Space Grant Leadership in Coordinated Student In-Space Experiences

University Spaceflight Competition (U-Space), Technology Demonstration, Science Measurements, plus more!

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Jump starting the next generation of space professionals careers today!
Common Goal

- Find ways to *attract, excite and train* new generations of *multidisciplinary* aerospace professionals that must think in new ways

Approach

- Create *exciting in-space student experience* opportunities with broad access
  - Build on Space Grant “Crawl, Walk, Run, Fly” theme
  - *In-space and challenging* are valuable in attracting students broadly from multiple disciplines
Use Solar Car Competition Model

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

Use solar car model to create exciting, sustainable *in-space competition*.
Informal SG Director Discussion

- Mike Drake (AZ)
- Luke Flynn (HI)
- Alec Gallimore (MI)
  - (Brian Gilchrist)
- William Garrard (MN)
- Philippe Geubelle (IL)
- Chris Hall (for Mary Sandy VA)
- Angela Des Jardins (MT)
Feedback

- Real interest in opportunities that provide broad access to space for our students.
- Regularly occurring, coordinated space flight program involving many universities could provide such an opportunity
  - for example, a single mission every two to three years.
- The focus or theme of such an activity could take more than one form, e.g.
  - Common science mission,
  - Technology demonstration, or a
  - Student competition (U-Space)
Feedback (Cont.)

- Such a space flight activity might fit well into a broader, but coordinated, set of programs that includes balloons, sub-orbital flights, etc.
- The vision of promoting such a recurring space flight opportunity and its impact on developing the U.S. workforce could be a *great opportunity for Space Grant*
- The predictability of launch and associated (launch) costs are a concern that must be clarified early on.
CubeSat Launch Opportunities (Changing Landscape)

- NASA released RFI to launch university CubeSats.
- AF Space Development Wing (formerly Space Test Program) supporting CubeSat launches on Minotaur.
- SpaceX stated intent to make CubeSat launches opportunities available on future Falcon 9 launches.
  - SpaceX already demonstrated Falcon 1 CubeSat launch
- ULA (United Launch Alliance) announced capability and interest in supporting CubeSat launches
  - Capacity of 60 - 1U CubeSats/per year starting in 2010.
- Foreign launch opportunities increasing
  - PSLV (India) with over 4 CubeSat launches planned for 2010
  - Vega (ESA) launch opportunity being defined.
Interest in Cubesats Growing (Changing Landscape)

- NASA RFI for CubeSat Launch
- NSF interest and funding of at least one (3U) CubeSat per year
  - Space weather and Atmospheric, Thermospheric, and Mesospheric (ATM) science.
- AF ORS (Operationally Responsive Space) has expressed interest in CubeSats for technology demonstration
- NRO's QbX program developing CubeSat technology payloads (for flight)
- Industry and other U.S. Government agencies positioning to use CubeSats
CubeSat Launch Costs

- Upward pressure on costs as interests grows
- Not possible to quote a simple, single price for all cases
- Cost driven by
  - Launch vehicles
  - Number of “identical” CubeSats/launch
  - Requested special services
- For given launch vehicle, single customer “quantity discounts” help (to a point)
- Mission flexibility helps significantly
CubeSat Project Co-Director: Jordi Puig-Suari (Cal-Poly)

- “I am very supportive of the idea of expanding opportunities for educational space flight missions!
- “I see a vision of a regularly occurring, coordinated flight activity involving many cubesats from different schools (e.g. 20, 30, or possibly more), flown as a single mission, as being feasible in the years to come.
- “The NASA Space Grant Consortium seem(s) to be an ideal group to organize such an activity.”
CubeSat Project Co-Director: Bob Twiggs (Stanford)

- Coordinated, recurring flight opportunity great!
- “Space Grant seems an ideal organization to lead!”
- Suggests starting pilot program to fly in 3 years leading to recurring build activities every 18 mos or so.
- Sees opportunities to connect with those interested in technology demonstration and/or science mission data
- Excited! Ready to help lead now!
Recommendations for Space Grant

- SG should **take the lead** in creating a nationwide, student-centric CubeSat flight program
  - Students want it
  - Elements of Industry and Government want it
  - SG seems well positioned to do this!

- Space Grant should study now
  - How SG can take leadership role in such an initiative
  - How such a program could be practically organized
  - What cost model is most viable, and
  - How to best attract resources for such an initiative.
BACK – UP SLIDES
Important Features of Solar Car Competition

- Government (DOE) and industrial sponsorship (GM, Toyota) of competition
  - Each car/team is self-funded
- Fund raising – design – fabrication – test – operations/logistics – strategy - outreach
- Most successful teams have strong tradition of mentorship
- Longevity of bi-annual competition allows schools and students to plan
Possible U-Space Competition 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 Competition**
There are practical questions to be answered, e.g.

- Regular availability of launch platform?
- What are practical limits to number of Cubesats flown at once?
- What orbital constraints will be required for competition?
- How will Cubesat launcher integration logistics be handled?
- How will spacecraft communications for each team be handled?