### JSC Senior Design Project and or Intern Request Form

**Project Title:** Thruster Plume Dust Model for Asteroid Exploration

**Project Description:** Develop a Thruster Plume Surface Dust Model for Exploration of Planetary or Asteroid Surfaces

**Choose most appropriate area of research:**
- [X] Planetary Surface Systems
- [ ] Ground Operations
- [ ] Propulsion
- [X] Spacecraft
- [ ] Human Health Program

**Program Applicability**
- [ ] ISS
- [ ] CEV/SLS
- [ ] Commercial Crew
- [X] Asteroid
- [ ] Adv. Technology (AES/STMD)

**Choose one project:**
- [X] Senior Design
- [ ] Internship

**Roles and Responsibilities of Senior Design POC/Mentor**

- I have coordinated with my management and I am able to support at least three (3) teleconferences (kick-off, midterm, 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.

**Check desired Timeframe for Internship:**
- [X] Year long
- [ ] Summer
- [ ] Fall
- [ ] Spring

**Check desired Major/Minor(s) for Internship:**
- [X] Aerospace Engineering
- [ ] Aeronautical Engineering
- [ ] Astronautical Engineering
- [ ] Biomedical Engineering
- [ ] Chemical Engineering
- [ ] Civil Environmental
- [ ] Health Engineering
- [ ] Electrical, Electronic Engineering
- [ ] Computer Engineering
- [X] Mechanical Engineering
- [ ] Physics
- [ ] 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. Aired

**Mentor’s E-mail:** john.w.aired@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:** 6/11/13

**(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
Title: Thruster Plume Dust Model for Asteroid Exploration
Sponsor: NASA Johnson Space Center, Engineering Directorate, Structural Engineering Division, Materials & Processes Branch
Personnel: 3-4 Engineering/Physics Students
Expected person-hours: 800
Deadline: Spring 2014

Statement of Work:
From past lunar and Martian surface landings, the interaction of the exhaust plume from a landing engine is well-documented. Similar phenomena will be expected when a spacecraft performs a rendezvous with an asteroid, especially is the surface is dusty. This task will develop a first-principles simulation of the dust plume kicked up from the thruster firings utilizing a simple, basic plume model, such as a source flow model, for Bipropellant, CH4/LOX, and/or LH2/LOX thrusters. Information will be gathered from the Astromaterials Research and Exploration Science Directorate (ARES) in order to get data on the dust profile for the Moon, Mars, and at least one asteroid.

The objective of this project will be to develop a thruster plume surface dust model for exploration of planetary or asteroid surfaces. The model will then be expanded to statistically describe the gas-dust particle interaction and reaction. This quick look model could be expanded by CFD in later versions but will give reasonable design information for exploration vehicles like the MMSEV or specific asteroid missions.