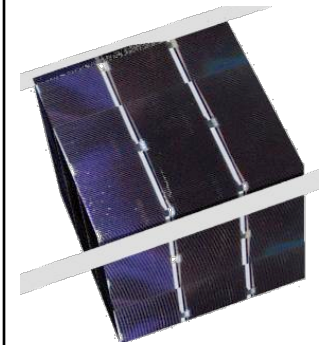


# U-Space Competition

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**(University Spaceflight Competition)**

Brian Gilchrist, Rafael Ramos  
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University of Michigan  
August 2008

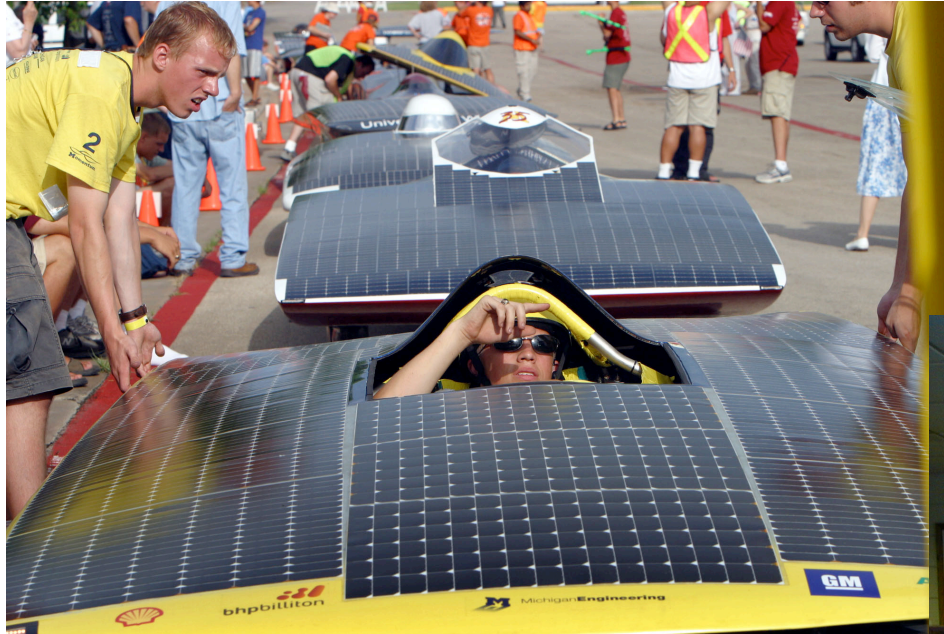


*Jump starting the next generation of space professionals careers today!*

# Challenges

- Finding ways to attract, excite and train new generations of aerospace professionals and train them to think in new ways
- Creating exciting in-space student experience opportunities with broad access given access to space is expensive and limited
  - Typically requires considerable commitment of time and effort

# Building on what we know works



Students can build small exciting spacecraft, but launch costs can be huge!

Students regularly build and privately fund *million-dollar* class solar cars for national International *competitions*



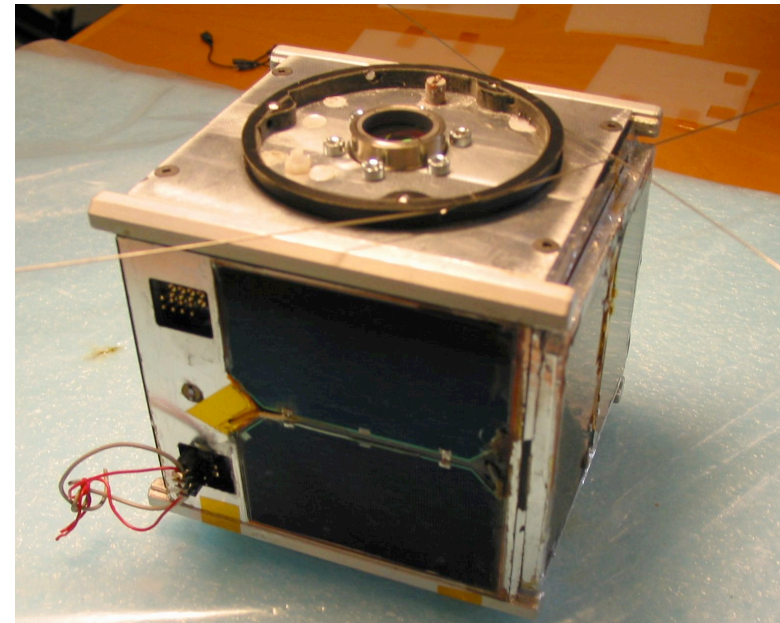
# The solution to the cost challenge is to think small

- Nano-sat (~1kg, 10x10x10cm) spacecraft called Cubesats address launch cost
  - A Cubesat launch is in the \$40k-\$50k range
  - Flying multiple cubesats at one time is feasible (Max? 24? 30?)
  - *This is a cost level where private funding of launch costs is feasible!*
- Spacecraft mass and volume constraints mean innovation, miniaturization, and sophistication are essential to win a competition



Students work in inexpensive, cube-shaped satellites, or CubeSats.

AAU Cubesat  
University of  
Aalborg,  
Denmark



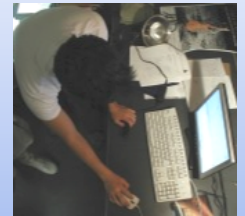
# A Possible U-Space Competition



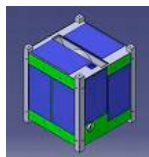
- Teams fund, design, build, test, and compete with a Cubesat that are launched together
  - Funding includes launch costs
- Competition goals would involve successful collection and analysis of required data
  - e.g. successful *operation* and data *transmission* to ground over TBD weeks
  - Example - collection of pre-defined Earth observations
- Public outreach



In-Space Operations



Tracking & Data Collection



Integration & Launch

Design, Build, Test

Media and Press Coverage



# U-Space Challenge *Possible Constraints*



- Each team must use a single Cubesat (1U) for its in-space element
- Funding of Cubesat, its flight, and operations would be each team's responsibility
  - Competition sponsorship could help lower costs
- Team must use their own transportable telemetry and commanding ground station
- Same ground station must be operated from at least two locations separated by a minimum TBD distance during the competition
- Orbit details would be preliminary and only finalized once a specific launch has been defined

# Possible U-Space Challenge Scenario: 4 phases



- Phase 0: Teams Selection “Competition”
  - Passing this milestone reserves a launch space
- Phase I: Cubesat Design, Build and *Flight Competition Review* (FCR)
  - Each *university* participates by constructing flight unit
  - Ends in official Cubesat FCR
  - Each Cubesat gets a “Go/No Go” official result
- Phase II: Cubesat Test, Integration, and Launch
- Phase III: U-Space In-Space Challenge



# There are practical questions needing an answer to know if U-Space is feasible, e.g.

- How will spacecraft communications for each team be handled?
- What orbital constraints will be required for competition?
- How will Cubesat launcher integration logistics be handled?
- What are the practical limits to the number of Cubesats flown at once?
- Should this be limited to educational institutions?



# What needs to happen next?

- Get community feedback, generate interest
- Create a more complete model of the proposed U-Space Challenge
- Generate a better understanding of competition costs and schedule