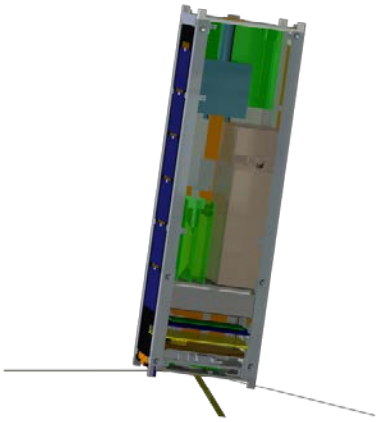
Project Title: Student Aerothermal Spectrometer SmallSat of Illinois and Indiana (SASSI^2)

Advisors: Dr. Alexander Ghosh, Prof. Zachary Putnam, Prof. Debbie Levin

Project Description:



An orbital mission is proposed to characterize the flow field and radiation generated by the diffuse bow shock formed during high-speed flight through the upper atmosphere. Commercial off the shelf (COTS) optical instrumentation, specifically an Ocean Optics HR 4000 Spectrometer, will be integrated into a 3U CubeSat to measure spectral radiation from the bow-shock produced by a reentering body. Novel MEMS-based pressure and temperature sensors will characterize the free-stream and help interpret spectrometer data while successful flight of these sensors will space-qualify them for future picosat missions. Such data from previous flight experiments has been important in diagnosing the adequacy of complex flow modeling issues such as thermochemical nonequilibrium as well as electronic excitation mechanisms. The successful implementation of optical instrumentation will provide benchmark data for fundamental flow, radiation, and materials modeling as well as provide operational correlations between vehicle reentry drag and radiation. Without *flight* spectral data, and the appropriate modeling efforts, the power of prediction to assist in new heat shield design does not exist for reentry into other planetary atmospheres. This is a severe limitation for future space exploration missions that the Student Aerothermal Spectrometer SmallSat of Illinois and Indiana (SASSI^2) experiment could aid in correcting. The data collected by SASSI^2 will be in direct support of the 2015 NASA Technology Roadmap, subsection 9.4.5.2, which lays out required advances in Aerothermodynamics Modeling for improvements in vehicle systems for entry, decent, and landing (EDL) technology.

Student Background and expected research activities:

The student should have a strong interest in space hardware development, and previous experience working with and designing spacecraft hardware is desired. The student will work in an interdisciplinary team, and assist with the design of a spacecraft bus. The student will further have the opportunity to work on one of the three payloads (cooling system, jitter reduction system or SPAD) based on their skills and interests. A diverse range of skillsets are sought, and being any of the following would put a student in consideration: programmer, electrical engineer, mechanical or aerospace engineer, physicist. The student may assist with the design and update to a system appropriate for their skillset such as the structure, the power system, the payload interface, the communication system and the command and data handling system.

Point of Contact: Dr. Alexander Ghosh (aghosh2@illinois.edu) and Prof. Zachary Putnam (zputnam@illinois.edu)

Funding: USIP Program. One position may be funded.