



The Kentucky Space Missions and Infrastructure

Jason R. Bratcher
<http://www.kentuckyspace.com>

CubeSat Developers' Workshop
San Luis Obispo, CA
24, April 2009



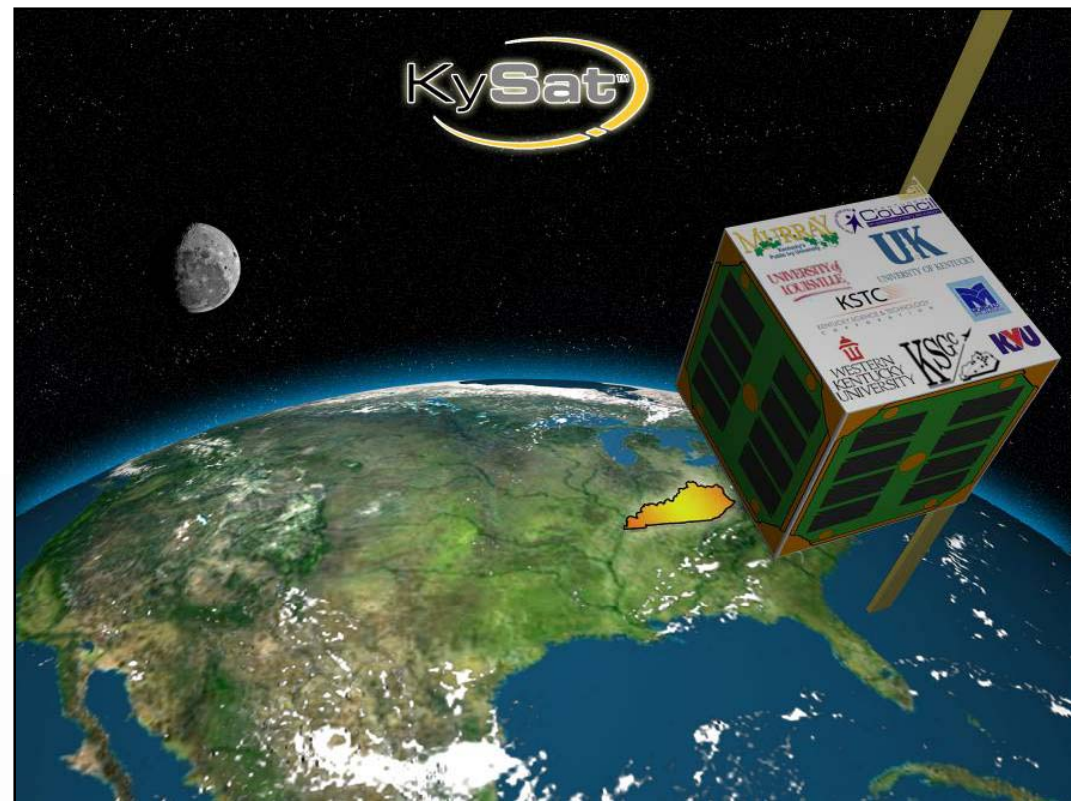
Kentucky Space Enterprise





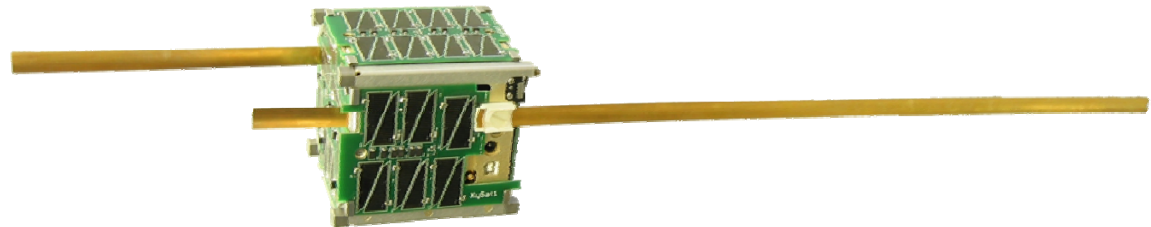
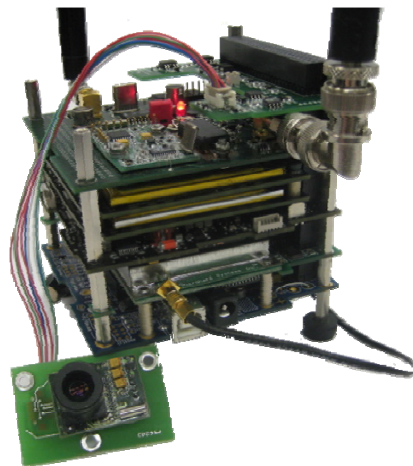
Kentucky Space

- ❑ Orbital
- ❑ Near-Space
- ❑ Sub-Orbital
- ❑ Infrastructure



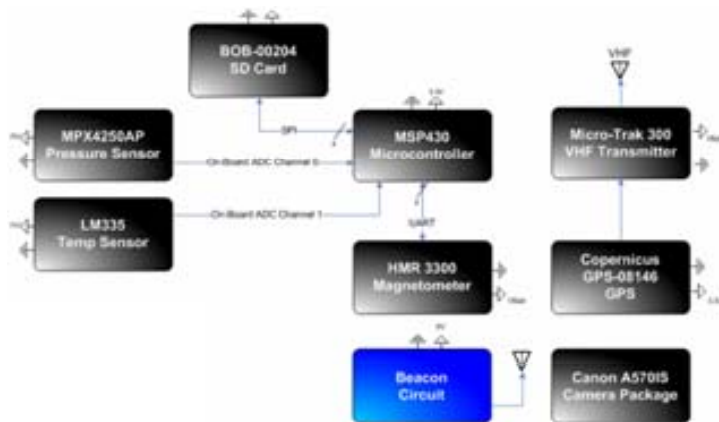
KySat-1

- ❑ NASA mission
- ❑ Test KySat Bus Standard
- ❑ Establish Flight Heritage
- ❑ Leverage COTS Subsystems
- ❑ K-12 Outreach



Balloon-1 Mission

- ❑ GPS altitude, pressure, and temperature sensors
- ❑ Simplex voice repeater, spot tracker, AX.25 telemetry
- ❑ Over 800 flight photos
- ❑ Successful Outreach – PearlSats

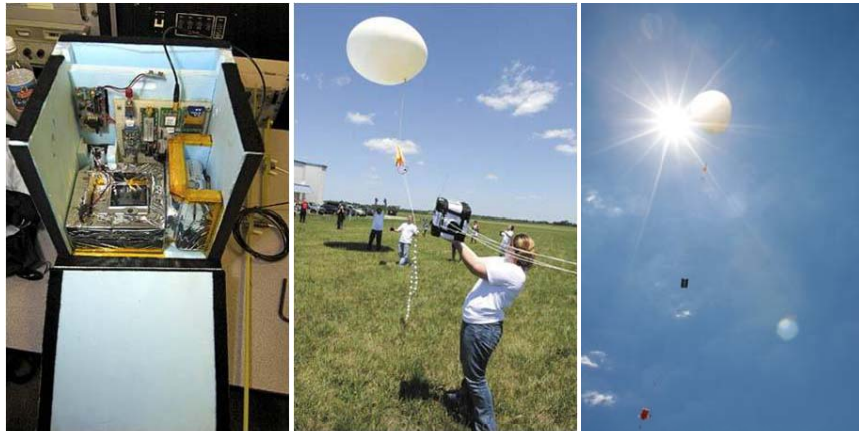


Warren County Airport,
Bowling Green, KY
Monday, 14 July, 2008

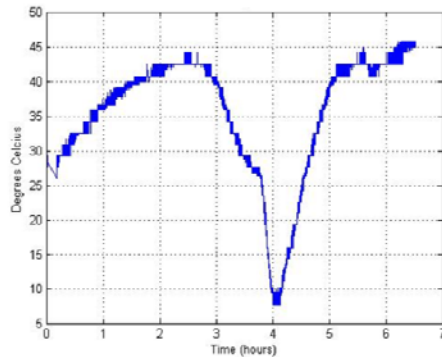




Balloon-1 Mission

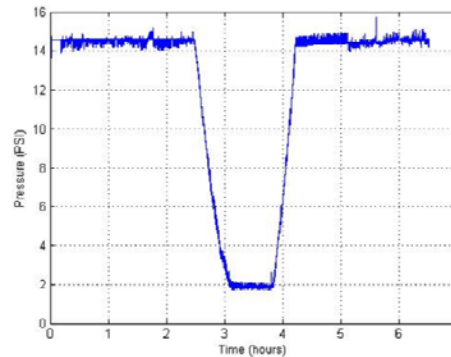


Temperature



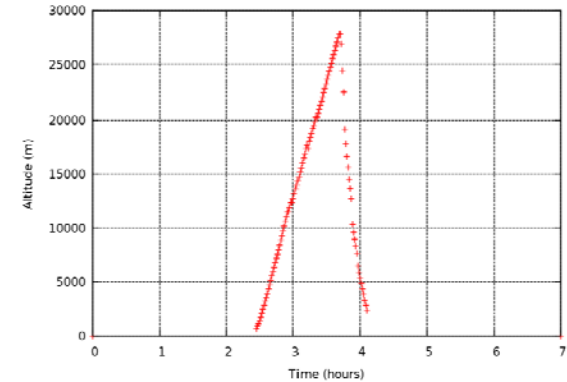
24 April, 2009

Pressure



CubeSat Developers' Workshop

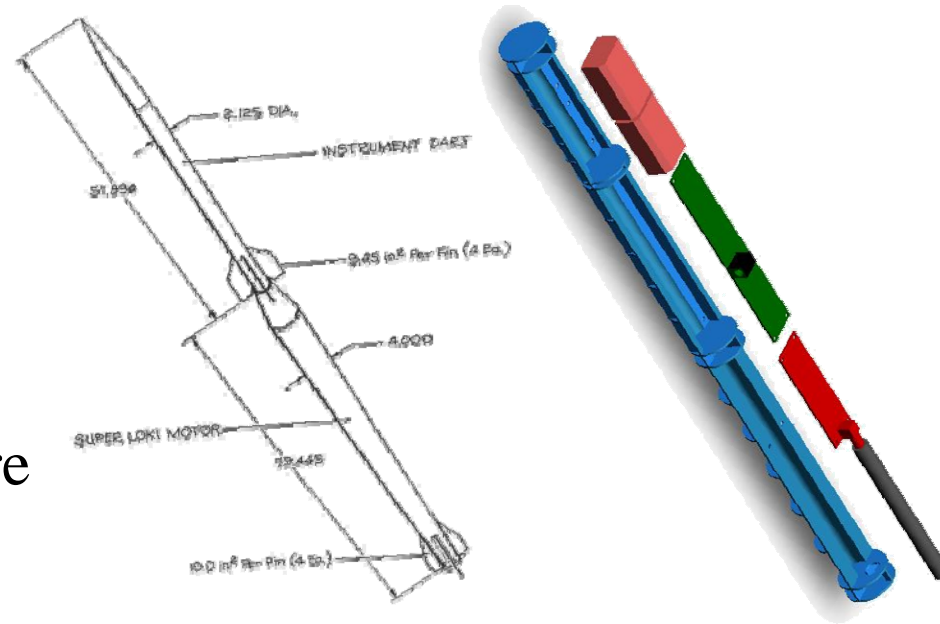
Altitude



7/19

Space Express

- ❑ Sub-Orbital Training Mission
- ❑ Testing Processes
- ❑ Working with Launch Integrator
- ❑ Flight Testing Hardware and Software



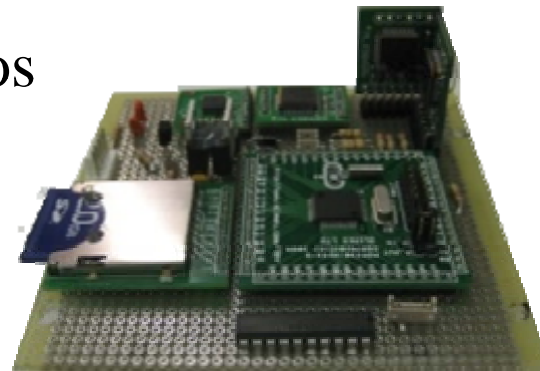
Space Express



White Sands Missile Range
White Sands, NM
5 December, 2007

Garvey Spacecraft P-12A

- ❑ 6 DoF IMU
- ❑ +/- 6g accelerometers
- ❑ 300 degree/s gyros
- ❑ SD Data Log
- ❑ Reconstruct Flight Path



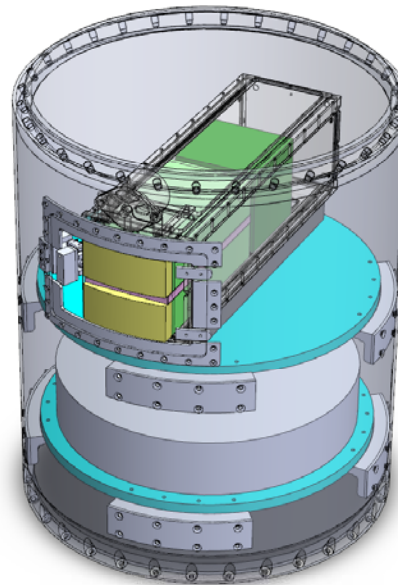
Mojave, CA
11 October, 2008



SOCEM

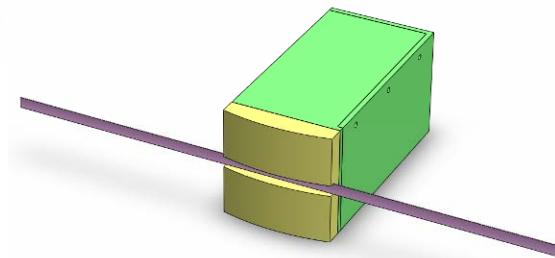
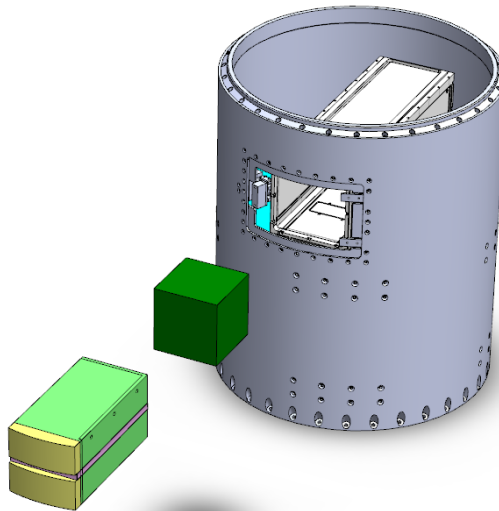
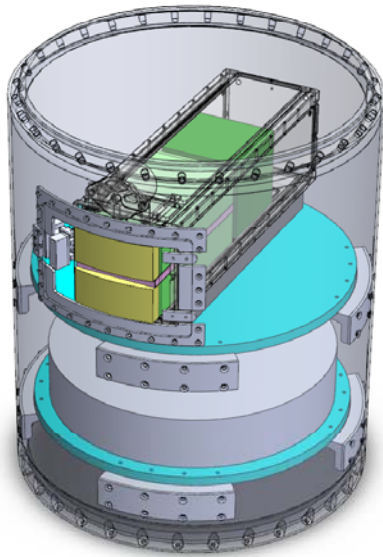


- **S**ub-
- **O**rbital
- **C**ubeSat
- **E**xperimental
- **M**ission





SOCEM Experiment Concept



Infrastructure



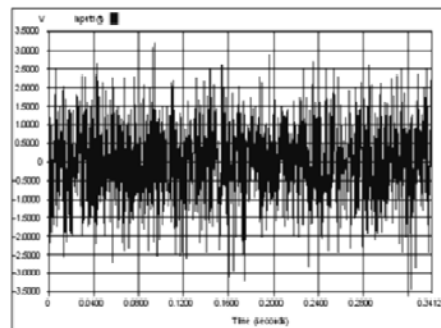
Thermal Vacuum Chamber

- Patch Heaters and Liquid Nitrogen cooling jacket for 1U CubeSats (-40 to +80C)
- Vacuum System
 - 10^{-8} torr empty
 - 10^{-6} torr with gas load



Shaker Facility

- ❑ MB Dynamics C10E
- ❑ 1200lbs max sine
- ❑ Find natural harmonics of hardware
- ❑ Random vibration to simulate launch



Ground Station Network

- S-Band Earth Station
 - A 21-meter fully steerable dish
 - L-Ku band Radio astronomy and S-band communications
- VHF/UHF Earth Stations
 - Morehead Space Science Center and UK Space Systems Laboratory (soon Murray State)
 - Remote/Automated operation and satellite tracking



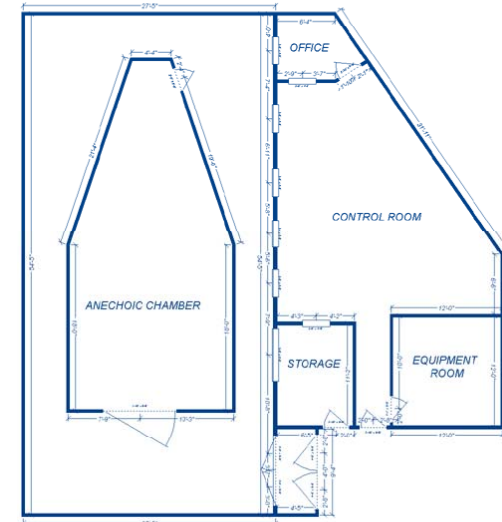
Space Science Center

- ❑ 45,000 ft², \$15.4 Million
- ❑ RF and electronics laboratories
- ❑ Advanced computing facility
- ❑ Rooftop antenna test range
- ❑ Clean rooms (micro-nano laboratory, space systems development laboratory)
- ❑ Digital Star Theatre



Anechoic Chamber

- Anechoic chamber that mimics electromagnetic environment of space
- Empirical measurements of antenna parameters
 - Radiation patterns
 - Gain
 - Radiated power stability
 - System temperature profiles
 - EIRP



Far Field Range

- Free space antenna range
- 100 MHz to 18 GHz
(extension to 40 GHz)
- Remote location and RF shielding of mountains provide an ideal RFI environment
- Antenna Test range
Positioner and control room





<http://www.kentuckyspace.com>

Jason R. Bratcher
jason.r.bratcher@gmail.com

