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Behavioral Model of High Performance Camera for NIF Optics Inspection

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Scholar End-of-Assignment Report FY07

I verify that my technical mentor listed below has already reviewed and approved my technical report: Yes ***or*** ~~No~~

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Visit Dates: May 30, 2007 – September 13, 2007

Project Title: Behavioral Model of High Performance Camera for NIF Optics Inspection

Project(s) Assignment/Description:

The purpose of this project was to develop software that will model the behavior of the high performance Spectral Instruments 1000 series Charge-Coupled Device (CCD) camera located in the Final Optics Damage Inspection (FODI) system on the National Ignition Facility. NIF's target chamber will be mounted with 48 Final Optics Assemblies (FOAs) to convert the laser light from infrared to ultraviolet and focus it precisely on the target. Following a NIF shot, the optical components of each FOA must be carefully inspected for damage by the FODI to ensure proper laser performance during subsequent experiments. Rapid image capture and complex image processing (to locate damage sites) will reduce shot turnaround time; thus increasing the total number of experiments NIF can conduct during its 30 year lifetime. Development of these rapid processes necessitates extensive offline software automation – especially after the device has been deployed in the facility. Without access to the unique real device or an exact behavioral model, offline software testing is difficult. Furthermore, a software-based behavioral model allows for many instances to be running concurrently; this allows multiple developers to test their software at the same time. Thus it is beneficial to construct separate software that will exactly mimic the behavior and response of the real SI-1000 camera.

The emulated camera software developed during the summer of 2007 is configurable to provide user-defined image sequence to the client and accurately mimics the response time of the SI-1000 camera. Software developers working on the Integrated Computer Control System (ICCS) will use the camera model to emulate a wide range of scenarios. For example, scripted image sequences of growing optical damage sites will be used to test the capability of optics inspection software, and the model's accurate timing emulation will be used to optimize procedures to perform image processing concurrently with mechanical repositioning of the instrument to image the next optic.

Figure/Picture/Graphic:

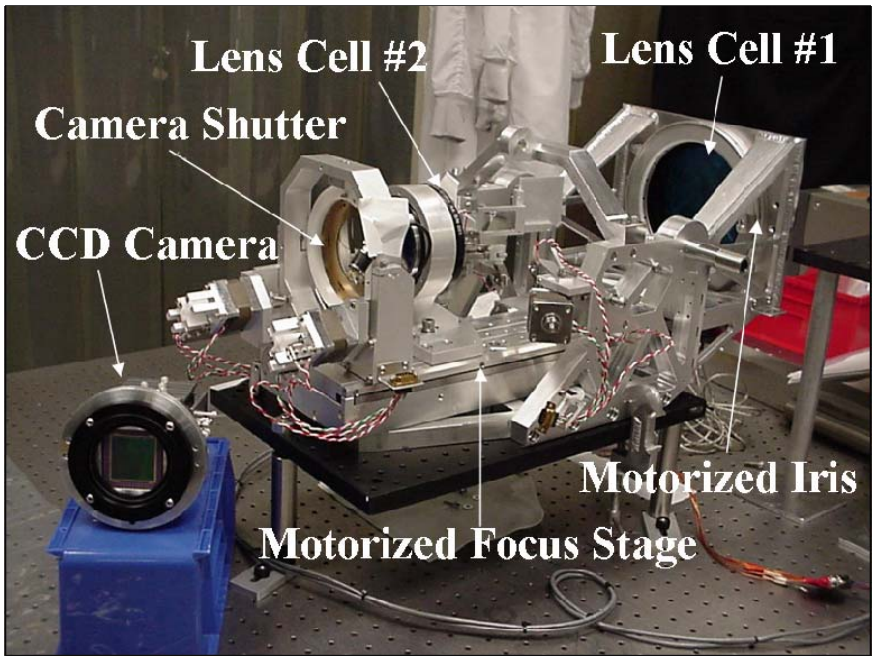

Figure 1. The FODI CCD camera assembly is a unique instrument with many precise moving parts to focus the light coming from the illuminated optic directly into the CCD camera aperture.

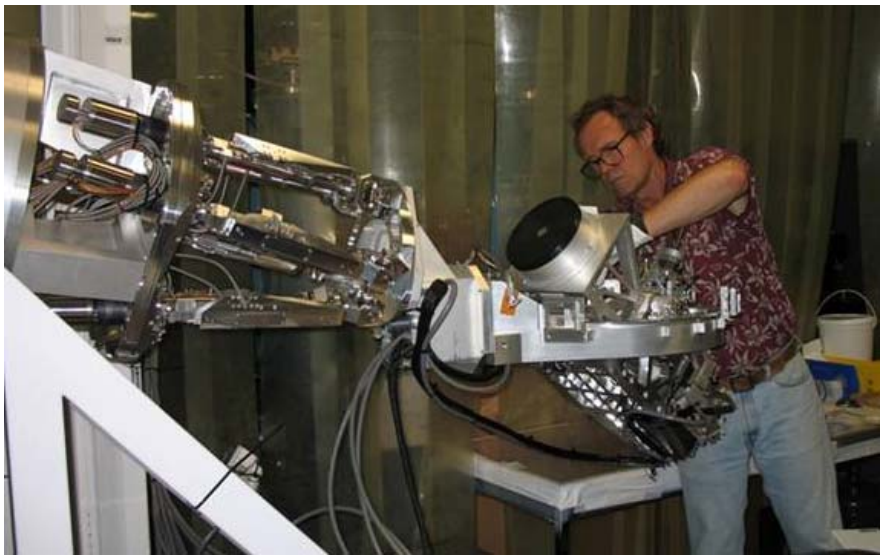

Figure 2. The FODI hexapod and camera assembly sits at the end of a long arm which is inserted into the target chamber post-shot. They give the camera the six degrees of freedom necessary to maintain its position at target chamber center (given a very small tolerance) while pivoting and rotating to obtain images of all the Final Optics as they are illuminated.