

THE STRATEGIC PARTNERSHIP FOR THE ADVANCEMENT OF ENGINEERING EDUCATION (SPACE) PROGRAM - TEACHING THE NEXT GENERATION OF SCIENTISTS AND ENGINEERS THE NASA SPACECRAFT AND MISSION DESIGN PROCESS. M.P.J. Benfield¹, M.W. Turner¹, P.A. Farrington¹, C.J. Runyon², and J. Hakkila² ¹The University of Alabama in Huntsville (301 Sparkman Drive, Huntsville, AL 35899), ²College of Charleston (66 George Street Charleston, SC 29424).

Introduction: The Strategic Partnership for the Advancement of Collaborative Engineering (SPACE), is a multidisciplinary, multi-university, multi-level program whose goal is to provide the opportunity for high school and undergraduate scientists and engineers to translate stakeholder needs and requirements into viable spacecraft missions via a distributed multidisciplinary team environment.

The current program supports three projects for students. The core of the program is the two-semester Integrated Product Team (IPT) project where science, engineering, and liberal arts undergraduate students from The University of Alabama in Huntsville, the College of Charleston, Alabama A&M University, Southern University at Baton Rouge, California State University, Los Angeles, and Ecole Supérieure des Techniques Aéronautiques et de Construction Automobile (ESTACA) in Paris, France form multidisciplinary competitive teams to develop system concepts of interest to the local aerospace community. External review boards composed of NASA and space industry-related engineers and scientists form to provide guidance and feedback throughout the semester and to ultimately choose a winner from the competing teams.

The other two projects, the Innovative Student Project for the Increased Recruitment of Engineering and Science Students (InSPIRESS) Level I and Level II focus exclusively on high school students. InSPIRESS Level I provides the opportunity for high schools to develop a payload to be accommodated on the spacecraft being developed by the senior design experience teams. InSPIRESS Level II provides local high school students first-hand experience in the senior design experience by allowing them to develop a subsystem or component of the UAH-led spacecraft over the two semesters. This program provides a model for NASA centers to engage the local community to become more involved in design projects.

Background: The SPACE Program combines the previously existing IPT project with the InSPIRESS project in an effort to provide one program structure for the two projects.

IPT. The IPT project focuses on having undergraduate science and engineering students at universities throughout the world work together in a competitive integrated product team structure to develop candidate spacecraft mission concepts for missions of interest within the Science Mission Directorate. This is the

second full year that the project has had the participation of undergraduate scientists from the College of Charleston acting in the role of the Principal Investigator (PI). The previous year has shown that this project acts as a fairly accurate representation of the conceptual design phase of a spacecraft mission with all of the issues and successes that that process continues to have. The scientists come from multiple disciplines, just as they may in the “real world”. For example, this year’s PI’s are majoring in astronomy, physics, geology and/or computer science while their teammates have strong backgrounds in marine science and biology. Together, with their engineering colleagues, they are learning to communicate across boundaries, create partnerships, and share new ideas as they build a team.

InSPIRESS. The Innovative Student Project for the Increased Recruitment of Engineering and Science Students Level I project is designed to provide a design experience for sophomore, junior, and senior students at local high schools to develop and design a payload to be accommodated on the IPT-developed spacecraft. Students in this project interact with the university undergraduates to understand the overall main spacecraft mission – in particular the primary science objectives as well as the spacecraft concept of operations and its design.

The high school students are challenged to develop a scientific question that they want to answer with data provided by their designed payload that can accomplish some secondary science objective for the mission of interest. They then have to design their payload using the standard engineering design process taught to them by Drs. Benfield and Turner throughout the year and provide a prototype of their proposed payload design to the university team to be chosen to fly on board the spacecraft designed by the university IPT program teams. This process engages the high school students and motivates them to learn about the science involved in spacecraft missions (the why), the engineering design process (the what), and the soft skills (i.e., presenting, reporting, teamwork) critical for the success of a future engineer or scientist.

Academic Year 2010-2011 Approach: For the 2010-2011 academic year two missions, with three teams competing on each mission, are being developed by the SPACE program: Radio Astronomy on the Moon (RAM) and Europa.

RAM: The RAM mission's goal is to land an array of radio astronomy telescopes on the far side of the moon using precision landing technologies developed from the Exploration Mission Systems Directorate (ESMD).

EUROPA: The Europa mission's goal is to explore the Jovian system moon Europa to understand its composition and potential existence of life.

Thirteen high school teams representing eight high schools in the Huntsville-Decatur area and one in Charleston are participating in the InSPIRESS Level I project. The high school teams are competing to provide a payload to be accommodated on the IPT-designed spacecraft. Each university team has two supporting high school teams that are competing to be selected. The selection of the payload to be accommodated rests with the university IPT, not the instructors. This selection requires close interaction between the high school and the IPT teams to continue the interaction of design changes and iterations, providing a mechanism for high school students to begin to understand college and the engineering design process.

Summary: The SPACE Program is an innovative education initiative being undertaken by several universities in an effort to train the next generation of NASA scientists and engineers. In the 2010-2011 academic year over 150 high school students and 100 university students are participating in this program. It is expected to continue to expand in the coming years as we continue to 'bring the real world into the classroom'.