**Interim Progress Report**

**NASA Grant #NAGS-12583**

(MIT OSP #6894375)


November 21, 2003

**Principal Investigator:**  
Dr. Mark L. Schattenburg  
MIT Center for Space Research  
70 Vassar St. 37-487  
Cambridge, MA 02139  
Tel: 617-253-3180  
Fax: 617-452-2888  
marks@space.mit.edu

Interim Progress Report

This Grant covers MIT support for the technology development of x-ray reflection gratings for the Constellation-X Reflection Grating Spectrometer (RGS). Since the start of the Grant MIT has extended its previously-developed patterning and super-smooth, blazed grating fabrication technology to ten-times smaller grating periods and ten-times larger blaze angles to demonstrate feasibility and performance in the off-plane grating geometry.

In the past year we successfully developed several nanoimprint grating replication methods that achieved very high fidelity replication of master silicon gratings. Grating geometry on the nano and macro scales were faithfully replicated, demonstrating the viability of the process for manufacturing the thousands of gratings required for the RGS.

We also successfully developed an improved metrology truss for holding test grating substrates during metrology. The flatness goal of grating substrates is under 500 nm. In the past, grating holders would cause non-repeatable distortion of >> 500 nm to the substrates due to friction and gravity sag. The new holder has a repeatability of under 50 nm which is adequate for the proposed RGS grating substrates.

Details can be found in the publications and Master’s theses listed below:

**Publications:**


Presentations:


Optoelectronic Applications, Boston, Massachusetts, Nov. 30, 2004 (invited paper C3.4).

Master's Theses: