

SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
ON TRACK - UNDERGRADUATE AND POSTGRADUATE SPACE EDUCATION (2)

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A PROTOTYPE-BASED SPACE SYSTEMS DESIGN COURSE

Abstract

Effective teaching of space systems design is a critical component of the education of future pioneers in space exploration. Some space systems design courses focus on paper designs of space missions, or for those with large budgets and access to launch vehicles, involve the design and launching of satellites. Many university programs, however, do not have affordable access to space, but would still like to provide a design experience that goes beyond producing a paper design. At North Carolina State University (NCSU), we have developed a space systems design course which focuses on the development of Earth-based hardware demonstrators (prototypes) of space systems concepts. The space systems design course is one of three design course options for seniors graduating with a Bachelors degree in Aerospace Engineering from NCSU (the other two options concern aircraft); the course lasts for two semesters (9 months). During the course, students are given an open-ended problem statement inspired by NASA or private space venture goals. The problem statements are given to students in the form of a Request for Proposals (RFP). Over the 9 months of the course, the students are expected to formulate requirements and identify constraints for a design which solves the problem present in the RFP, formulate a complete design which both satisfies the RFP requirements and conforms to the constraints of the course, construct the design using a limited budget, and perform tests demonstrating that the item or items constructed meet the project requirements. The students present their work in a variety of settings, including a Preliminary Design Review (PDR), Critical Design Review (CDR), a web page, oral presentations and demonstrations to an AIAA student design conference, and a presentation to a panel of experts from NASA and Academia. We believe this method of teaching the course is an effective way of exposing students to a complete cycle of the space design process, from initial RFP through the testing and reporting process, and have found that it can be accomplished within a limited budget of from 1000-1500 dollars (US) per team. In this paper, we describe the conduct of the course, chronicle its evolution over the past six years, given examples of specific student projects, detail the lessons learned in teaching the course, and provide a blueprint for others wishing to provide an affordable hardware-based space systems design course.