

Visitor Research Report

Visitor Name: Mr. Michael Okyen
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Area of Research: Multifunctional Aerospace Materials

Period of Visit: May 12, 2008 to August 15, 2008

Goal:

My goal while visiting NIA was gain experience in the design and construction of a research project while supporting graduate research. While my first summer at NIA served more as an introduction to research, this summer was focused on actually participating in research by developing my own project, the solar simulator. I also wanted to further the research into the lunar brick material that had been discovered the summer before. Through these experiences, I hoped to gain a better understanding of the engineering design process and which fields I hope to pursue in my career.

Strategy:

The primary means by which I sought to reach my goal was by working closely with the graduate students, my fellow undergraduate Scott Hopkins, and other people at NIA. The project we undertook spanned several fields, from physics to thermodynamics to electronics. By using the human resources around me, I planned to not only complete the project, but also learn a great deal from others around me. Dedication and hard work are two of the greatest forms of respect from an employee to their employer.

Accomplishments:

This summer, my project was to construct a solar simulator to use in the synthesis of Dr. Logan's "moon bricks." The bricks are formed by mixing the lunar soil, called regolith, with powdered Aluminum and heating the bricks. In the lunar environment, solar energy will be used to initiate these reactions, so to test this concept we designed and constructed a solar flux simulator. We spent more than half the summer designing the system in Autodesk's Inventor CAD software and ordering parts, and the rest building the simulator. We used twelve 250 Watt lightbulbs and a series of lenses to focus the light. Dr. Wong from the UVA group was instrumental in the lens design and selection, as well as permitting us the use of some tools to which we didn't have access. By the end of the summer, we had completed most of the construction of the simulator. Due to our inexperience in the design process, we hadn't planned enough time to complete the building, however, we had definitely learned how to organize such a project. The graduate students will finish up the construction of the simulator and hopefully have it in operation this fall.

Future Work:

In a continuation of the research into the moon bricks, a small scale dome will be constructed sometime in the future. It will be made from specific geometry shapes, so that it will be easily constructible in the lunar environment. Dr. Logan would like us to work on constructing this prototype in the future for both strain testing and as a proof of concept to continue to prove the technology is viable for NASA use.

Pending Publications:

A report is being constructed to submit to the Pacific International Space Center for Exploration Systems (PISCES) Lunar Outpost Design Competition. The conference is in November 2008, and the report will be used to select two semi-finalists. Scott Hopkins and I wrote a section of the report on the solar simulator.