**Basic assumptions:**

— re-use as much as possible the ACS SM3B requirements
— maintain three sections: engineering, optical alignment, calibration
— avoid implementation details
— add pointer to relevant CEIS spec requirements. This allows us to keep the SMOV requirements as a document standing on its own while maintaining the requirement traceability that independent reviews have asked the WFC3 project.
— unless otherwise stated the requirements can be implemented with SMS commanding.
L.10.4.1  WFC3 Verification Requirements

L.10.4.1.1  Engineering Requirements

L.10.4.1.1.1  WFC3 entry into each of four instrument states (Boot, Hold, Operate, Observe) shall be demonstrated. Operations shall be commanded via stored commands transmitted over the Supervisory Bus.

*Relevant CEIS requirements: 4.10.1.1 Observe modes*

L.10.4.1.1.2  WFC3 entry into each of the defined detector states shall be demonstrated. Operations shall be commanded via stored commands transmitted over the Supervisory Bus.
L.10.4.1.1.3  WFC3 command and engineering data interface via the RIU and science data transmission via the Science Data Formatter (SDF) shall be verified by monitoring of normal configuration and science activities.

L.10.4.1.1.4  The ability to load and dump on-board memory shall be demonstrated.

⇒ Special commanding

L.10.4.1.1.5  The ability to read and write data from and to the science data buffer shall be demonstrated.

L.10.4.1.1.6  The performance of the Channel Select Mechanism, M1 and IM2 Alignment and Focus Corrector Mechanisms, UVIS Selectable Optical Filter Assembly, IR Filter Wheel, and UVIS CCD shutter shall be verified.

Relevant CEIS requirements: 4.10.1.4 Alignment modes
L.10.4.1.1.7 The functionality of the WFC3 Tungsten and Deuterium calibration lamps shall be verified. Operation of the deuterium lamp shall be deferred for an initial outgassing period following release of the observatory, as defined in the CARD 3.4.13.11.

*Relevant CEIS requirements: 4.10.1.2 Internal Calibration Lamps*

L.10.4.1.1.8 Functionality of the WFC3 UVIS CCD detector shall be demonstrated. This shall include the proper accumulation of signal over a specified time interval and data readout, readout of subarrays, and on-chip binning.

*Relevant CEIS requirements: 4.10.2 CCD detector operations requirements*

L.10.4.1.1.9 Functionality of the WFC3 IR detector shall be demonstrated. This shall include the proper accumulation of signal over a specified time interval and multiaccum data readout, readout of subarrays, and characterization of the reference pixels.

*Relevant CEIS requirements: 4.10.3 IR detector operations requirements*
L.10.4.1.1.10  The ability of the TECs to cool and stably control the detectors shall be tested at a small number of temperature set points, in order to determine the coldest stable operating point. The goal is to demonstrate that this point be at least as cold as –83C for the UVIS CCDs and 150K for the IR detector. WFC3 detectors cannot be cooled before 21 days in vacuum (CARD 3.4.13.15).

*Relevant CEIS requirements:* 4.7 CCD thermal control, 4.9 IR thermal control

→ Special commanding

L.10.4.1.1.11 The ability to perform a CCD anneal shall be demonstrated. *Relevant CEIS requirements:* 4.7.2 CCD detector warm operations

L.10.4.1.1.12  WFC3 operations shall be managed to minimize risk of contamination of its optical surfaces by materials outgassed either internally or from other units installed during the SM as well as from the payload bay environment during servicing (CARD 3.4.13.15, 3.4.13.16, 3.4.13.17). A contamination monitoring program shall be initiated as early as possible after the SM.

*Relevant CEIS requirements:* 6.4 Contamination control
L.10.4.1.2 **Optical Alignment Requirements**

L.10.4.1.2.1 The encircled energy and image diameter shall be measured over a grid of focus and tilt positions for both M1 and IM2 correctors. These measurements shall be used to set the nominal corrector positions.

*Relevant CEIS requirements: 4.10.1.4 Alignment modes*

L.10.4.1.2.2 The image quality at the detectors over the full field shall be measured via broad and narrow band imaging of stars. The requirement for encircled energy in the UVIS channel field center is 75% within a diameter of 0.25 arcseconds, through the F631N filter. The requirement for encircled energy in the IR channel field center is 75% within a diameter of 0.60 arcseconds, for a star observed through the F164N.

*Relevant CEIS requirements: 4.3.2 Image quality*
L.10.4.1.2.3 The pointing stability of the OTA-WFC3 combination shall be measured over at least three orbits including hot and cold spacecraft attitudes. The purpose of these measurements is to confirm that the typical thermal environment after SM4 does not cause unacceptable image drifts.

*Relevant CEIS requirements:* 4.3.2.4 Image jitter, 4.3.2.5 Image drift

L.10.4.1.2.4 The WFC3 Point Spread Function (PSF) shall be measured over a large dynamic range in order to study PSF wings and image ghosts.

*Relevant CEIS requirements:* 4.3.2.1 UVIS point source profile, 4.3.2.2 IR point source profile, 4.3.2.6 Ghost images, 4.3.2.7 Large angle stray light
L.10.4.1.3 Calibration Requirements

L.10.4.1.3.1 The plate scale, orientation and geometric distortion shall be measured for each of the WFC3 channels by imaging an astrometric field. Relevant CEIS requirements: 4.3.1.1 Pixel spacing, 4.3.1.2 Field of view, 4.3.1.3 Field of view distortion, 4.3.1.5 Geometric distortion

L.10.4.1.3.2 The absolute FGS/WFC3 alignment shall be determined.

L.10.4.1.3.3 Dark rate, read noise and CTE shall be measured for the CCD detector. The hot pixel creation rate shall be assessed and the efficacy of the hot annealing cycle shall be demonstrated. The stability of these parameters over a 30 day baseline shall be determined. Relevant CEIS requirements: 4.6.3 CCD readout noise, 4.6.4 CCD Dark current, 4.6.9 CTE and radiation damage, 4.7.2 CCD detector warm operation
L.10.4.1.3.4 Dark rate, background level, and read noise shall be measured for the IR detector. IR bad pixels shall be characterized. The stability of these parameters over a 30-day baseline shall be determined.

*Relevant CEIS requirements: 4.4.8 IR Background, 4.8.3 IR readout noise, 4.8.4 IR dark current, 4.8.5 IR amplifier glow*

L.10.4.1.3.5 The behavior of both channels during SAA passages shall be characterized. The SAA afterimage shall be measured for the IR detector.

*Relevant CEIS requirements: 4.6.15 CCD detector cosmic ray susceptibility, HgCdTe detector cosmic ray susceptibility*

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L.10.4.1.3.6 Instrument sensitivity vs. wavelength shall be measured for a subset of WFC3 spectral elements. Sensitivity measurements shall be performed using astronomical standard stars. The photometric stability shall be determined over several orbits. As part of this process, UV sensitivity measurements shall be obtained as early as possible, to enable early trending of UV sensitivity.

*Relevant CEIS requirements:* 4.4.1 wavelength range, 4.4.2 optics throughput, 4.4.3 spectral range stability, 4.6.2 CCD QE, 4.8.2 IR detector QE

L.10.4.1.3.7 The flat field uniformity per pixel and cosmetic defect fraction shall be measured for both WFC3 detectors. The ability to determine the residual response variation using the WFC3 internal calibration sources shall be demonstrated. The difference between sky flats and internal flats and temporal stability of the flat field correction shall be assessed.

*Relevant CEIS requirements:* 4.6.11 CCD flat field, 4.8.11 IR flat field