A Sub-Orbital Hardware Apprenticeship Program

to Train

Future Generations of NASA Scientists and Engineers

Motivation

- Where will we obtain the workforce to execute ambitious goals we have?
- How and where will they be trained?
- 1950s - 1960s: Apollo trained work force of 400,000;
- 1960s - 1970s: Declining work force;
- 1970s – present: Work force has remained roughly constant, but aging;
- 30-year Moon/mars time frame will require ~100k new engineers & scientists
- Long-sightedness and aggressive action required by NASA leadership
- Most pressing need will be for engineers & scientists able to develop hardware

A Guiding Principle:

- For those who have been associated with sub-orbital activities, it is **self-evident** that the relatively inexpensive hands-on experience provided there is an ideal way for engineers, and scientists to prepare for future careers in space science.

Existing Programs:

- Penn State: Student Program Involving Rocket Investigation Techniques (SPIRIT; Tim Wheeler)
- LSU: Advanced Thin Ionization Calorimeter (ATIC; Balloons; Mike Cherry)
- NASA: Student Launch Initiative (SLI; Dave Bohlin)
- Stanford University (and others): CubeSat
- Various Universities: R&A supported active research programs utilizing rockets, balloons, and aeronautic assets
- Others….

Eric has circulated short white paper outlining the need and proposing a pilot program that includes two elements:

1) **University Sub-Orbital Course**
   A for-credit academic year program involving undergraduate and early graduate students. Hardware costs at University and WFF to be covered by NASA. Faculty salary covered by academic institution (as part of normal teaching load). Activities to culminate in annual rocket, balloon, or aircraft launch, featuring scientific and/or engineering measurements in flight, followed by post flight analysis of data and hardware performance. More Senior students to adopt leadership positions and mentor junior students

2) **Summer Sub-Orbital Course**
   A for-credit summer course, also involving undergraduates and early graduate students, culminating in a rocket or balloon launch at end of 6-10 week training and development process. Similar approach to measurements and post flight analysis.

These activities would be distinct from ongoing Sub-orbital Research activities.

Conceptual rocket payload for proposed Undergraduate Student Launch Program

- Terrier Orion launch vehicle
- Wallops launch range
- Water recovery

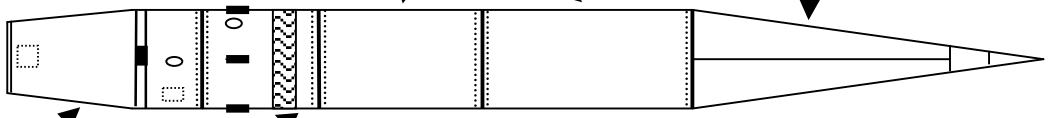
Nose Cone options:
1) Deployable clam shell for exposure of instruments at low altitudes;

2) Forward ejecting for exposure of instruments at high altitude

3) Fixed and sealed

Sealed experiment sections

- Internal rack structures
- Adjustable deck plate mounting to accommodate different height instruments



2nd Stage ignition and despin systems with recovery system housed in aft transition section

Basic telemetry system

(Thanks to Phil Eberspeaker)

Next Steps:

- Study existing and past programs (take the best; leave the mistakes)

- Develop concept in more detail; integrate balloon and aeronautics elements

- Brief concept to HelioPhysics and SMD management

- Develop detailed pilot program Plan

- Implement pilot program using SMD funds

- Perform evaluation and mid-course corrections

- Expand planning to broader program

- Implement broader program utilizing funds from NASA EPO