SSC17-WK-21

Bringing Space to the Classroom Through STEM Education Providing Extreme Low Earth Orbit Missions Using ThinSats

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Brenda Dingwall, Joyce Winterton
NASA GSFC Wallops Flight Facility
Wallops Island, VA
brenda.j.dingwall@nasa.gov

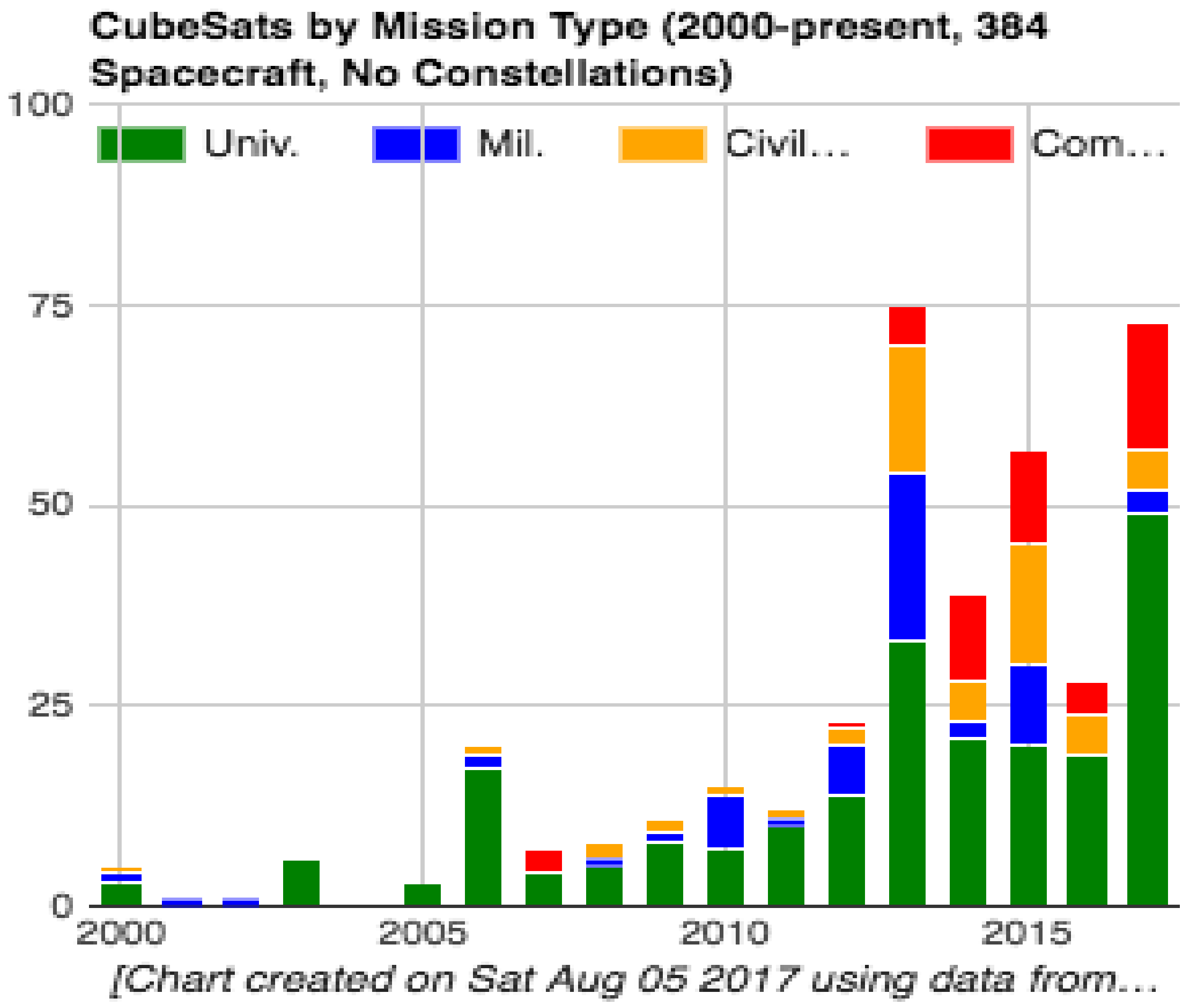
Robert Twiggs, Matt Craft
Twiggs Space Lab, LLC
2340 Old Hickory Lane, Suite 100,
Lexington, KY 40515
Matt.craft@twiggsspacelab.com

Hank Voss, Matt Orvis
NearSpace Launch, Inc.sapce
8702 E. 825 S., Upland, IN 46989
mattorvis@nearspacelaunch.com

V Dale Nash, Sean Mulligan, Brian Crane
Virginia Commercial Space Flight Authority
4111 Monarch Way #303, Norfolk, VA
23508
brian.crane@vaspace.org

Judi Sandrock, Bjarke Gotfredsen
MEDO
MEDO Space
Unit 8A Alta Via Park
Somerset West Business Park
Cape Town, 7130, South Africa
bg@medo.co.za

CubeSat History

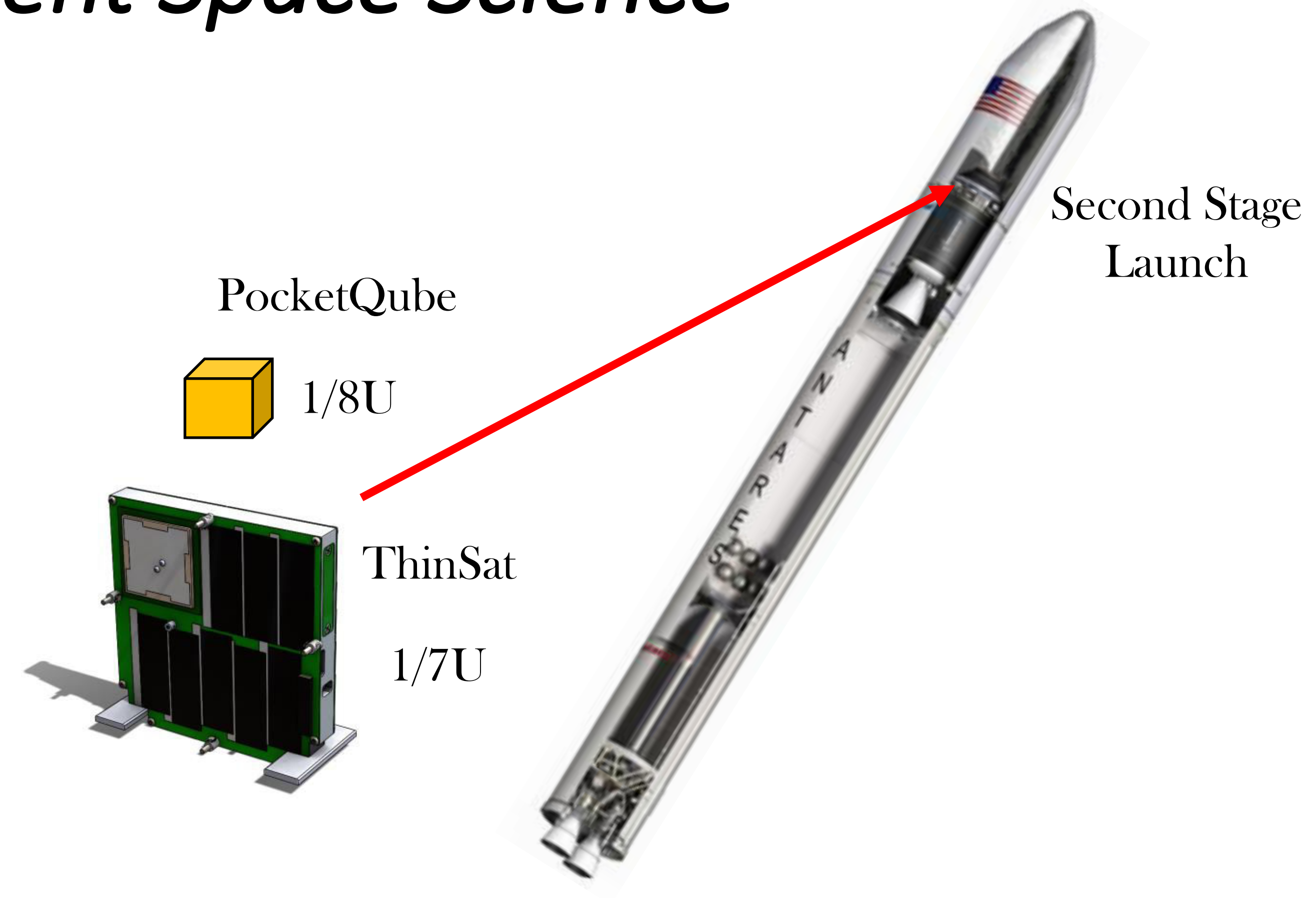


- Swarthout chart shows the incredible growth in CubeSat industry
- What began as a tool for education has become a tool for science and industry.
- Cost and documentation costs have increased to the point that participation is cost prohibitive

A New Approach to Student Space Science

- VCSFA and Orbital ATK collaboration will offer 12U launch capacity on the 2nd stage of future Orbital ATK Antares launches beginning in the 2018 timeframe.
  - Spacecraft released at 200-250km altitude
  - Same orbit inclination as ISS
  - Orbital life approximately 5 days
  - No lasting orbital debris

- 2nd Stage Antares launch ideally suited for ThinSats
  - Short lifetime ideal for K-12 launches
  - Frequency of Antares launches assures regular launch opportunities.
  - Relative simplicity of ThinSat facilitates the ability to develop and launch spacecraft within an academic year.



Orbital ATK
Cygnus ISS Resupply

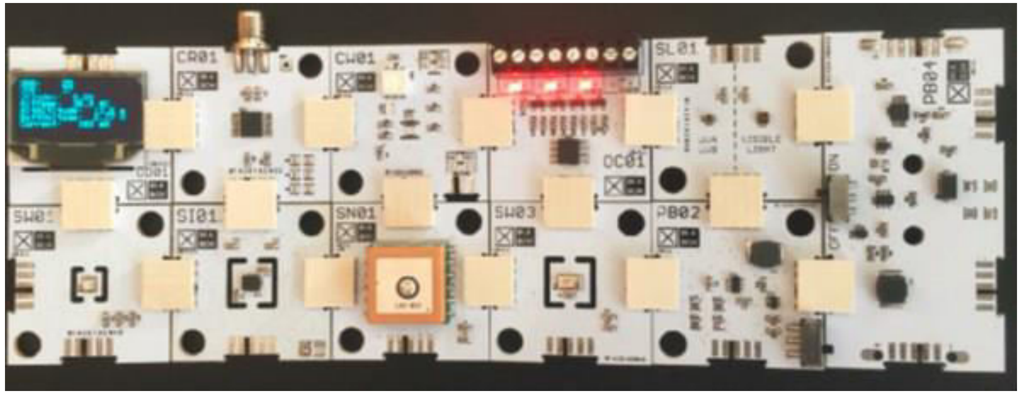
Antares in Flight

Three Phase Approach to ThinSat Development

- Phases are designed to take students through the spacecraft design and development process by allowing them to experience the design/build/fly iterative process.
- Phase 1 – Introduction to spacecraft design, space science and data collection
  - Flight of initial design on a low altitude balloon
- Phase 2 – Design and test of an engineering model
  - Engineering model will be flown on a high altitude balloon
- Phase 3 – Design of flight article

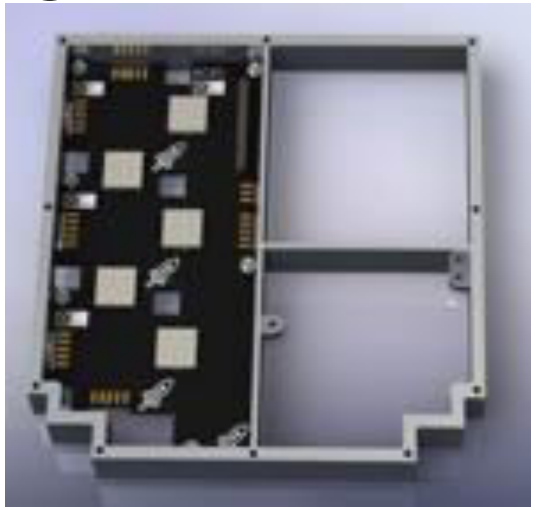
Phase 1 – Introduction to Space Science

- Students introduced to sensors, software, electronics, and data collection methods.
  - Hands on experience designing, constructing and testing various configurations of a FlatSat using “Xinabox” kits
    - Plug and play connections
    - No soldering required
    - Pre-programmed
    - X Chips are programmable.
    - Can connect with groundstation through wifi
    - Once complete, FlatSats balloon flight

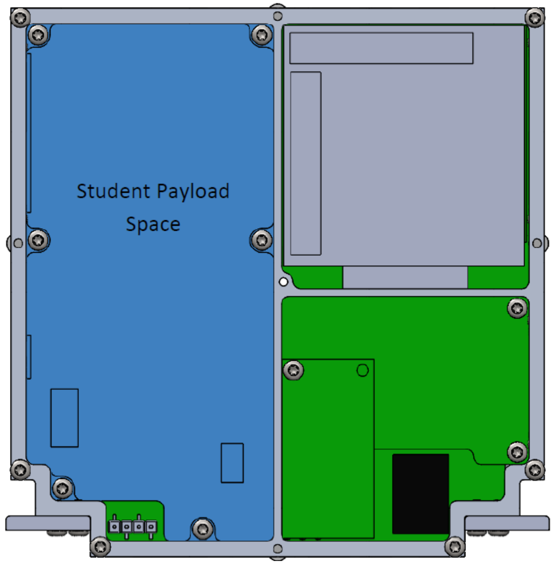


Phase 2 – Design and Test of an Engineering Model

- Students will design and test a payload utilizing the ThinSat Engineering Model.
- Students can select from motherboard and space hardened X-chips, or develop a customized payload from scratch.
- Students will integrate the payload with the engineering model and prepare it for a high-altitude balloon fightperformed by NSL in Upland, Indiana.

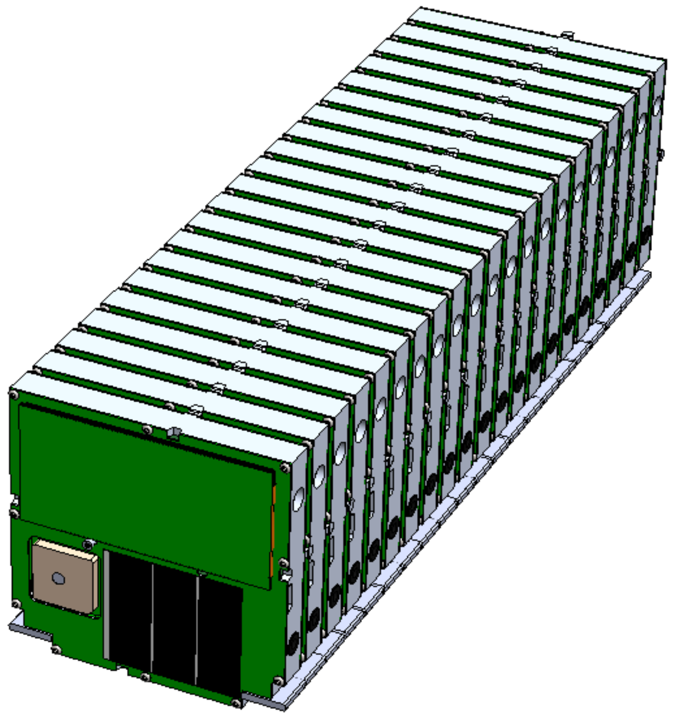


Student Payload Space

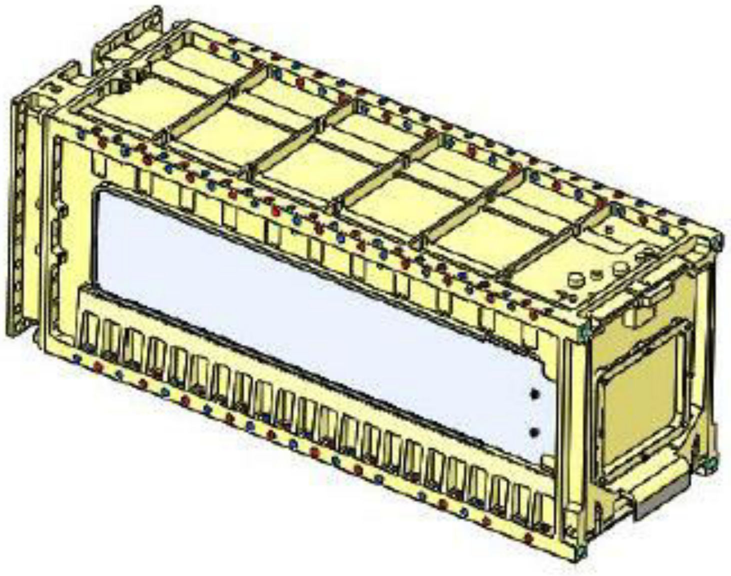


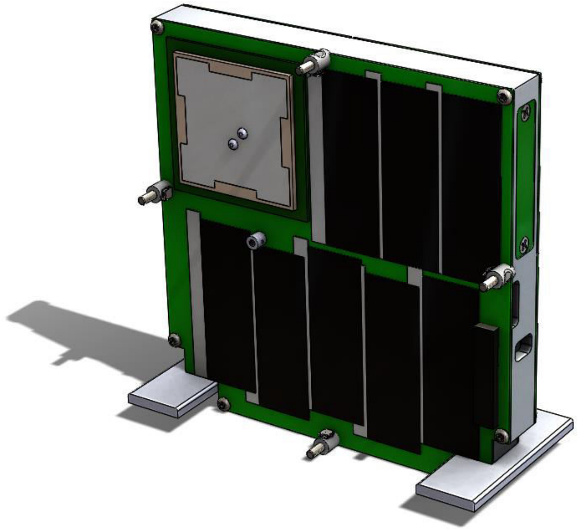
Phase 3 – Final Design and Flight

- Student payloads returned following High Altitude Balloon Flight
- After review of flight data, students determine and execute any required modifications to the payload.
- Once the payload is complete, students will send payload to TSL for integration into ThinSat Flight Model.
- Thinsats will undergo environmental testing and be integrated into the CSD



CSD Configuration





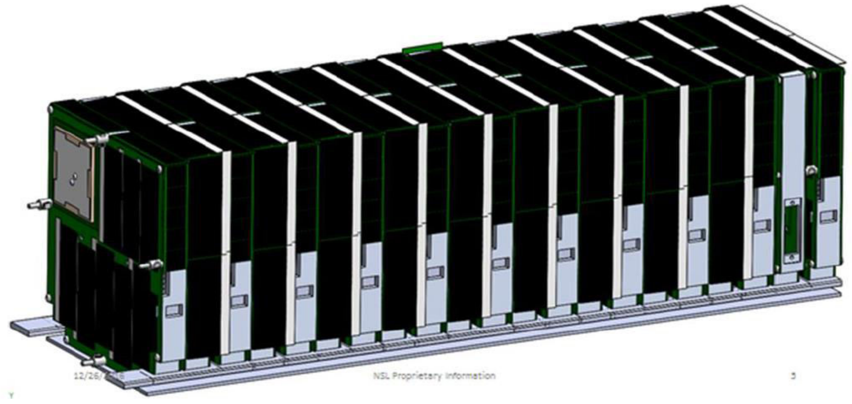


Figure: Twenty one Thin-Sats are flipped sequentially for space optimization with antennas and for centering the center of mass.

Locking Mechanisms

- ThinSats are locked into CSD with a rail structure
- 2 inch metal rails are locked down on CSD rail
- 4 Alignment Tabs on each ThinSat (hold in-place)
- The two ThinSats Adjacent to a railed ThinSat will not have rails
- There will be 7 ThinSats with 2 inch rails and 14 ThinSats without rails in each CSD

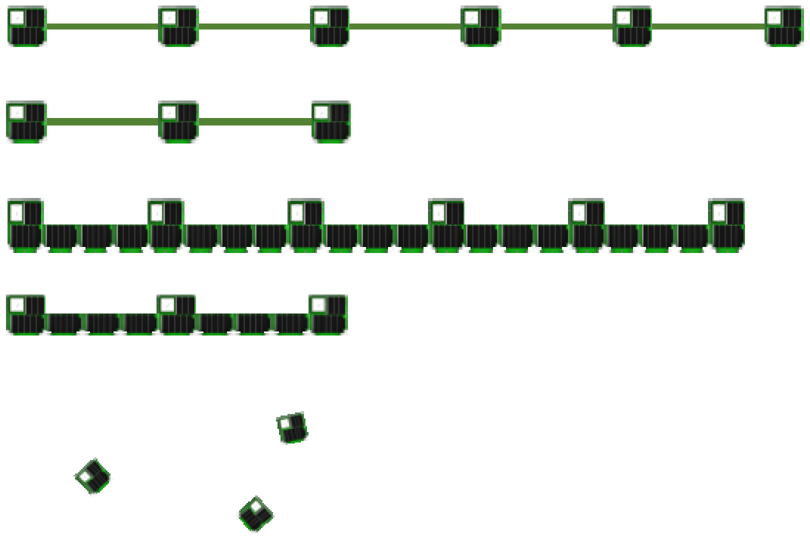
Deployment Scheme

Grouping

- Based on design of tab structure, a small grouping of ThinSat would include 3 ThinSats (1 Center ThinSat with a tab and 2 Side ThinSat without tabs)
- Grouping should be based on multiples of 3 (3, 6, 9, etc.)
- ThinSats could be flown autonomous
- Tether Options of Nitinol Rod and Fanfold Articulating Solar Arrays

ThinSat Grouping Types

- 6 with Nitinol Rod
- 3 with Nitinol Rod
- 6 with Fanfold Solar Arrays
- 3 with Fanfold Solar Arrays
- 3 Independent



Want to get involved?

- Contact Us!

Robert Twiggs, Matt Craft
Twiggs Space Lab, LLC
2340 Old Hickory Lane, Suite 100,
Lexington, KY 40515
Matt.craft@twiggsspacelab.com

V Dale Nash, Sean Mulligan, Brian Crane
Virginia Commercial Space Flight Authority
4111 Monarch Way #303, Norfolk, VA
23508
brian.crane@vaspace.org

Brenda Dingwall, Joyce Winterton
NASA GSFC Wallops Flight Facility
Wallops Island, VA
brenda.j.dingwall@nasa.gov

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8702 E. 825 S., Upland, IN 46989
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Unit 8A Alta Via Park
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Cape Town, 7130, South Africa
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