

Motivating a future workforce: How to run a Cubesat class at a university

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Cubesat at the University of Illinois

ENG 491CU
was organized
in fall 2001.

ION1 was lost
in the DNEPR
launch

Illini Sat bus
development
begins

2001

2006

2007

To date, over 150
students have
been involved

Students from AE,
ECE, ME, CS, and GE
have all participated



Cubesat as curriculum

- Motivation: ABET accreditation require “Interdisciplinary Engineering” projects
- Course objective: To provide a design experience in a systems type project with interdisciplinary engineering



Cubesat as curriculum

- Cubesat is a great way to teach large system engineering with a small interdisciplinary design.

Small Projects

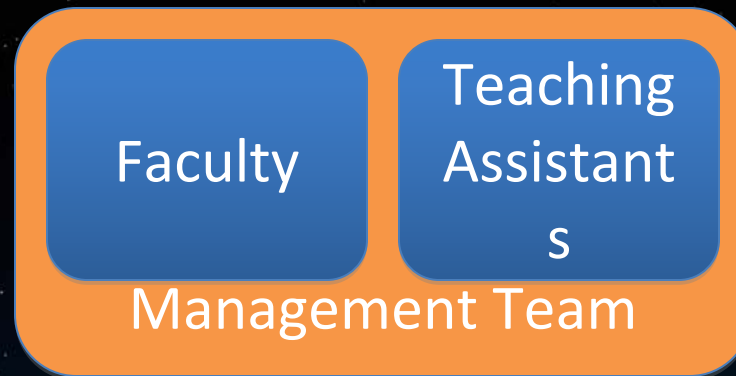


Cubesat

Large Projects



Course Management

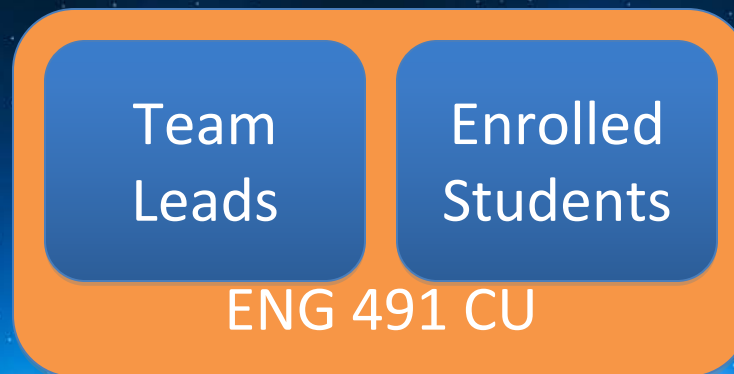


- One AE professor and one ECE professor serve as course directors and mentors
- The University supports 2 50% or 4 25% TA's each semester
- The management team has weekly lunch or conference meetings to plan for class and review team progress
- Sets goals for the semester and keeps everything moving forward

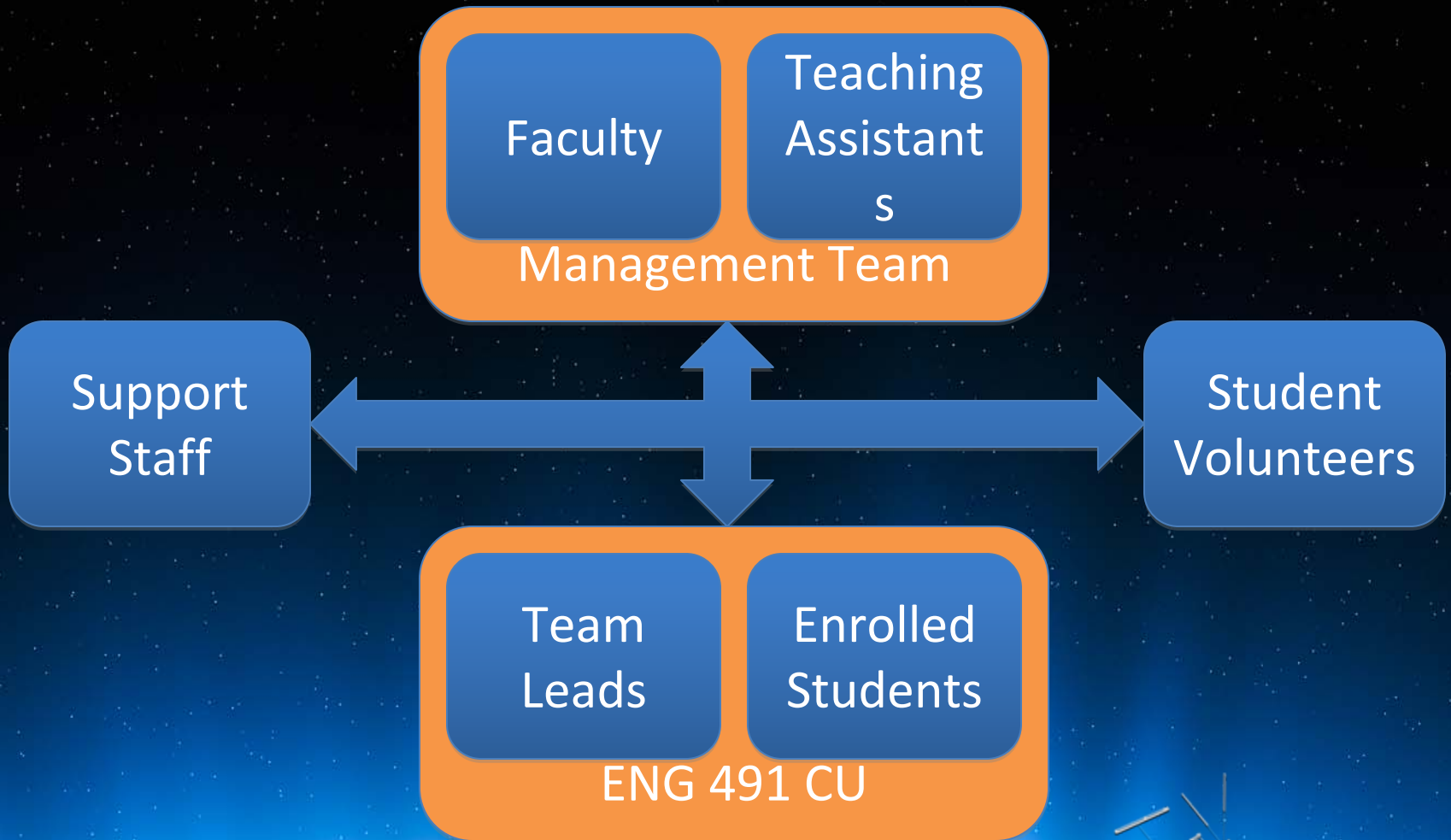


Course Management

- 3-6 students per team
- Teams include command and data handling, power, payload, communications, attitude determination and control, and structures
- A team lead is selected who serves as a liaison/spokesperson
- Each student is responsible, i.e. has ownership over their part of the project



Course Management



Course Organization

- It's a laboratory class
- One hour class per week
 - 10 min. announcements
 - 20 min. lecture
 - 30 min. action item tracking
- One hour team meeting per week outside of class with TA



Part of Spring 2009 class

Course Evaluation and Deliverables

Proposal (10%)

Design Review (15%)

Demonstration (25%)

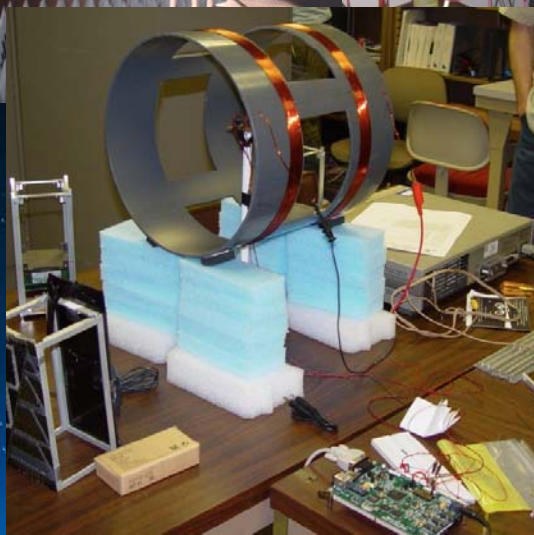
Oral Presentation (10%)

Final Report (40%)

- Evaluation sheets filled out by TA's and faculty
- Evaluations are heavy on lab fabrication and testing



Facilities at U of I



- Hardware lab with a small cleanroom, soldering station, thermal vac chamber, and 4 instrumented benches
- Software lab with 8 workstations for simulation and solid modeling
- Ground station for tracking and communicating with satellites
- Campus facilities include an electronics shop and two machine shops for fabrication.

Challenge 1: Communication



What students tell one another

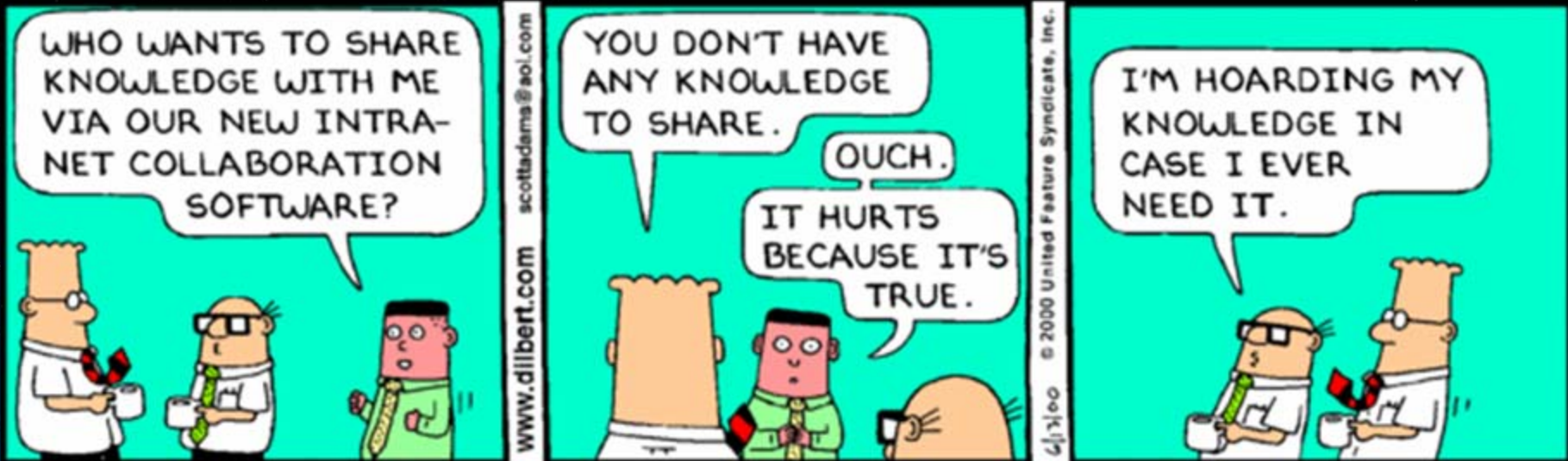
What students tell the staff



Challenge 2: Recruitment



Challenge 3: Knowledge Transfer



New students are always excited to jump in, but there is a learning curve in Cubesat

Hopefully senior students don't do this!



Our toolbox

The screenshot shows a web browser window with the URL <http://cubesat.ae.uiuc.edu/twiki/bin/view/Ion2/WebHome>. The page title is "ION 2 Web" and it is part of the "University of Illinois at Urbana-Champaign -- Spring 2009" project. The page content includes a "Class Information" section with links to "Class Schedule", "Contact Information", "Office Hours", "Master Data Sheet", "Tutorials", "Presentations", and "Course Templates". There is also a "Teams" section with links to "Attitude Determination and Control", "Command and Data Handling", "Communications", "Ground Station", "Power", "Sensors", "Structures/Thermal", and "Management Team". The left sidebar contains navigation links for "ADACS", "Communication", "Payload", "Power", "Structures", and "Management".

Twiki document management

The screenshot shows a web browser window with the URL http://cubesat.ae.uiuc.edu/tracker/view_all_bug_page.php. The page title is "View Tasks - Mantis". The page content includes a "Viewing Tasks (1 - 50 / 106)" table with columns for "ID", "Category", "Severity", "Status", "Updated", and "Summary". The table lists various tasks related to the ION 2 project, such as "Design and Build Solar Panels", "Test solar panels", "Bottom Plate Finalization", "find machine shop with 5-way tooling press", "Develop Solar Panel Assembly and Manufacturing Document", "Design Battery Casing", "Rename Parts in Assembly w/o rev number", and "Redesign of pull pin retainer -> Create Drawings".

ID	Category	Severity	Status	Updated	Summary
0000019	Solar Panels	minor	assigned (SalmanMak)	2009-04-14	Design and Build Solar Panels
0000201	Solar Panels	minor	assigned (Dori)	2009-04-14	Test solar panels
0000189	Structure	minor	assigned (petersK)	2009-04-14	Bottom Plate Finalization
0000202	Structure	minor	resolved (Dori)	2009-04-14	find machine shop with 5-way tooling press
0000056	Solar Panels	minor	assigned (SalmanMak)	2009-04-14	Develop Solar Panel Assembly and Manufacturing Document
0000003	Battery	minor	assigned (petersK)	2009-04-14	Design Battery Casing
0000198	Structure	minor	resolved (petersK)	2009-04-14	Rename Parts in Assembly w/o rev number
0000132	Structure	major	assigned (petersK)	2009-04-14	Redesign of pull pin retainer -> Create Drawings

Mantis task tracking



Acknowledgements

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- The students make the work go forward!



Outline

- Cubesat at the University of Illinois
- Why Cubesat was made part of the curriculum
- Course management, organization, and facilities
- Our toolbox for success – Effective reporting and communications

