Marshall Problem Statement/ Senior Design Topic

Problem Title: **Design of a Specimen Holder for Studying Space Environmental Effects on Materials Exposed to the Lunar Environment and Materials Selection for Lunar Missions**

MSFC Mentor Name and Organization: **Tracie Prater, EM04 (materials engineering support office)** - **coordinator for project, hardware design and materials selection aspects**

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Indicate which discipline/s is/are most appropriate to work on this problem, e.g., aerospace, mechanical, electrical, chemical, industrial, civil, computer, physics, materials, test, nuclear, earth science, other: **Mechanical, physics, materials**

Marshall Problem Statement

Background: The big picture with references to previous work (Why would a senior design student be excited about this work?)

NASA Marshall Space Flight Center has a long history of space environmental effects research. Previous platforms that have been used to assess the impact of the space environment (UV radiation, vacuum exposure, atomic oxygen, micrometeroid impacts) on materials used in long duration missions include: the Long Duration Exposure Facility (LDEF), the Passive Optical Sample Assembly-I (POSA), and the Materials International Space Station Experiment (MISSE). As NASA undertakes a return to the moon via Gateway and commercial lander services, there will be an opportunity and an increased need to study the impact of the lunar environment on materials exposed to it. The lunar environment is harsh and materials will be exposed to high energy particles, abrasive dust, and thermal swings in the course of a mission. In this project, teams will perform a trade study to select materials which have high value for lunar habitat and lander applications, presenting a recommendation for materials which should be included in space environmental exposure experiments on the lunar surface. Teams will also gain familiarity with NASA's principles of materials selection and the Materials and Processes Technical Information System (MAPTIS), where results from previous exposure experiments are cataloged. Teams can also design a sample cartridge holder for an experiment on lunar space environmental effects and materials. Teams may consider operational concepts for deployment of the system on the lunar surface and return of the system to an orbiting outpost.

Recent/on-going research on the problem (What resources, if any, are available to the senior design team, such as equipment, software, facility utilization)

Design teams will have access to NASA subject matter experts, who will consult on the project throughout its lifecycle. SMEs the team can ask questions may include those familiar with exposure flight experiments, material selection, and hardware design. The teams will also have access to the Materials and Processes Technical Information System (MAPTIS) and technical reports on previous flight experiments on materials exposure. Materials to build the prototype can be procured by the university with the funds allocated for this activity by NASA.

Details of the problem; design constraints, requirements (if any), outcome expected (one semester Senior Design course lasts 15 weeks; two semester course lasts 30 weeks.) (What do you expect the

senior design team to accomplish?)

This project is intended for a 2-semester design course. The outcome will be a trade study with recommendations for materials to include in the experiment and a design of a prototype system.

Senior Design Project Rules:

1. Weekly telecons will be scheduled to maintain proper progress and prevent dead-end ventures.

2. Deliverables required (e.g. one semester course - a written final report; two semester course - written final report and a prototype/model (if practical)