

Minimizing Uncertainty in Cryogenic Surface Figure Measurement

Blake, P. N.; Mink, R.; Chambers, V. J.; Content, D.; Davila, P.
(NASA/Goddard Space Flight Center);

Robinson, F. D.
(Orbital Sciences Corporation)

A new facility at the Goddard Space Flight Center is designed to measure with unusual accuracy the surface figure of mirrors at cryogenic temperatures down to 12 K. The facility is currently configured for spherical mirrors with a radius of curvature (ROC) of 600 mm, and apertures of about 150 mm or less. The goals of the current experiment were to 1) Obtain the best estimates of the cryo-changes, $\Delta(x,y)$: the changes in surface figure between room temperature and the two cryo-temperatures 87 K and 20 K; and 2) Determine the uncertainty of these measurements, using the definitions and guidelines of the *ISO Guide to the Expression of Uncertainty in Measurement*.

A silicon carbide mirror was tested, and the cryo-change from room temperature to 20 K was found to be below 4 nm rms. This report describes the facilities, experimental methods, and uncertainty analysis of the measurements.

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