS-08, the lamp and aperture functional test.
DURATION: 1 Internal Orbit

DATA REQUIREMENTS: 0.3 Gbits.

ANALYSES & EXPECTED RESULTS: The “internal sparse field method” quantifies two key aspects of Charge Transfer Inefficiency (CTI) effects on spectroscopic measurements: (1) the amount of charge lost outside a standard extraction aperture, and (2) the amount of centroid shift experienced by the charge that remains within that extraction aperture (Goudfrooij, et al. 2006).

The SMOV4 STIS-14 CTI activity comprises the first visit in a more extensive Cycle 17 CTI measurement program that will establish a new baseline (post Side-2 failure) for CTE performance. The full Cycle 17 program will characterize the CTE losses as a function of signal level (and CCD gain settings) and signal position, characterize CTE losses for spectroscopic versus imaging modes and monitor CTI as a function of time.

This activity is the first visit in the Cycle 17 calibration program to characterize the STIS CCD CTI.

COMMENTS:

AUTHOR/telephone/email: Mary Elizabeth Kaiser/401-516-5088/kaiser@pha.jhu.edu

DATE: September 27, 2007
ACTIVITY TITLE:  CCD Spectroscopic Throughputs

ID:  STIS-15

APPLICABLE SMOV REQUIREMENTS:  L.10.4.5.4.3

DESCRIPTION:  This activity has two functions: Determination of the STIS sensitivity for the CCD spectroscopic modes and verification of the CTE correction at high signal levels. It also provides a measure of the resolution in the spatial direction at two positions along the slit for each CCD spectroscopic mode.

Confirmation of STIS sensitivity for CCD spectroscopic modes: Obtain exposures in each of the 3 low-resolution CCD spectroscopic modes (G230LB, G430L, and G750L) to establish the post-SM4 STIS baseline sensitivity. The sensitivity is monitored at the nominal (central) target position along the 52X2 slit and at the E1 position, which is closer to the location of Amp D, the default CCD amplifier. Thus, fewer parallel shifts are required and CTI effects are mitigated. The sensitivity of the medium resolution CCD modes (G230MB, G430M, G750M) is also checked at the nominal and E1 slit positions for two grating settings for each mode.

This activity resumes sensitivity monitoring of each CCD spectroscopic mode to enable detection of any change due to contamination or other causes. The duty cycle for monitoring the sensitivity of the low resolution spectroscopic modes is once every 1.5 months, and once per year for each of the 3 medium resolution modes. The same high-declination calibration standard (AGK+81D266) is used throughout the program.

Verification of the CTE correction at high signal levels: CTI is a function of signal level. In this activity, the target is stepped along the slit (52X2) in mode G430L and the flux is measured at 7 positions to verify CTE correction at high flux levels.

IMPLEMENTATION METHOD:  Stored commanding

DEPENDENCIES:  Execute after the CCD Image quality and target acquisition activity (STIS-13). This activity uses an external target and may need to execute after the end of the BEA period.

DURATION:  3 orbits (external).

DATA REQUIREMENTS:  0.3 Gbits.

ANALYSES & EXPECTED RESULTS:  This activity will provide a broad range of basic performance information. The absolute sensitivity of STIS will be measured for two positions along the slit for the 3 low resolution spectroscopic modes and at two grating positions (central wavelengths) for each of the 3 medium resolution modes. Ratioing the results for each mode with the last Cycle 12 sensitivity measurements will provide a measurement of the environment over the past several years and establish the current
baseline for contamination monitoring and trending instrument sensitivity. The resolution in the spatial direction is obtained at two spatial positions for each mode. The G430L spectra acquired at multiple slit positions will be analyzed using the methodology laid out in ISR STIS 2006-03 (Goudfrooij and Bohlin, 2006) to assess the CTI dependence on high signal levels. The algorithm discussed therein has been incorporated into the CalSTIS pipeline.

Results of this activity will be used to refine exposure times for Cy 17 observations if necessary.

**COMMENTS:** This activity comprises the first visit of the nominal Cycle 17 CCD Spectroscopic Sensitivity Monitoring program, establishes the baseline for the Medium Resolution Spectroscopic Sensitivity Monitor that is executed annually, and executes the Cycle 17 observations for verification of the CTI correction at high signal levels. This activity may be regarded as part of the Cycle 17 calibration program. The low-resolution CCD spectroscopic modes are monitored once every 1.5 months.

**AUTHOR/telephone/email:** Mary Elizabeth Kaiser/401-516-5088/kaiser@pha.jhu.edu

**DATE:** September 25, 2007
ACTIVITY TITLE: CCD Image and Pointing Stability

ID: STIS-16

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.3.5

DESCRIPTION: Check image motion using external star field and internal aperture illuminated by lamp. Images of star field and 0.1x0.09 aperture are alternately recorded for two orbits. This activity is to be executed after large angle maneuver predicted to induce large thermal change that might affect focal plane-to-STIS and internal STIS optical stabilities. Advice should be sought from thermal engineers for worst-case thermal change. If possible, this activity will be done using an established astrometric star field, such as those in NGC 188 or M35.

IMPLEMENTATION METHOD: Stored commanding

DEPENDENCIES: Must execute after STIS-13. Large angle maneuver expected to induce worst case motions for focal plane-to-STIS and STIS internal must be done just before this activity.

DURATION: 2 external orbits

DATA REQUIREMENTS: 0.5 Gbits

ANALYSES & EXPECTED RESULTS: Typical motion of focal plane to STIS and/or STIS internal motion is significant during the first orbit, mostly in the first third of orbit after a large angle maneuver. Measurements of field format using stellar images and the 0.1x0.09 aperture illuminated by a lamp. IDL software tools will be used with Don Lindler participation.

COMMENTS: Since new instruments have been added and modifications have been done to HST, this is required to confirm that no additional thermal motions have been induced by the changes.

AUTHOR/telephone/email: Ted Gull/ 301-286-6184/Theodore.R.Gull@NASA.GOV

DATE: September 25, 2007
ACTIVITY TITLE: FUV MAMA HV Recovery

ID: STIS-17

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.1.11

DESCRIPTION: This activity addresses the concerns over Cesium migration from the FUV-MAMA photocathode into the pores of the microchannel plate and lays out the procedures necessary to permit a safe and controlled recovery of the FUV-MAMA detector to science.

The recovery consists of four separate and unique procedures (visits) and they must be completed successfully and in order. They are: (1) a signal processing electronics check, (2) 1st high voltage ramp-up to an intermediate MCP voltage of -1500V with limits modifications and voltage plateaus, (3) 2nd high voltage ramp-up to an intermediate MCP voltage of -1950V (300V below the nominal MCP voltage) with limits modifications and voltage plateaus followed by a fold distribution test, and (4) a final high voltage ramp-up to the full operating voltage, again with limits modifications and voltage plateaus, followed by a fold distribution test.

During the 1st high voltage ramp-up, a time-tag exposure and diagnostics are performed followed by a dark exposure. During the 2nd and 3rd high voltage ramp-ups, time-tag exposures are taken, diagnostics are performed, followed by darks, flat field ACCUMs, and fold analysis tests. Full details of these procedures will be described in a STIS TIR in preparation by Tom Wheeler.

IMPLEMENTATION METHOD: Stored commanding

DEPENDENCIES: To be done after STIS-04 has been completed. The first visit (signal processing test), may be executed at any time after that. However, visits 2-4 should not begin until at least 4 days after HST release following SM4, and not until at least three days after the MAMA LVPS’s have been turned on.

DURATION: 21,000 s (four full internal orbits)

DATA REQUIREMENTS: Science data to SSR and engineering telemetry.

ANALYSES & EXPECTED RESULTS: The time-tag images will be examined for unusual spatial or temporal features. Dark and images will be examined for unusual features, blemishes, and defects. The engineering telemetry data will be examined (voltages, currents, temperatures, relay position, status, and event counts) for agreement with predicted values and previous ground and on-orbit test data. Fold analysis results will be compared to predicted and previous results.

COMMENTS: A minimum delay of 36 hours is required between visits for data downlinking and analysis. Ideally one visit of this program should be scheduled every other
day. The special commanding needed for this proposal will have been tested as part of the STIS System Functional Test associated with the STIS-R SMGT.

**AUTHOR/telephone/email:** Thomas Wheeler (410) 338-4337 wheeler@stsci.edu

**DATE:** 09/27/07
ACTIVITY TITLE: NUV MAMA HV Recovery

ID: STIS-18

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.1.11

DESCRIPTION: This activity addresses the concerns over Cesium migration from the NUV-MAMA photocathode into the pores of the microchannel plate and lays out the procedures necessary to permit a safe and controlled recovery of the NUV-MAMA detector to science.

The recovery consists of four separate and unique procedures (visits) and they must be completed successfully and in order. They are: (1) a signal processing electronics check, (2) 1st high voltage ramp-up to an intermediate MCP voltage of -1500V with limits modifications and voltage plateaus, (3) 2nd high voltage ramp-up to an intermediate MCP voltage of -1750V (300V below the nominal MCP voltage) with limits modifications and voltage plateaus followed by a fold distribution test, and (4) a final high voltage ramp-up to the full operating voltage, again with limits modifications and voltage plateaus, followed by a fold distribution test. A minimum delay of 24 hours is required for data down-linking and analysis.

During the 1st high voltage ramp-up, a time-tag exposure and diagnostics are performed followed by a dark exposure. During the 2nd and 3rd high voltage ramp-ups, time-tag exposures are taken, diagnostics are performed, followed by darks, flat field ACCUMs, and fold analysis tests. Full details of these procedures will be described in a STIS TIR in preparation by Tom Wheeler.

IMPLEMENTATION METHOD: Stored commanding

DEPENDENCIES: The first visit (signal processing test) may be done any time after STIS-04 has been completed. However, visits 2-4 should not be done until at least 36 hours after STIS-17 (FUV MAMA HV Recovery) has been completed.

DURATION: 22,000 s (four full internal orbits)

DATA REQUIREMENTS: Science data to SSR and engineering telemetry.

ANALYSES & EXPECTED RESULTS: The time-tag images will be examined for unusual spatial or temporal features. Dark and images will be examined for unusual features, blemishes, and defects. The engineering telemetry data will be examined (voltages, currents, temperatures, relay position, status, and event counts) for agreement with predicted values and previous ground and on-orbit test data. Fold analysis results will be compared to predicted and previous results.

COMMENTS: A minimum delay of 36 hours is required between visits for data down-linking and analysis. Ideally one visit of this program would be scheduled every other
day. The special commanding needed for this proposal will have been tested as part of the
STIS System Functional Test associated with the STIS-R SMGT.

**AUTHOR/telephone/email:** Thomas Wheeler (410) 338-4337 wheeler@stsci.edu

**DATE:** 09/27/07
ACTIVITY TITLE: FUV Dark Measure

ID: STIS-19

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.11

DESCRIPTION: The STIS MAMA HV power supplies are turned on only during each day’s block of SAA-free orbits. The FUV MAMA dark current glow has been observed to increase with the length of time the FUV HV power supply has been on. The rate of this daily increase has changed over the years and also appears to be sensitive to temperature. To measure the rate at which the dark current increases, a series of five 1380s FUV MAMA dark exposures spread over 5 or more orbits of a single SAA period shall be taken as soon as possible after the completion of STIS-17. All exposures will be internals and fit into occultation orbits. A second similar block of five exposures should be done near the end of the SMOV period when the temperature of the aft-shroud and STIS are in the range expected for normal Cycle 17 operations.

IMPLEMENTATION METHOD: Stored commanding

DEPENDENCIES: First iteration of five visits should start as soon as practical after the completion of STIS-17, FUV MAMA HV Recovery. The second iteration should be done later, after all significant heat sources in the aft-shroud (including the COS detectors) are operating, and the temperature of the STIS FUV MAMA tube is within the typical range expected for Cycle 17 operations.

DURATION: 300 minutes (ten 1800 s internal visits divided into two groups)

DATA REQUIREMENTS: 0.67 Gbits.

ANALYSES & EXPECTED RESULTS: The FUV dark current will be measured over the whole detector and in the standard regions used to monitor the FUV dark current. These results will be compared to previous trends (STIS ISR 2007-02) and used to estimate the dark current behavior expected during cycle 17.

COMMENTS:

AUTHOR/telephone/email: Charles Proffitt/410-338-4938/proffitt@stsci.edu

DATE: September 7, 2007
ACTIVITY TITLE: NUV Dark Monitor

ID: STIS-20

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.11

DESCRIPTION: The STIS NUV-MAMA dark current is dominated by a phosphorescent glow from the detector window. Meta-stable states in this window are populated by cosmic ray impacts, which, days later, can be thermally excited to an unstable state from which they decay, emitting a UV photon. The equilibrium population of these meta-stable states is larger at lower temperatures; so warming up the detector from its cold safing will lead to a large, but temporary, increase in the dark current.

To monitor the decay of this glow, and to determine the equilibrium dark current for Cycle 17, four 1380s NUV-MAMA ACCUM mode darks should be taken each week during the SMOV period. The observations should be done in pairs, with the two observations of each pair separated by 4 to 7 orbits to ensure that they are taken at different parts of the same SAA-free block. Each pair should be taken 3 to 4 days after the preceding pair. Once the observed dark current has reached an approximate equilibrium with the mean detector temperature, the frequency of this monitor can be reduced to one pair of darks per week.

IMPLEMENTATION METHOD: Stored commanding

DEPENDENCIES: Begin monitor observations within 36 hours after the completion of STIS-18, “NUV-MAMA HV Recovery”.

DURATION: 4 x 1800 s internal visits per week

DATA REQUIREMENTS: 67 Mbits per visit x 4 visits per week.

ANALYSES & EXPECTED RESULTS: The mean dark rate in each exposure will be tabulated and compared with predictions of a model for the NUV window glow. These results will be used to estimate the mean NUV MAMA dark rate expected for Cycle 17, and to determine when the window glow has declined enough to allow GO observations that are sensitive to the amount of dark current to proceed.

COMMENTS: This activity may be subsumed into the Cycle 17 NUV Dark Monitor Calibration Program.

AUTHOR/telephone/email: Charles Proffitt/410-338-4938/proffitt@stsci.edu

DATE: September 24, 2007
ACTIVITY TITLE: FUV-MAMA Optical Format Verification

ID: STIS-21

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.3.3

DESCRIPTION: For each FUV-MAMA spectral optical element in the MSM (G140L, G140M, E140M, E140H), a LINE lamp spectrum will be taken to match selected observations that were done as part of the cycle 11 STIS/CAL program 9618. The new observations need only be done for one CENWAVE value of each grating. These observations will verify the optical paths and MSM positioning used for each of these modes, and will also allow a check of the spectral resolution. The normal monthly MSM offsetting should be turned off and the zero-offset MSM positions should be used for these observations.

IMPLEMENTATION METHOD: Stored commanding

DEPENDENCIES: Should occur no sooner than 36 hours after STIS-17 (FUV-MAMA HV Recovery) has been completed.

DURATION: 60 minutes (two 1800 s internal visits)

DATA REQUIREMENTS: 268 Mbits.

ANALYSES & EXPECTED RESULTS: For each lamp spectrum obtained, compare the position of the spectral lines and the locations masked by the aperture bars to corresponding observations from program 9618. Look for any unexpected or operationally significant shifts in how the spectrum is projected onto the detector. Also, compare the line profiles for selected spectral lines to check for any changes in spectral resolution or focus across the detector. Look especially for any changes that are significant enough to affect operations or science data quality, or which might require table or database updates.

COMMENTS: We plan to choose a subset of CENWAVE settings that also match those used for the initial alignment checks done during SMOV2 by program 7078. Suggested settings: G140M 1371 52x0.05 200s; G140L 52x0.05 300s; E140M 0.2x0.06 663s, E140H 1416 0.2x0.09 266s.

AUTHOR/telephone/email: Charles Proffitt/410-338-4938/proffitt@stsci.edu

DATE: September 10, 2007
ACTIVITY TITLE:  NUV-MAMA Optical Format Verification

ID:  STIS-22

APPLICABLE SMOV REQUIREMENTS:  L.10.4.5.3.3

DESCRIPTION:  For each NUV-MAMA spectral optical element in the MSM (G230L, G230M, E230M, E230H, and PRISM), a LiNE or HITM1 lamp spectrum will be taken to match selected observations that were done as part of the cycle 11 STIS/CAL program 9618. The new observations need only be done for one CENWAVE value of each grating. These observations will verify the optical paths and MSM positioning used for each of these modes, and will also allow a check of the spectral resolution. The normal monthly MSM offsetting should be turned off and the zero-offset MSM positions should be used for these observations.

IMPLEMENTATION METHOD:  Stored commanding

DEPENDENCIES:  Should occur no sooner than 36 hours after STIS-18 (NUV-MAMA HV Recovery) has been completed.

DURATION:  60 minutes (two 1800 s internal visits)

DATA REQUIREMENTS:  335 Mbits.

ANALYSES & EXPECTED RESULTS:  For each lamp spectrum obtained, compare the position of the spectral lines and the locations masked by the aperture bars to corresponding observations from program 9618. Look for any unexpected or operationally significant shifts in how the spectrum is projected onto the detector. Also, compare the line profiles for selected spectral lines to check for any changes in spectral resolution or focus across the detector. Look especially for any changes that are significant enough to affect operations or science data quality, or which might require table or database updates.

COMMENTS:  We plan to choose a subset of CENWAVE settings that also match those used for the initial alignment checks done during SMOV2 by program 7078. Suggested settings: G230L 52X0.05 100s LINE lamp at 3.8mA; G230M 2338 52X0.05 100s; E230M 2561 0.2X0.06 120s; E230H 2513 0.1X0.09 872s; PRISM 2125 52X0.05 HITM1.

AUTHOR/telephone/email:  Charles Proffitt/410-338-4938/proffitt@stsci.edu

DATE:  September 10, 2007
ACTIVITY TITLE: FUV MAMA Image Quality

ID: STIS-23

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.3.4

DESCRIPTION: This proposal will measure the FUV spectroscopic PSF along the length of a long slit. It will do this by observing a point source with the 52X0.1 aperture and the G140L grating, using a three-point centered Perpendicular-to-Slit dither pattern with 0.1” spacing to observe the target both in and just out-side of the aperture. This three-point pattern will be done at six different positions along the length of the aperture, including both the nominal centered aperture position and the D1 aperture position, which is located at a position of low FUV dark current. A single centered exposure will also be taken through the photometric 52X2 aperture to provide a reference for estimating the small slit throughput. Sufficient targets will be provided to allow this test to be executed at any time during the BEA period.

IMPLEMENTATION METHOD: Stored commanding

DEPENDENCIES: Should follow STIS-11 (external focus check) and STIS-21 FUV (Optical Format Verification). This program should be deferred if there is evidence that adjustment of STIS corrector or the HST secondary is required.

DURATION: 2 external orbits

DATA REQUIREMENTS: 1.3 Gbits

ANALYSES & EXPECTED RESULTS: The PSF quality will be evaluated in a number of ways. The centered spectra through the 52X0.1 aperture will be compared with the 52X2 reference spectrum to estimate the aperture throughput vs. position. The cross-dispersion profile observed for each centered spectrum will be compared with previous observations and PSF models. The fractional flux seen in the exposures offset perpendicular to the aperture will be used as a check of the PSF in the dispersion direction. STIS IDT IDL tools will be used with assistance of Don Lindler to analyze the data.

COMMENTS:

AUTHOR/telephone/email: Ted Gull/ 301-286-6184/ Theodore.R.Gull@NASA/

DATE: September 27, 2007
ACTIVITY TITLE:  NUV MAMA Image Quality

ID:  STIS-24

APPLICABLE SMOV REQUIREMENTS:  L.10.4.5.3.4

DESCRIPTION:  This proposal will measure the NUV spectroscopic PSF along the length of a long slit.  It will do this by observing a point source with the 52X0.1 aperture and the G230L grating, using a three-point centered Perpendicular-to-Slit dither pattern with 0.1” spacing to observe the target both in and just out-side of the aperture. This three-point pattern will be done at six different positions along the length of the aperture, including both the nominal centered aperture position and the D1 aperture position, which is located at a position of low FUV dark current. A single centered exposure will also be taken through the photometric 52X2 aperture to provide a reference for estimating the small slit throughput. Sufficient targets will be provided to allow this test to be executed at any time during the BEA period.

IMPLEMENTATION METHOD:  Stored commanding

DEPENDENCIES:  Should follow STIS-11 (external focus check) and STIS-22 NUV (Optical Format Verification). This program should be deferred if there is evidence that adjustment of STIS corrector or the HST secondary is required.

DURATION:  2 External Orbits

DATA REQUIREMENTS:  1.3 Gbits

ANALYSES & EXPECTED RESULTS:  The PSF quality will be evaluated in a number of ways. The centered spectra through the 52X0.1 aperture will be compared with the 52X2 reference spectrum to estimate the aperture throughput vs. position. The cross-dispersion profile observed for each centered spectrum will be compared with previous observations and PSF models. The fractional flux seen in the exposures offset perpendicular to the aperture will be used as a check of the PSF in the dispersion direction. STIS IDT IDL tools will be used with assistance of Don Lindler to analyze the data.

COMMENTS:

AUTHOR/telephone/email:  Ted Gull/301-286-6184/ Theodore.R.Gull@NASA/GSFC

DATE:  September 27, 2007
ACTIVITY TITLE: MAMA Spectroscopic Throughputs

ID: STIS-25

APPLICABLE SMOV REQUIREMENTS: L.10.4.5.4.3

DESCRIPTION: This activity has two functions: Determination of the STIS sensitivity for the MAMA spectroscopic modes and a baseline measurement for standard focus monitoring at NUV wavelengths.

Confirmation of STIS sensitivity for MAMA spectroscopic modes: Obtain exposures in the FUV and NUV low-resolution, medium-resolution and echelle modes to determine the post-SM4 STIS spectroscopic sensitivity, (re)establish a baseline for contamination/sensitivity monitoring, and evaluate changes in sensitivity since the STIS side-2 LVPS failure. To accomplish this, an external standard star is observed in each of the 2 low-resolution MAMA spectroscopic modes (G140L and G230L) at the nominal target position through the 52X2 slit. The sensitivity of the medium resolution long-slit modes (G140M and G230M) is checked at a total of three central wavelengths (1173Å, 1567Å, and 2818Å). BD+28D4211 is observed using the echelle modes with the 2X2 slit at a total of 5 central wavelengths: E140M(1425Å), E140H(1416Å), E230M(1978Å, 2707Å), and E230H(2263Å) to determine the spectroscopic throughput of these modes.

This activity resumes sensitivity monitoring of each MAMA spectroscopic mode to enable detection of any change due to contamination or other causes. Cycle 17 resumes the previously established duty cycle for monitoring the sensitivity of the UV channels. Calibration standards stars are observed once every 3 months for the low-resolution spectroscopic modes, yearly for each of the 2 medium-resolution modes, and once every 6 months for each of the 4 echelle modes. This activity uses the same calibration standards, AGK+81D266, GRW+70D5824, and BD+28D4211, that were used in previous HST Cycles to monitor the STIS sensitivity. Each target is specific to a particular mode.

Baseline measurement for focus monitoring at NUV wavelengths: ACQ/PEAKs are performed using the CCD/G230LB mode with the 0.1X0.09 aperture. The target is stepped in a crossed linear pattern to enable measurement of the focus (PSF) in the cross-dispersion (spatial) direction as a function of UV wavelength. The focus is also monitored in imaging mode by observing an appropriate standard star with the F28X50OI filter and the CCD.

IMPLEMENTATION METHOD: Stored commanding

DEPENDENCIES: Execute after the CCD target acquisition activity (STIS-13) and the FUV (STIS-23) and NUV (STIS-24) MAMA Image Quality activities. This activity uses external UV targets and the FUV and NUV MAMA detectors. It should execute after the end of the BEA period.
**DURATION:** 4 orbits (external).

**DATA REQUIREMENTS:** 1 Gbits.

**ANALYSES & EXPECTED RESULTS:** This activity will provide a broad range of basic performance information. The absolute sensitivity of STIS will be measured for each FUV and NUV grating mode. Ratioing these results for each UV mode with the previous (Cycle 12) sensitivity will provide a measurement of the STIS environment over the past several years and establish the current baseline for contamination monitoring and trending instrument sensitivity. The UV is sensitive to contaminants. Wavelength dependent sensitivity corrections will be derived and implemented in the calibration pipeline and used to refine exposure time predictions (ETC updates). The spectroscopic focus and UV (OII) imaging focus will be monitored as part of a Cycle 17 trending program.

**COMMENTS:** This activity comprises the three visits of the nominal Cycle 17 MAMA Spectroscopic Sensitivity Monitoring program. It establishes the Spectroscopic Sensitivity Monitor baseline for the low-resolution, medium-resolution, and echelle modes. Prior to first-order medium-resolution spectral sensitivity observations, an image of the standard star is taken using the F28X50OII aperture with the CCD as part of an ongoing UV focus monitoring program.

This activity may be regarded as part of the Cycle 17 calibration program.

**AUTHOR/telephone/email:** Mary Elizabeth Kaiser/401-516-5088/kaiser@pha.jhu.edu

**DATE:** September 26, 2007
**ACTIVITY TITLE:** MAMA Image Stability

**ID:** STIS-26

**APPLICABLE SMOV REQUIREMENTS:** L.10.4.5.3.5

**DESCRIPTION:** The maximum thermal motion of the MAMA detectors occurs in the first portion of those orbits that immediately follow a large angle maneuver, as this produces the maximum external changes on the portion of axial bay closest to the STIS instrument. During the second orbit on the same target, the shifts are smaller, but the largest shift is still near the beginning of the orbit. We will follow these changes for two orbits with each MAMA using internal lamp images done with the medium dispersion echelle formats in order to obtain a two-dimensional series of reference points on the 2-dimensional detector format. Exposures will be executed using one of the small echelle apertures with the medium resolution echelle gratings, and will have exposure times of 120 seconds for deep, sharp spectral line images.

Each orbit will start with a sequence of six of these dispersed lamp images. For the remainder of each orbit, dark exposures of 600 to 800 s in length will be interspersed between the lamp spectra. This provides frequent sampling in the portion of the orbit where thermal flexure is largest, while avoiding excessive lamp use when shifts are expected to be slower. The dark frames will also provide a useful addition to the calibration of the MAMA detector dark current.

**IMPLEMENTATION METHOD:** Stored commanding

**DEPENDENCIES:** Each of the two orbit internal executions must be done after large angle maneuvers that are predicted by thermal models to have a large effect on the internal echelle optics. This activity should be sequenced after STIS-25 STIS MAMA Spectroscopic Throughputs, but there is no need to wait for downlink or analysis of that program’s data. If possible, this can be done in parallel with similar thermal stability tests for other instruments.

**DURATION:** Two visits, two orbits each. Total 4 full internal orbits (11,500 s).

**DATA REQUIREMENTS:** 5.5 Gbits for each of the two visits.

**ANALYSES & EXPECTED RESULTS:** All spectra are internal wavecals with echelle gratings. Cross-correlations will be performed with respect to the initial exposure and to an averaged exposure. STIS IDT IDL tools will be used with the assistance of Don Lindler.

**COMMENTS:** These deep exposures will also be of use to confirm the updated wavecals reference wavelengths provided by ESA and NIST. The dark frames will provide information on the dark count rate. Lamp on time will be about 2900 seconds per two orbit visit. This totals to about 16.1 mA-hours. Total LINE lamp usage to mid-2004
was about 2200 mA-hours out of an estimated 15000 mA-hour lifetime, so this test will use only about 0.1% of expected lamp lifetime.

NOTE: make sure that mechanisms are not moved between wavecal and dark exposures. Recommend that this internal motion measurement be for two full orbits as major maneuver is at beginning.

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