

Achieving Educational Outcomes Through CubeSat Curriculum Incorporation

Jeremy Straub¹, Ronald Fevig²

¹ Department of Computer Science, University of North Dakota

² Department of Space Studies, University of North Dakota

Overview

- * What types of educational outcomes can be produced by a CubeSat project?
- * Why are these outcomes highly desirable?
- * How does this relate to academic criteria? Industry criteria?
- * Discussion of the North Dakota Space Robotics Program and the outcomes that it produced

CubeSat Project Educational Outcomes

- * Technical outcomes – students learn specific and generalizable skills about satellite construction and related to supporting fields (e.g., EE / ME / CS / etc. skills)
- * Cross-Discipline Outcomes – students see the importance of other disciplines in achieving collaborative goals and learn to work with students in these areas (e.g., speak the specialized lingo, etc.)

CubeSat Project Educational Outcomes

- * Professional Development – students begin to learn what is expected in a professional work environment
- * Work Practices – students learn how to work in an industry analog work environment
- * Our distributed work environment with minimal direct interaction between some teams mirrors many large corporate-type and contractor/sub-contractor work environments

Why are these outcomes desirable?

- * Small satellite projects are highly motivational for students
- * The projects prepare students for an easier transition to the workforce
- * The projects provide excellent and inspirational examples for students to discuss at interviews with prospective employers (even if the job has nothing to do with space!)

Why are these outcomes desirable?

- * The projects may help students perform a personal 'gap' analysis and identify areas for personal improvement
- * The projects provide team working environment experience a key desire for many prospective employers

Academic & Industry Criteria

- * Small satellite projects can be incorporated within existing program frameworks
 - * Sophomore / Junior level electives or technical class incorporation
 - * Senior design project topic
 - * Project management course incorporation
 - * Well aligned with ABET requirements for engineering programs

North Dakota Space Robotics Program (NDSRP)

- * A state-wide effort that will result in the construction and launch of the first ND satellite
- * Is just completing its first year of operation
- * Has involved students and faculty at four-year college and doctoral-granting institution
- * The scope of participation is expected to expand for future years

Structure

- * Central management
- * Five distributed teams:
 - * Payload
 - * Operating Software
 - * Structure
 - * Electronics Design & Fabrication
 - * Operations

Working Style

- * Teams at a campus have a regular combined meeting
- * Teams communicate between campuses by phone, email, and Adobe™ Connect distance collaboration software
- * Significant inter-team coordination is required to achieve successful integration

What are we doing / have we done?

- * We're building an engineering prototype for a 1-U CubeSat that will initially be launched by high altitude balloon (HAB) in preparation for an orbital launch in 2013
- * Mission goals include both hardware design / integration and software design
- * The key mission goals relate to testing / demonstrating software components that would be helpful in a planetary science environment

Outcomes

- * Student comfort level for ‘space’ has increased
 - * Familiarity with SMAD and similar processes
 - * Understanding of how general engineering and software principles apply in an orbital environment and applicable constraints
- * Interdisciplinary participation
 - * Students have increased understanding of needs and capabilities of other disciplines
 - * Understanding of where their work fits into whole picture

Thanks &
Any Questions