WFC3 Side Switch Re-Commissioning

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This is the contingency plan for WFC3 re-commissioning on Side 1 following a side switch.

Key Assumptions and Constraints
- Must obtain maximum confidence in Side 1 prior to cooling detectors to avoid multiple cooldown cycles.
  - Real-Time vs. SMS controlled cooldown to be decided during contingency – ability to monitor and abort during cooldown is critical
- Retain option to perform SMOV on only one channel
- CSM Resolver recalibration is not required on Side 1
  - Consistent with ground testing experience
- Science can start fairly quickly with some degree of risk
  - Only “Engineering Activities” absolutely required to start some science
- Re-use of 2009 SMOV Proposals (subset at visit level) rather than writing new proposals
- ERO science is not included in this plan
Fallback Plans

- WFC3 SMOV design is primarily channel based
  - Either UVIS or IR commissioning can proceed without the other
- Major risk areas within each channel
  - Detector cooling: science margin exists to operate warmer at cost of considerable re-calibration (e.g. darks and flats)
  - Detector noise: most of SMOV can proceed during analysis of cause
- Phased start to GO science observations
  - EASY = programs not pushing on risk areas (can overlap sci cal part of SMOV)
  - HARD = programs dependent upon performance in “risk areas”
    - Defer until SMOV determines if these programs require modification
Preliminary Proposal Validation

- SMS OAT work completed
  - 11454 – WFC3 SMS based FT
  - 11358 – Image Memory load and dump (subset)
  - RAM tested via RT commanding
  - 11431 – ANNEAL (full version)
  - 11434 and 11435 – UVIS and IR File Alignments (visit 1 only)

- STScI proceeding to create and validate (PIT) all SS-SMOV proposals
WFC3
Engineering Activities (1)

• 11454/WF01 – Activation Test
  – Re-run of SM4 FT to confirm basic function and stability of instrument.
  – Provide global check of basic SI functionality

• 11358/WF03 – Science Data Buffer Check
  – Validates memory in Side 1 MEB (untested since 2008)

• NOTE: The proceeding steps:
  – Must be done prior to detector cool-downs
  – May all proceed regardless of results of each step

• 11419/WF06 – UVIS Detector Functional test
  – Verify detector readout operation, noise level, and gain.
  – Obtain series of darks and internal flat fields.

• 11420/WF07 – IR Detector Functional test
  – Verify detector readout operation, noise level, and gain.
  – Obtain series of darks and internal flat fields.
WFC3
Engineering Activities (2)

- 11421/WF08 – Channel Select Mechanism Test
  - Verify proper positioning of CSM IR fold mirror and IR diffuser
  - Verify unobstructed UVIS beam
- 11422/WF09 – SOFA and Tungsten Lamp test
  - Verify operation of all SOFA filter wheels.
  - Verify operation of at least 2 Tungsten lamps.
  - Establishes an initial baseline over a broad wavelength range.
- WF10 – IR FSM and Tungsten Lamp Test
  - Verify operation of FSM.
  - Verify operation of at least 2 Tungsten lamps.
  - Establishes an initial baseline for all IR filter elements.
- 11426/WF13 – UVIS SMOV Contamination Monitor
  - Standard star and bias/dark/internal flat observations in F218W, F225W, F275W, F606W
  - Execute weekly for 4 weeks until transition to Cal Contam Monitor (CY21=13088) – 2 orbits per visit
WFC3
Engineering Activities (3)

• 11427/WF14 – UVIS Shutter test
  – Verify operation and timing of the UVIS shutter mechanism.
  – Obtain internal flat fields over a range of exposure times to verify shutter shading is unchanged from ground testing.
  – Obtain observations of a standard star at 0.5, 0.7, 1.0, 1.5, and 2.0 seconds at four locations within the FOV using subarrays.

• 11428/WF15 – D2 Calibration lamp test
  – Verify operation of D2 lamp via UV filter internal flat fields.
  – Establishes an initial baseline for UV filter elements.
  – Determine on-orbit range of D2 lamp “turn-on” times.
  – De-scoped from 2009 SMOV by factor of 2 (Visits 2,5,6,9,11,12 only)

• 13071/WF18 – UVIS Hot Pixel Anneal
  – Demonstrate ability to performance UVIS anneal
  – Maintain strategy of limiting hot pixel growth with CCDs cold
  – Must be performed within 30 days of cool-down of UVIS detector.
  – Uses current (March 2013) Anneal strategy
  – Execution with “UVIS only” or “Full Anneal” to be decided at time of SMS build
WFC3
Contingency Alignment Activities

• Assumptions:
  – No credible failure modes should degrade the alignment outside of the range of the fine alignment proposals.
  – Activating the internal WFC3 tip-tilt/focus mechanisms should not be done solely to verify their operation for a potential future (“out years”) use.

• Conditions for execution of WFC3 Fine Alignment Proposals:
  – Observed degradation of PSF by >20 percent in EE and/or central pixel flux fraction
  – Change in optical bench temperature by >2 degrees C.

• Note: These proposals will require near real-time availability of unique staff

• 11434/WF21 – UVIS Fine Alignment
  – Observe a sparse star field (NGC 188) over a 7 step internal focus sweep.
  – Update optimal focus (real-time uplink)
  – Observe a sparse star field (NGC 188) over a 3x3 internal tip-tilt sweep.
  – Update optimal tip-tilt alignment position (real-time uplink)

• 11435WF22 – IR Fine Alignment
  – Observe a sparse star field (NGC 188) over a 7 step internal focus sweep.
  – Update optimal focus (real-time uplink)
  – Observe a sparse star field (NGC 188) over a 3x3 internal tip-tilt sweep.
  – Update optimal tip-tilt alignment position (real-time uplink)
WFC3
Science Calibration Activities (1)

• 11432/WF19 – UVIS Internal Flats
  – Obtain internal flat fields using the Tungsten lamps
    • D2 flat obtained in activity WF15
  – Limited subset of heavily used filters to verify stability of contamination and instrument flat field (Visits 90-96 only)

• 11433/WF20 – IR Internal Flats
  – Obtain internal flat fields using the Tungsten lamps.
  – Limited subset of heavily used filters to verify stability of instrument flat field (Visits 1,2,3 only)

• 11442/WF29 – FGS-UVIS Alignment
  – Observations of NGC 188 at three positions separated to at least 10 arc seconds and moving in orthogonal directions will be obtained.

• 11443/WF30 – FGS-IR Alignment
  – Observations of NGC 188 at three positions separated to at least 10 arc seconds and moving in orthogonal directions will be obtained.
WFC3
Science Calibration Activities (2)

• 11436/WF23– UVIS Image Quality
  – Detailed characterization of the achieved image quality using the NGC 188 sparse star field.
  – Four observations in F275W and F621M using a 2x2 dither pattern with 0.5 pixel steps will be obtained at two pointings offset by 10 arc seconds.

• 11437/WF24 – IR Image Quality
  – Detailed characterization of the achieved image quality using the NGC 188 sparse star field.
  – Four observations in the F098M, F105W, F127M, F160W, and F164N using a 2x2 dither pattern with 0.5 pixel steps will be obtained at two pointings offset by 10 arc seconds.

• 11438/WF25 – UVIS PSF Wings
  – Observations of a moderately bright star in F275W and F621M to measure the wings of the PSF over a large dynamic range
  – De-scope from 2009 SMOV to include only one field point.

• 11439/WF26 – IR PSF Wings
  – IR PSF Wings in F098M and F160W will be measured at 5 field points over a large dynamic range.
WFC3
Science Calibration Activities (3)

- 11450/WF37 – UVIS Photometric Zero Points
  - Photometric standard star will be observed in high priority filters using sub-arrays.
- 11451/WF38 – IR Photometric Zero Points
  - Two photometric standard stars (red and blue) will be observed in each filter.
- 11452/WF39 – UVIS Flat Field uniformity
  - Omega Cen star field will be observed to assess quality of low frequency flat fields and to check astrometric calibration.
- 11453/WF40 – IR Flat Field uniformity
  - The 47 Tuc star field will be observed to assess quality of low frequency flat fields and to check the astrometric calibration.
WFC3 Calibration Activities (4)

- 11798/WF43 – UVIS PSF Core Modulation
  - Measure impact of UVIS Shutter induced jitter on observations

- 13069/NEW – WFC3 UVIS Post-Flash Calibration
  - Confirm operation and level of UVIS Post-Flash on redundant lamp
  - Initial Calibration of Post-Flash
  - Include Visits B0,B1,B2,B3, D0,D1,D2,D3 from CY19 CAL 13069
Timeline

- **Week 1:**
  - Activation Test (i.e. FT), Memory Tests, go for detector cooldown
- **Week 2:**
  - Engineering Tests; then start “Easy Science”
- **Week 3:**
  - Science Calibration Pages 1 & 2
  - Decision on Image Quality/Optical Alignment
- **Week 4:**
  - Complete Science Calibration; Start “Hard Science”
    - OR
  - Stop Science & Perform Fine Alignment (might take 2 weeks)
- **Week 5 or 6:**
  - Complete Science Calibration; Start “Hard Science”
# WFC3 SS-SMOV Program (1)

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<tr>
<th>Activity</th>
<th>ProplD</th>
<th>Title</th>
<th>Visits #1</th>
<th>Visits #2</th>
<th>Comments</th>
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<th>Int Orbits</th>
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Activities in Blue are UVIS proposals
Activities in Red are IR proposals
Yellow Highlight indication omission from SMOV
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Notes

- External orbits = 48 (compared to 132 for SM4 SMOV)
- Internal orbits = 98
  - Anneal & Bowtie from CyXX calibration program
  - Additional 23 External and 2 Internal contingency on optical alignment

- SMOV Activities De-scoped or Omitted for Re-commissioning
  - UVIS Contamination Monitor: one month only; then resume Cal plan
  - Anneal: use current Anneal procedure (probably w/ two channel Anneal)
  - Internal Flats (UVIS and IR): spot checks only
  - Alignment: Initial (coarse) not required; Fine kept as contingency
  - UVIS PSF Wings: only central field point observed
  - Line of Sight Pointing Stability: omitted
  - Plate Scale Calibrations: checked inside Flat Field test
  - UVIS&IR Darks, Bowtie: covered by calibration monitor programs
  - SAA operation and contour tests: omitted