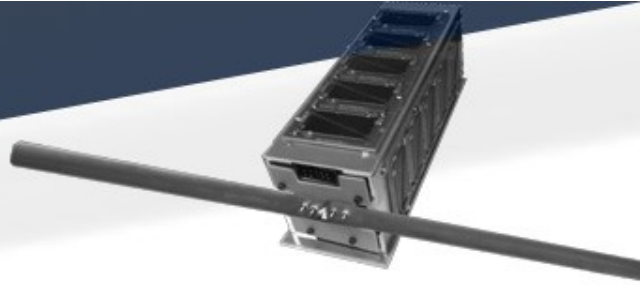
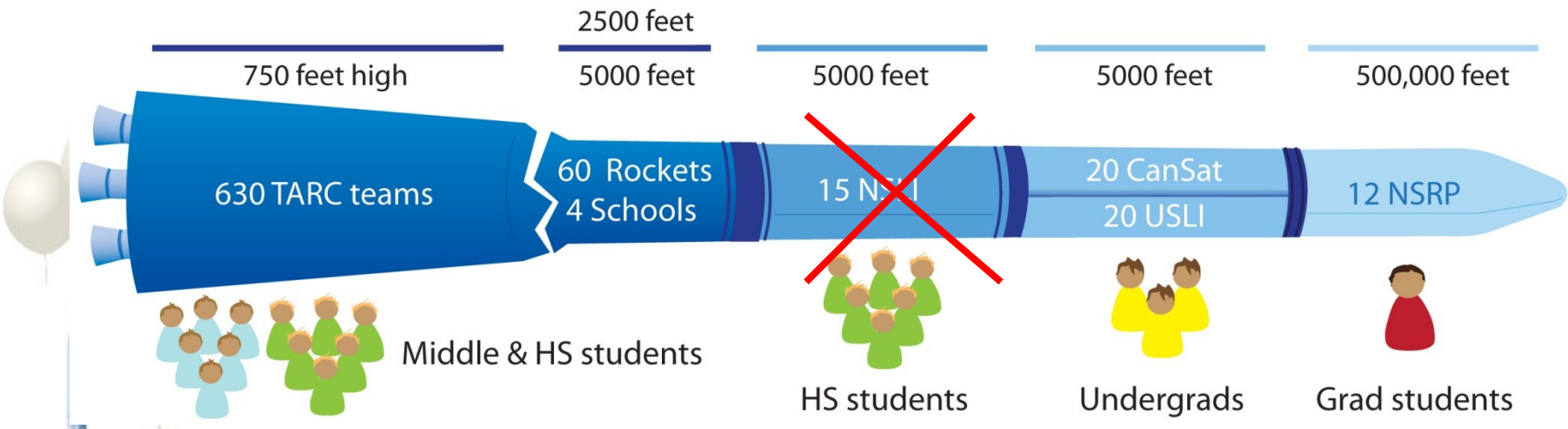


Building the STEM Pipeline with Rockets and CubeSats at Sonoma State University

Prof. Lynn Cominsky
SSU Education/Public Outreach and
Department of Physics & Astronomy

This work has been supported by NASA Grant NNX12AB97G and California Space Grant

Broken Pipeline Problem



- For the past 3 years, the SSU team has been learning how to fly rockets and balloons, while designing the S4 flight electronics and software
- We have designed a “flight board” which includes base components and optional sensors and have written an educator guide with background information, instructions and additional resources.
- Last summer, we trained a group of teachers to build these payloads and launched them at Lucerne dry lakebed in Southern California
- This year, the teachers are building S4 payloads with their middle & high-school students and flying them on rockets or tethered balloons

Meet the S4 partners

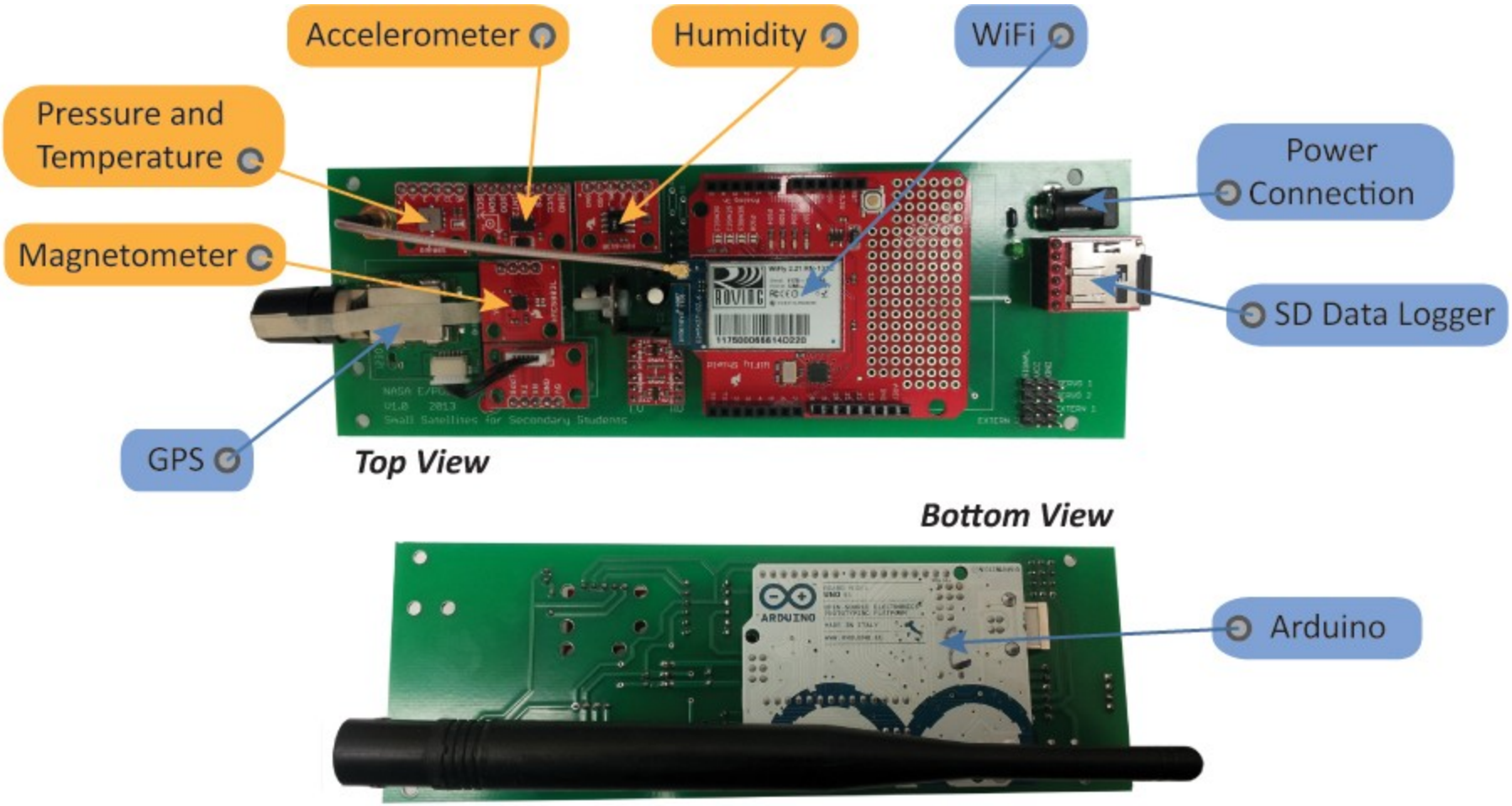
- **Association of Experimental Rocketry of the Pacific (AeroPac) –** the Northern CA/Nevada chapter of the Tripoli Rocketry Association
  - Tony Alcocer – President
  - Ken Biba – Education Director
- **Endeavour Institute** – Balloon Fests
  - Steve Kliewer, Director
- We also partner with a few other rocket clubs: **LUNAR** (Livermore Unit of NAR) and **ROC** (Rocketry Organization of California) for launches

s4.sonoma.edu

ARLISS as the inspiration for S4

- AeroPac and Bob Twiggs started A Rocket Launch for International Student Satellites (ARLISS) over 10 years ago
- University students from across the globe come to the Black Rock playa to launch payloads which are ejected from the rockets
- Mostly students from Japan, but also Korea, India, Turkey, and a few from the USA

S4 Payload

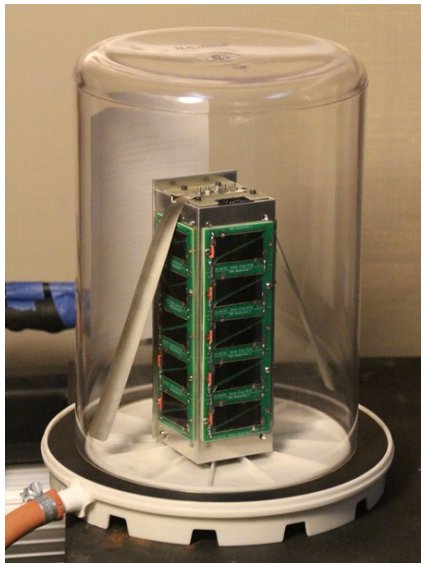

Accelerometer
Humidity
WiFi
Pressure and Temperature
Power Connection
Magnetometer
SD Data Logger
GPS
Top View
Bottom View
Arduino

S4 Teacher Training – July 201
Aero Institute, Palmdale Ca

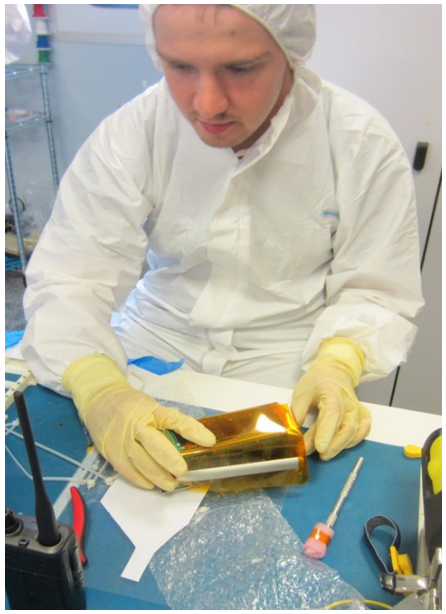
- 18 educators from a diverse set of schools and other teaching organizations
- Week long course
- Built, tested and flew a prototype payload
- Helped us refine our educational materials and the payload itself
- Included talks from our partners and mentors

SU students build and launch PocketQube – Nov 2013

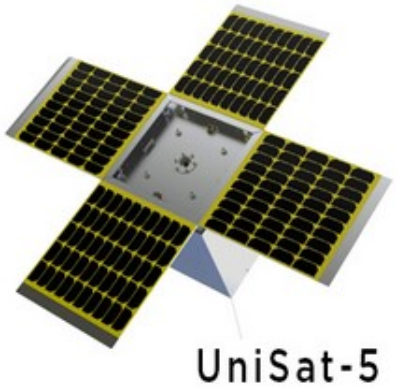
- SSU student Kevin Zack designed the S4 board
- He then started working on the PocketQube project
- PocketQubes are smaller than traditional CubeSats
- Our “3P” satellite was 15 x 5 x 5 cm & weighed about 0.5 kg
- It was launched from Unisat-5, an Italian



SSU Vacuum testing



Sean McNeil (MSU) integrating with



UniSat-5 launched several CubeSats and PocketQubes

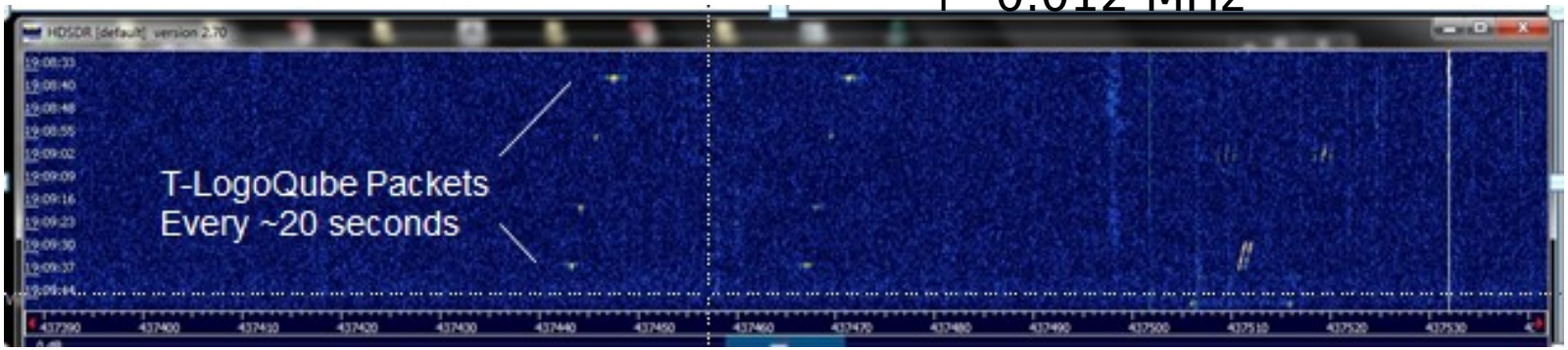
- Collaboration between SSU and Morehead State University
- SSU provided the electronics
- MSU provided the solar panels, structure and integration with Unisat-5
- After launch on Russian Dnepr-1, we renamed the satellite

Dnepr-1

http://universe.sonoma.edu/T-LogoQube

T-LogoQube team with Yagi antenna at the Little H-bar Ranch: L to R – Hunter Mills, Ben Cunningham, Kevin Zack, Steve Anderson, Aaron Pacheco (SRJC), Garrett Jernigan and Lynn Cominsky

First packets detected using the Yagi antenna at 437.465 +- 0.012 MHz



Next steps

- Middle and high school students are building S4 payloads and flying them this spring and summer
- SSU has partnered with NAR and AeroPac to offer S4 flights to up to 5 of the TARC finalists (since NSLI was cancelled for this year)
- SSU students are working on next CubeSat – x-ray detector to be launched by Nanoracks from the ISS
- SSU students have received partial funding from national SPS award to build Yagi antenna
- California Space Grant funding hired 2 interns from local community colleges + 1

For more information about these projects visit:

To see all our projects: