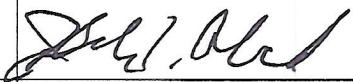
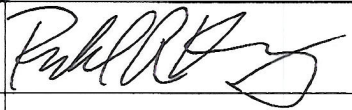
JSC Senior Design Project and or Intern Request Form

ES-4

Project Title:	Model to predict Optical Properties in Space		
Project Description:	Correlation and Improvement of Optical Properties Model using Materials on ISS Experiment (MISSE) data		
Choose most appropriate area of research:	☐ Planetary Surface Systems ☐ Ground Operations ☐ Propulsion ☒ Spacecraft ☐ Human Health Program		
Program Applicability	☒ ISS ☒ CEV/SLS ☒ Commercial Crew ☒ Asteroid ☐ Adv. Technology (AES/STMD)		
Choose one project:	**Roles and Responsibilities of Senior Design POC/Mentor**		
☒ Senior Design	I have coordinated with my management and I am able to support at least three (3) teleconferences (kick-off, mid-term, and final) with a Senior Design Project Team at a university that chooses my project. I understand that I shall not provide any sensitive or classified information to the Senior Design Project students of faculty. I will provide feedback to the project team if requested.		
☐ Internship	I have coordinated with my management and I am able to support an intern. If an intern is selected for my project, I will provide an environment where an intern can grow and we may have a mutually beneficial and successful internship. My project will be able to provide a desk space, work area, and computer for an intern. I will review any final report or presentation that the intern generates during his/her internship and submit it to Export Control (DAA) for approval. This project opportunity will be posted in OSSI, through the office of Education (use exact same title). OSSI website: : https://intern.nasa.gov		
Check desired Timeframe for Internship:	☒ Year long ☐ Summer ☐ Fall ☐ Spring		
Check desired Major/Minor(s) for Internship:	☒ Aerospace Engineering ☐ Aeronautical Engineering ☐ Astronautical Engineering ☐ Biomedical Engineering ☐ Chemical Engineering ☐ Civil Environmental ☐ Health Engineering ☐ Electrical, Electronic Engineering ☐ Computer Engineering ☒ Engineering Physics ☐ Industrial Manufacturing Engineering ☒ Materials, Metallurgical Engineering ☒ Mechanical Engineering, Mechanics ☐ Nuclear Engineering ☐ Astronomy, Astrophysics ☐ Chemistry ☒ Optics ☒ Physics ☐ Atmospheric Sciences ☐ Geography ☐ Geosciences ☐ Oceanography ☐ Natural Resource Management ☒ Mathematics, Applied Mathematics ☐ Computer Science ☐ Astrobiology ☐ Biology ☐ Biochemistry/Biophysics ☐ Microbiology Bacteriology ☐ Chemical Engineering ☐ Other, please specify:		
Mentor Name:	John W. Alred	Mentor's E-mail:	john.w.alred@nasa.gov
Title & Organization:	Deputy Branch Chief (Acting), Materials and Processes Branch / ES4	Phone #:	281-483-5939
Alternate POC/Mentor Name:		Alternate's E-mail:	
Education Office Signature and Date:		Intern Mentor's Signature & Date: 5/28/13	
As supervisor/manager, I approve of the above named individual as Senior Design Project POC of Intern Mentor.		Supervisor/Manager's Signature & Date 06/11/13	
(For Intern Request Only) As Administrative Officer, I am aware that the above named Intern Mentor has submitted a request for an Intern.		Administrative Officer's Signature & Date: 6/11/13	Dera A. Yochov

Title: Model to Predict Optical Properties in Space

Sponsor: NASA Johnson Space Center, Engineering Directorate, Structural Engineering Division, Materials & Processes Branch

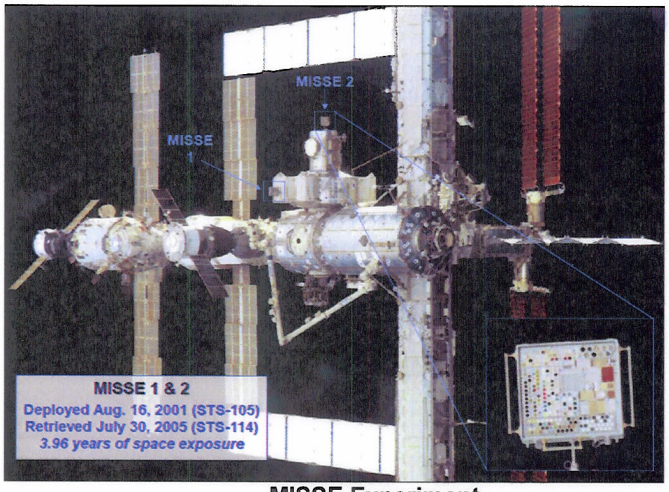
Personnel: 1-2 Engineering/Physics Students

Expected person-hours: 400 Deadline: Spring 2014

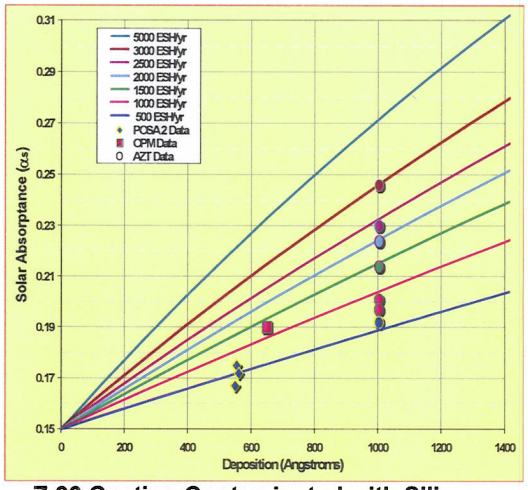
Statement of Work:

An existing model to predict the optical properties (solar absorptance and thermal emissivity) of thermal control surfaces in terms of exposure to solar vacuum ultraviolet (VUV) and contamination layer is known to overpredict. From first principles, this model could be updated to consider how fast the contamination layer goes down and how much VUV the surface gets. Also, the model could be updated to include the effect of atomic oxygen (AO -sometimes a bleaching effect, sometimes making things darker). The ultimate goal is to use the Materials on ISS Experiment (MISSE) data to update the model for the previously-mentioned effects as well as the type of coating, the method of application, and any overcoats. This updated model will assist ISS life extension. Also, previous discussions with the ISS Passive Thermal Control Systems (PTCS) team focused on a more standardized approach for beginning-of-life and end-of-life optical properties for their analyses. One such study with PTCS was previously done regarding improperly manufactured beta cloth. The techniques of that study could be expanded with assistance from the PTCS community.

The objective of this project will be to improve the optical properties model by correlation using MISSE data. The optical degradation model for solar absorptance was developed from Mir data (reference: S. Koontz and C. Soares, "External Spacecraft Contamination", NASA JSC-27644, 1996) and has been extended via hardware flown on ISS. Presently, the solar absorptance Model dependent on total Equivalent Sun Hours (ESH) from Vacuum Ultraviolet (VUV); the thickness of the contamination layer; and the Beginning-of-Life (BOL) solar absorptance. Presently, atomic oxygen erosion issues are not included the model, but data exists for such an extension.



MISSE Experiment



Z-93 Coating Contaminated with Silicone