KySat-1 Status
Lessons Learned

Tyler J. Doering
http://www.kysat.com

CubeSat Developers' Workshop
San Luis Obispo, CA
11 April 2008

Outline

- Introduction to KySat
- Space Express
- KySat-1 Status
- CubeSat Infrastructure
- Lessons Learned

Ownership Consortium

KySat

UK UNIVERSITY OF KENTUCKY

MURRAY Kentucky's Public Ivy University

MOREHEAD STATE UNIVERSITY

KCTCS

UNIVERSITY of LOUISVILLE dare to be great

WESTERN KENTUCKY UNIVERSITY

KSGC Kentucky Space Grant Consortium

ONE MISSION: BETTER LIVES KENTUCKY Council on Postsecondary Education

KSTC KENTUCKY SCIENCE & TECHNOLOGY CORPORATION

KENTUCKY SCIENCE & ENGINEERING FOUNDATION

Belcan

Mission Partners

STANFORD Aeronautics & Astronautics SSDL Space Systems Development Laboratory

Ames Research Center

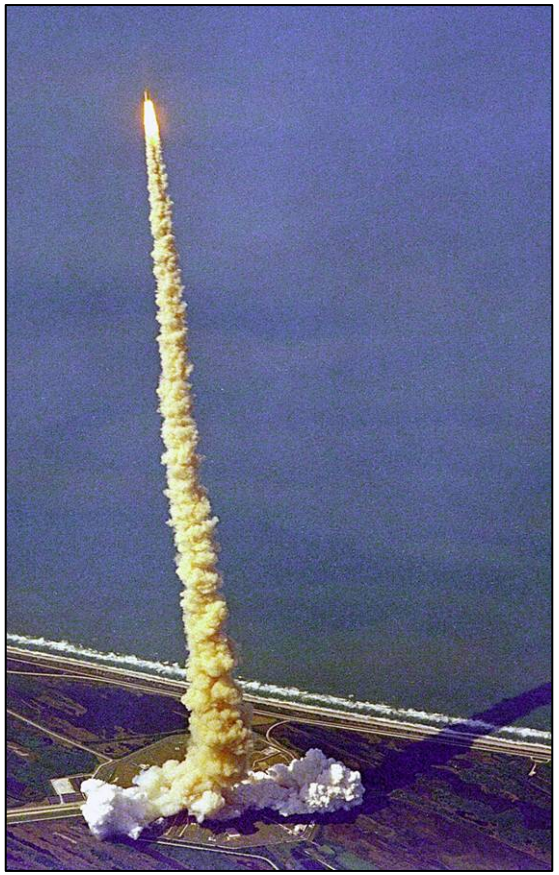
KatySat

KVC KY VIRTUAL CAMPUS

CAL POLY

Kentucky Space Enterprise

- Technology
  - Satellites Every 12-18 Months
  - KySat Bus Standard
  - On-Orbit Operations Network
  - Cubesat Test Capability
- STEM Learning
  - Payload Design Opportunities
  - On-orbit Learning Applications
  - K-12 Outreach Emphasis
- Commercial Applications
  - Kentucky Spin-offs
  - Experimental Payloads



Space Express Mission

- Sub-Orbital Training Mission
- Flight Testing Hardware and Software
- Flight Testing Processes
- Working with Launch Integrator
- Going to Space

The Launch

- Launched December 5th
- White Sand Missile Range
- Super Loki Sounding Rocket
- First 1.5 Seconds were Perfect

Super Loki Smoke Trail

- Dramatic Roll/Yaw “Maneuver”
- Payload Sent a Packet at T+7 Seconds (Survived the Break-Up)
- Possible Failure in Composite Tube
- Mission Takeaways
  - Integrator Communication
  - Mission Deliverables
  - Launch/Integration Schedule

Smoke Trail Back to KY

Kentucky satellite launch a failure

By Art Jester
ajester@herald-leader.com

The journey to space began with a bunch of failures. Check out NASA's record in the late 1950s, before manned flights.

On Wednesday, Kentucky was left with mixed results after it first satellite — unmanned, of course — was launched at the vast White Sands Missile Range, N.M., where the United States set off the first atomic bomb in 1945.

Kentucky's scheduled five-minute, suborbital flight ended after about 1½ minutes in what was called a "catastrophic structural failure" with the 10-foot rocket and

See SATELLITE, B3

CAMILLE WEBER | cweber1@herald-leader.com

SATELLITE Orbital launch still planned

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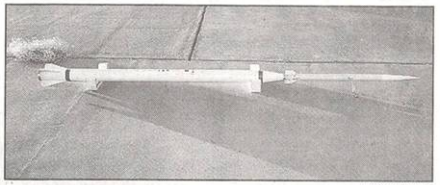


PHOTO PROVIDED

Kentucky's first satellite was scheduled for a five-minute suborbital flight, but it lasted only 1½ minutes.

booster. The satellite failed to reach its target altitude of 127 kilometers and did not go into space.

But Kris Kimel, president of the Kentucky Science & Technology Corp., sponsor of the KySat Space Express, said the result "doesn't have any real effect" on the planned launch of an orbital satellite after July 2008.

The problem Wednesday, he said, was with the first or second stage of the vehicle sent aloft by a California company for KySat.

"We had a very successful lead-up to launch, and the payload the students designed functioned properly," Kimel said yesterday from San Jose, Calif., at a conference on space. "The caliber at which they're learning is very high — communications, scientific sensors, temperature sensors."

"People at this conference are saying to me, 'Welcome to space,'" Kimel said. "These failures are not uncommon."

Kimel said the failure was caused by some combination of speed, heat and pressure. The booster and launch by Lunar Rocket and Rover Co. of Los Alamitos, Calif., cost KSTC $28,000, Kimel said.

The company remains among several U.S. and overseas firms in the running for the 2008 orbital launch, which will cost $45,000 to $75,000, he said.

The 2008 mission was originally going to launch from Kazakhstan, using a former Soviet intercontinental missile once armed with a nuclear warhead aimed at the United States. For several reasons, KySat is now looking for another site, Kimel said.

Tyler Doering, of Walton, a University of Kentucky graduate student in electrical and computer engineering, was student design team leader.

"We were not necessarily happy," Doering said. "Our team succeeded in delivering a working payload that survived the flight. We did everything we could, and the failure was out of our hands."

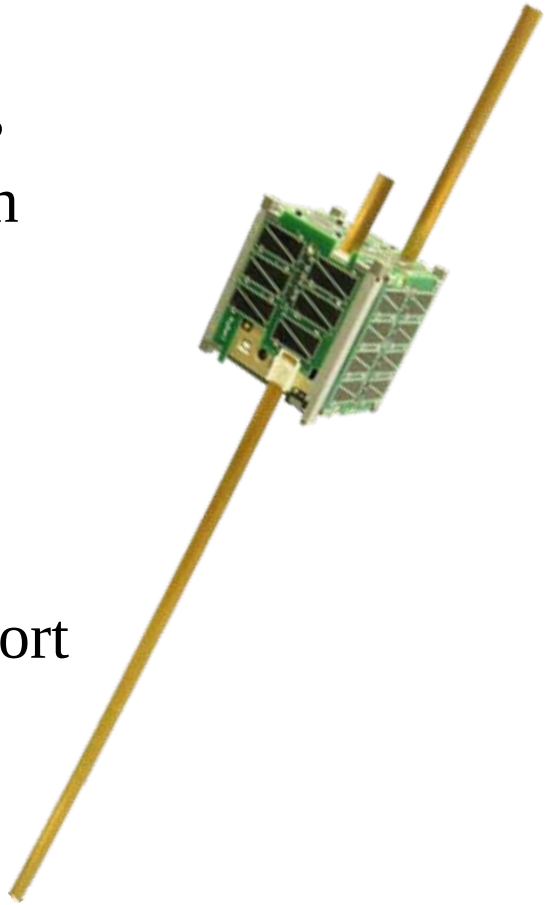
"What we were doing is definitely not easy," he said. "It's a really huge engineering project. You're pushing yourself to the edge of your knowledge and stamina."

The team worked from 4 a.m. to 11 p.m. for four days at White Sands, he said. The 12 students were from UK; University of Louisville; Kentucky Community and Technical College System; and Morehead State, Murray State and Western Kentucky universities.

For more, go to www.kysat.com.

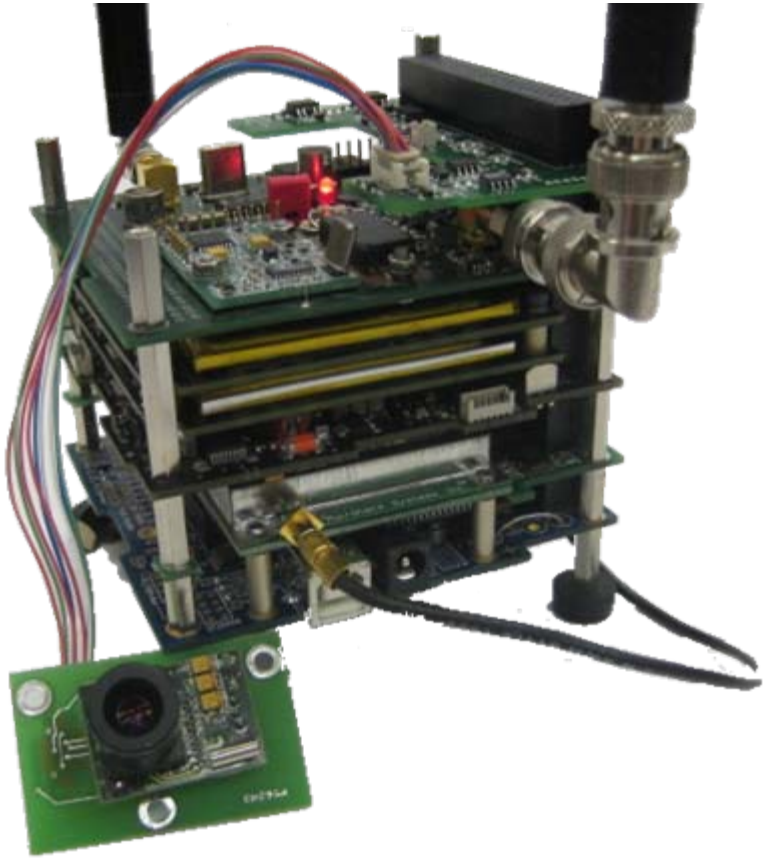
KySat-1 Mission Objectives

- The Purpose
  - Build Technological Interest in Students
  - Science, Technology, Engineering, Math
  - K-12, 13-16, 17 plus…
- The Plan
  - Attractive Concept of Operations
  - Provide a Satellite to Enable ConOps
  - Provide Educational and On-Orbit Support



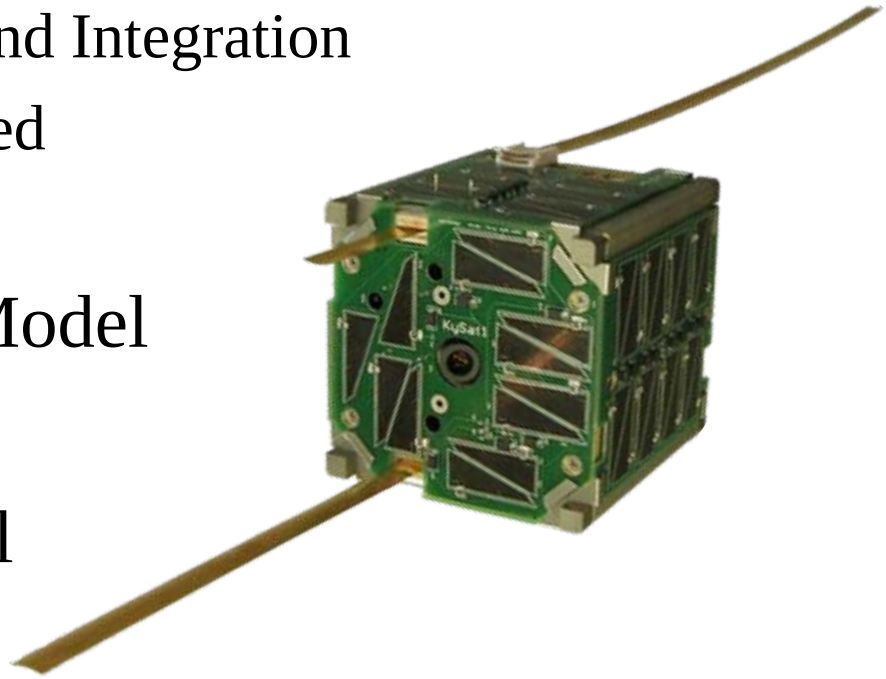
KySat-1 Bus

- KySat Solar Cells Arrays
- Pumpkin Frame
- Pumpkin FM430
- Microhard S-Band Radio
- KySat System Support Module
- Clyde Space EPS
- StenSat UHF/VHF Radio
- KySat Payload Interface Module



Status of KySat-1

- Engineering Model Complete
  - Flight Software Testing and Integration
  - Hardware Stack Completed
  - Mechanical Integration
- Testing of Engineering Model
- Facilities Established
- Assembling Flight Model
- Testing Flight Model



CubeSat Infrastructure

- Cleanroom
- Vibration Facilities
- Anechoic Chamber
- Thermal Vacuum Chamber
- 2 UHF/VHF Ground Stations
- 21-M S-Band Ground Station
- Services Available

Lessons Learned

- Project Management
  - Multi-University Team
  - 1 Satellite, 6 Universities
- Talent Recruiting
  - Getting Good Students
  - Keeping a Large Team Involved
  - Always Training Replacements
- Establishing and Maintaining Schedules
  - Schedule Documents Length of Past Tasks, to Predict Duration of Future Tasks
- Establishing Facilities takes Time and Energy
  - Never too Early to Start Tracking Satellites and Vibrating Hardware
- Developing Techniques on Flight Hardware
- COTS Hardware
  - Still Takes a Large Integration Effort
- Industry Collaboration
  - Belcan

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