

Launch and Field Operations without leaving your Office and CubeSat Test Opportunities

Prof. Bob Twiggs
Stanford University

CubeSat Developers Workshop
April 19-21, 2007
Huntington Beach, Ca

Overview

- **Need for incentives for new students**
- **Need for bringing launches to the classroom**
- **Opportunities for testing CubeSats**
- **Bringing new students into the space community**
- **Beyond CubeSats**

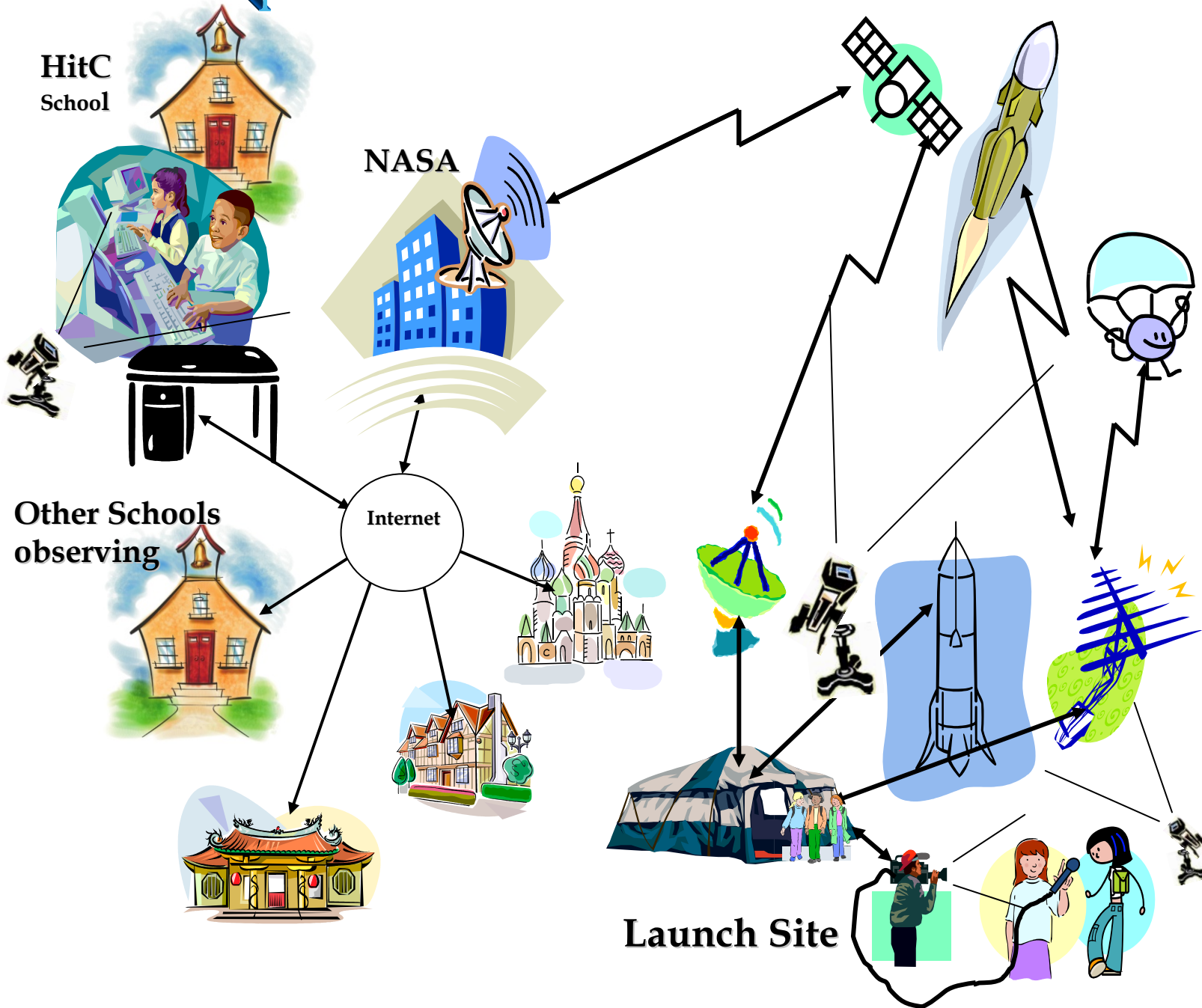
Need for incentives for new students

- Why aren't students interested in Science & Math?
 - "Most boring subject – no connection to real world"
 - "Video games much more fun"
 - Bad teachers discourage students
- Should all students be interested in Science & Math?
- Should all students go to college?
- We need feed lines of students that want to take challenge of STEM
- How do we encourage students to get in that line?

Need for bringing launches to the classroom

- **Provide programs in grade and high school for student space experiments**
 - **Build payloads for LOW space simulation & activities**
 - **3 ft diameter balloons**
 - **100k ft altitude balloons**
 - **Amateur rockets 12k ft, 30k ft, 60k ft, 100k ft, 380k ft.**
 - **Problem---→ can not take all students to launch**
 - **Take the launch to the students**
 - **Have trouble launching rockets launching rockets from Stanford Campus**
- **Get real time data link (GEO links) from launch sites to classroom**
 - **Real time two-way video**
 - **Two-way audio**
 - **Two-way data to test payload and get payload data during test**

Space Mission Center in the Classroom



Space Mission Center in the Classroom



Ames Research Center

Fremont High School
Sunnyvale, California



LOCKHEED MARTIN
We never forget who we're working for!

NORTHROP GRUMMAN

SPACE SYSTEMS
LORAL

SPACEX

Jet Propulsion Laboratory
California Institute of Technology

Raytheon

BOEING

Orbital

THE AEROSPACE CORPORATION



APL



Launch Site
Data

Live Video

Classroom

Launch

Launch

000

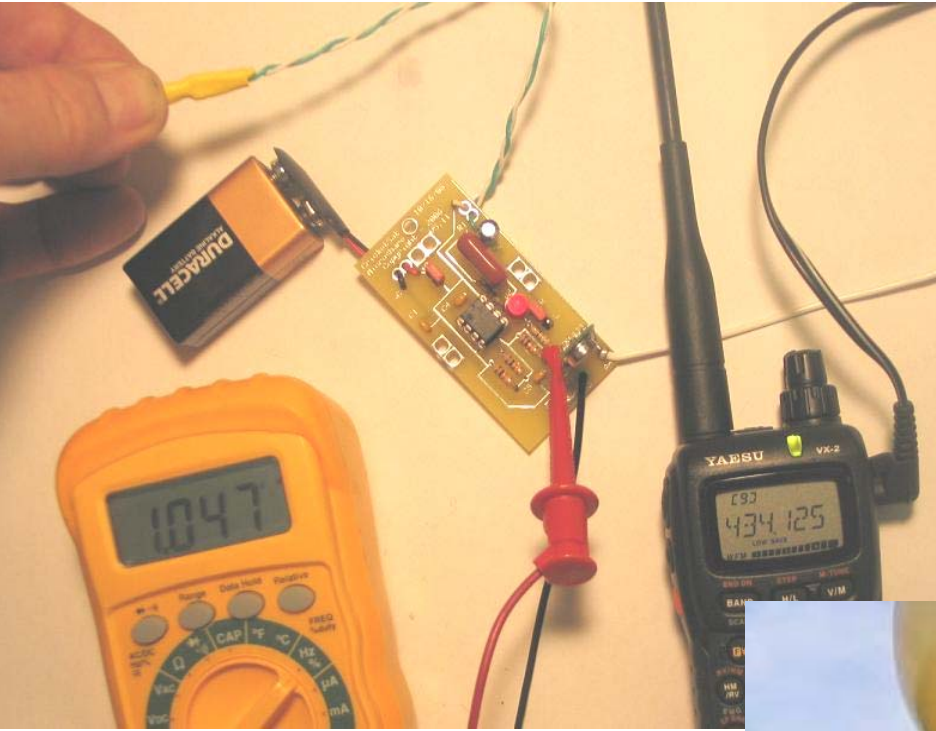
000

Opportunities for testing CubeSats

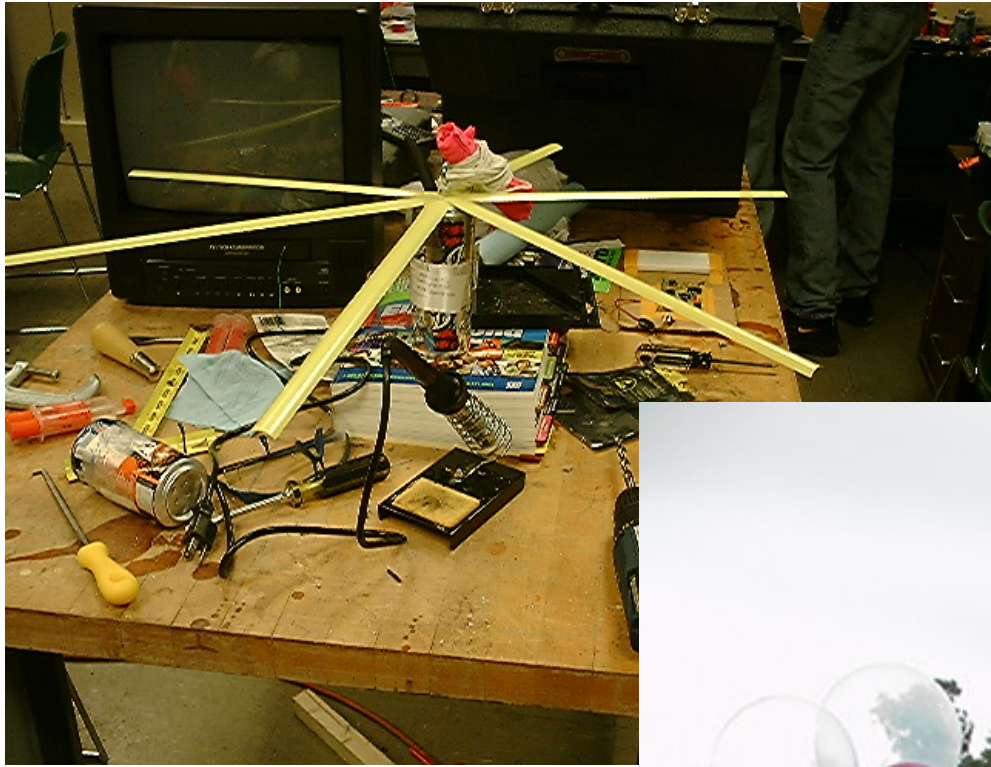
•Payload flight opportunities

- 3ft diameter balloons (Do it yourself)
- 100k ft altitude balloons (Several Universities)
- Amateur rockets 12k ft (ARLISS – Sept every year)
- 30k ft, 60k ft, 100k ft, 380k ft (Rocket Maverick – July, Oct)
- 5k ft - ??? (Garvey SC – July, August,)
- ??? – way up there (Lunar Rocket & Rover – this year)

CricketSats - on balloons



CanSat- on balloons



CanSat - on airplanes



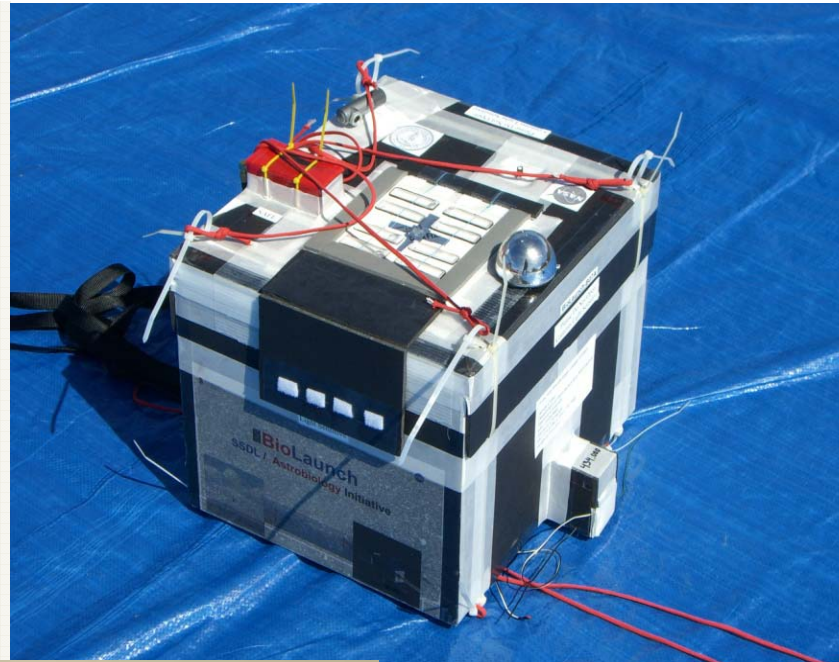
CanSat - on rocket



CubeSats - on balloons

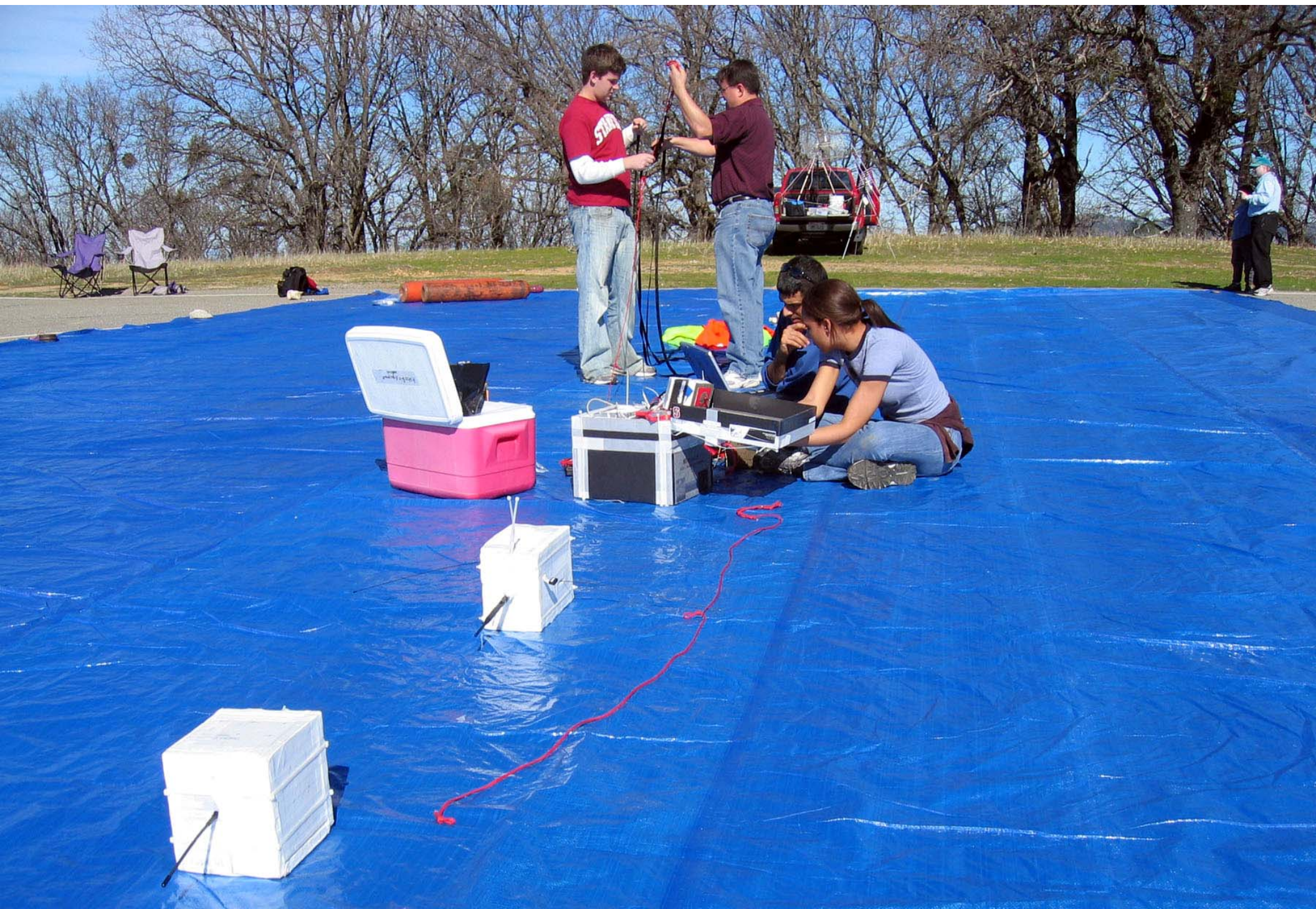
Flight Hardware and Experiments Spectrometer Flight Box

Spectroradiometer
Radiation Exposed
Cuvettes
AstroChemistry
Experiment
PC104 Computer
WebCam
GPS and Radio Beacons





Flight Operations



Flight Operations



Flight Operations



Flight Operations



Flight Operations



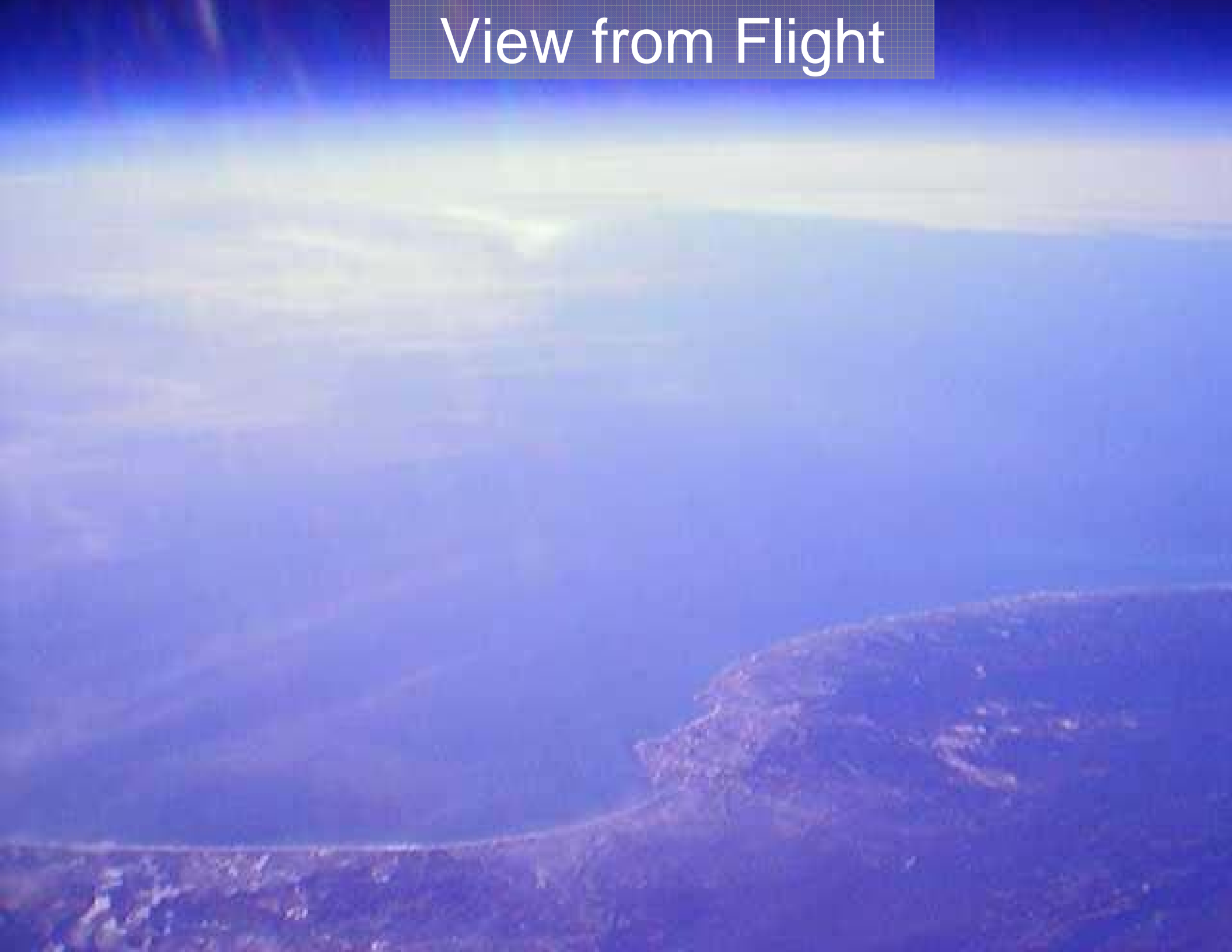
Flight Operations



View from Flight



View from Flight



Ground Station



Flight Profile



© 2007 Europa Technologies

Image © 2007 TerraMetrics

© 2007 Google™

End of the Flight



Bringing new students into the space community

- Take fun projects to the schools**
- Need full time mentors**
- Need micro funding to purchase materials**

Effort being lead by:

**California Space Authority
WIRED Program**

See Christine Purcell

Beyond CubeSats

Moon

Mars

Asteroids

Comets

And beyond

**Questions for
You?**

**Think about where we
10 years ago with small
satellites?**

**Where will we be
10 years from now?**

Beyond CubeSats

Moon

Mars

Asteroids

Comets

And beyond

Thanks







