Paper ID: 72583
student

IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
On Track - Undergraduate Space Education (3)

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VERTICALLY INTEGRATED PROJECT BASED METHOD APPLIED TO SMALL SATELLITE TECHNOLOGY DEVELOPMENT

Abstract

Small satellite missions and technology development presents a unique platform for preparing undergraduate engineering students for future careers. University based small satellite projects provide students access to hands-on opportunities to apply theory learned in classes through computational analysis, hardware experimentation, and product design. They also allow students to gain project management skills and see systems engineering and design life cycle from a perspective few semester long courses and lectures can provide. Since 2017, undergraduates have been involved in the Purdue University team investigating the Film Evaporation MEMSTunable Array (FEMTA), a novel microthruster that evaporates ultra-pure deionized water to generate thrust and is intended for use as active attitude control on small satellites. This technology development project is well suited for including undergraduates, as the system operation can be easily understood by a student with only an introductory understanding of fluid mechanics. Undergraduates initially investigated single axis rotation control of a model CubeSat and now focus a suborbital payload to test the propellant management system. Undergraduates earn degree credit for aiding the faculty and graduate students in this long-term, multidisciplinary, and vertically-integrated – including students from freshmen to seniors -research project team. Vertically integrating allows students to participate for their entire undergraduate studies, while providing projects with stability and a knowledge base shared amongst many students. While this method can be applied to projects that are not aerospace related, small satellite projects allow students to add a breadth and depth of subject matter to their professional development. This project has included mechanical engineers, aerospace engineers, electrical and computer engineers, and computer science majors. This environment grants students the ability to learn new perspectives and problem-solving techniques from their peers. By requiring students to earn degree credit for project work, students become more invested and develop better professional habits such as proper documentation and communication. Student testimonials have cited this project as an asset while talking with company recruiters and for graduate school applications. The same methods developed on the FEMTA project are also being applied to the Purdue student team that is developing the camera system for the NASA Solar Cruiser mission, with similar success.