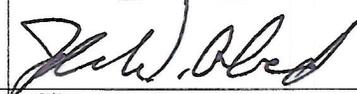
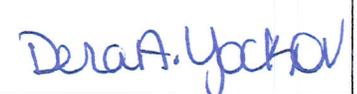


JSC Senior Design Project and or Intern Request Form

ES-2

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:	<input checked="" type="checkbox"/> Planetary Surface Systems <input type="checkbox"/> Ground Operations <input type="checkbox"/> Propulsion <input checked="" type="checkbox"/> Spacecraft <input type="checkbox"/> Human Health Program		
Program Applicability	<input type="checkbox"/> ISS <input type="checkbox"/> CEV/SLS <input type="checkbox"/> Commercial Crew <input checked="" type="checkbox"/> Asteroid <input checked="" type="checkbox"/> Adv. Technology (AES/STMD)		
Choose one project:	Roles and Responsibilities of Senior Design POC/Mentor		
<input checked="" type="checkbox"/> 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.		
<input type="checkbox"/> 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:	<input checked="" type="checkbox"/> Year long <input type="checkbox"/> Summer <input type="checkbox"/> Fall <input type="checkbox"/> Spring		
Check desired Major/Minor(s) for Internship:	<input checked="" type="checkbox"/> Aerospace Engineering <input type="checkbox"/> Aeronautical Engineering <input type="checkbox"/> Astronautical Engineering <input type="checkbox"/> Biomedical Engineering <input type="checkbox"/> Chemical Engineering <input type="checkbox"/> Civil Environmental <input type="checkbox"/> Health Engineering <input type="checkbox"/> Electrical, Electronic Engineering <input type="checkbox"/> Computer Engineering <input checked="" type="checkbox"/> Engineering Physics <input type="checkbox"/> Industrial Manufacturing Engineering <input checked="" type="checkbox"/> Materials, Metallurgical Engineering <input checked="" type="checkbox"/> Mechanical Engineering, Mechanics <input type="checkbox"/> Nuclear Engineering <input type="checkbox"/> Astronomy, Astrophysics <input type="checkbox"/> Chemistry <input type="checkbox"/> Optics <input checked="" type="checkbox"/> Physics <input type="checkbox"/> Atmospheric Sciences <input type="checkbox"/> Geography <input type="checkbox"/> Geosciences <input type="checkbox"/> Oceanography <input type="checkbox"/> Natural Resource Management <input type="checkbox"/> Mathematics, Applied Mathematics <input type="checkbox"/> Computer Science <input type="checkbox"/> Astrobiology <input type="checkbox"/> Biology <input type="checkbox"/> Biochemistry/Biophysics <input type="checkbox"/> Microbiology Bacteriology <input type="checkbox"/> Chemical Engineering <input type="checkbox"/> 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:	 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 if 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.



Attitude Control Jet Plume



Typical Asteroid