



# ON-ORBIT INITIALIZATION OF THE WORLDVIEW-1 OPTICAL FOCAL SYSTEM USING THE ITT MTF MEASUREMENT TOOLKIT

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## Background



On September 18, 2007 DigitalGlobe successfully launched WorldView-1, the world's first commercial half-meter resolution satellite. During the initialization and commissioning phase, the satellite underwent rigorous radiometric and geometric calibration and vigorous system testing to ensure instrument integrity. These activities were completed and full operational capabilities (FOC) declared on November 19, 2007.

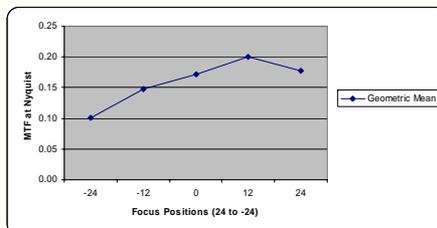
## Initial WV-1 MTF Validation

During initial commissioning activities, adjustments were made to a mirror in the telescope to focus light on the EO focal plane. On-orbit fine focus maneuvering moved the mirror +/- 2 12 steps increments. The MTF results were recorded for each step. This determined the need to adjust +6 steps from nominal.

Focus	Along-Scan	Cross-Scan	Geometric Mean
-24	0.09	0.11	0.10
-12	0.12	0.17	0.15
0	0.17	0.18	0.17
12	0.19	0.21	0.20
24	0.18	0.18	0.18

WV-1 initial fine focus readings determined slight adjustments required.

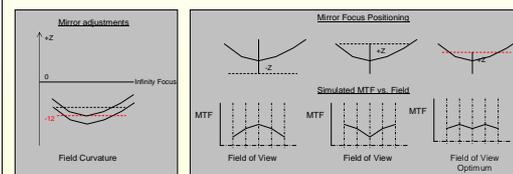
MTF Vs. Adjustment Steps



Simulated pre-launch focus data determined a pattern for optimum focus to have high MTF to the right and left of center.

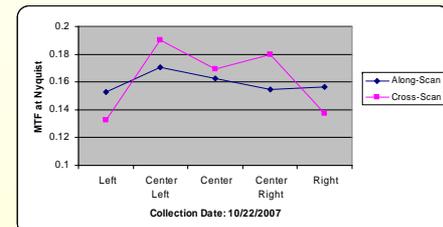
WV-1 final focus was determined by balancing the performance across the field of view.

Target Thru Focus Behavior

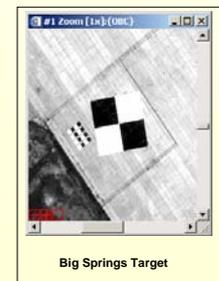


Telescope moved during focus initialization +/-Z

MTF Vs. Field of View



## MTF Technique Overview



A user selected Region of Interest (ROI) from an image is sequentially searched for areas of edge content.

User modified parameters constrain edge location (e.g. size, angle contrast, uniformity). The MTF is calculated using an algorithm derived by Tatian (J. Opt. Soc. Amer., vol. 55 No. 8, p. 1014, 1965).

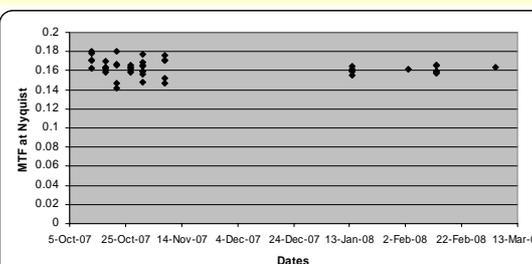
The resultant individual edge MTFs are averaged to produce an estimate of the MTF in the along-scan and cross-scan directions.

## Monitoring of WV-1 MTF

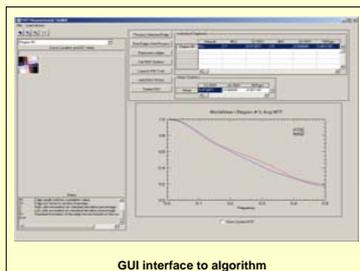
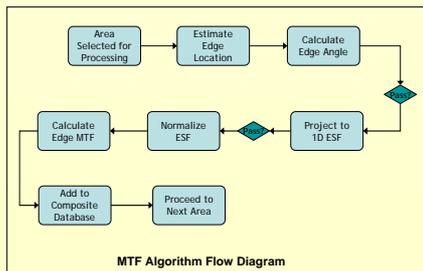
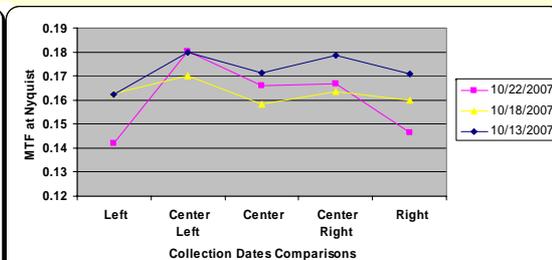
Post launch, MTF readings monitor the image quality of the sensor.

Multi-shift shot series monitors MTF across the field of view.

MTF vs. Time



MTF Vs. Field of View



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