CUBESAT
California Polytechnic State University

CubeSat Standard Updates

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CubeSat Developers' Workshop

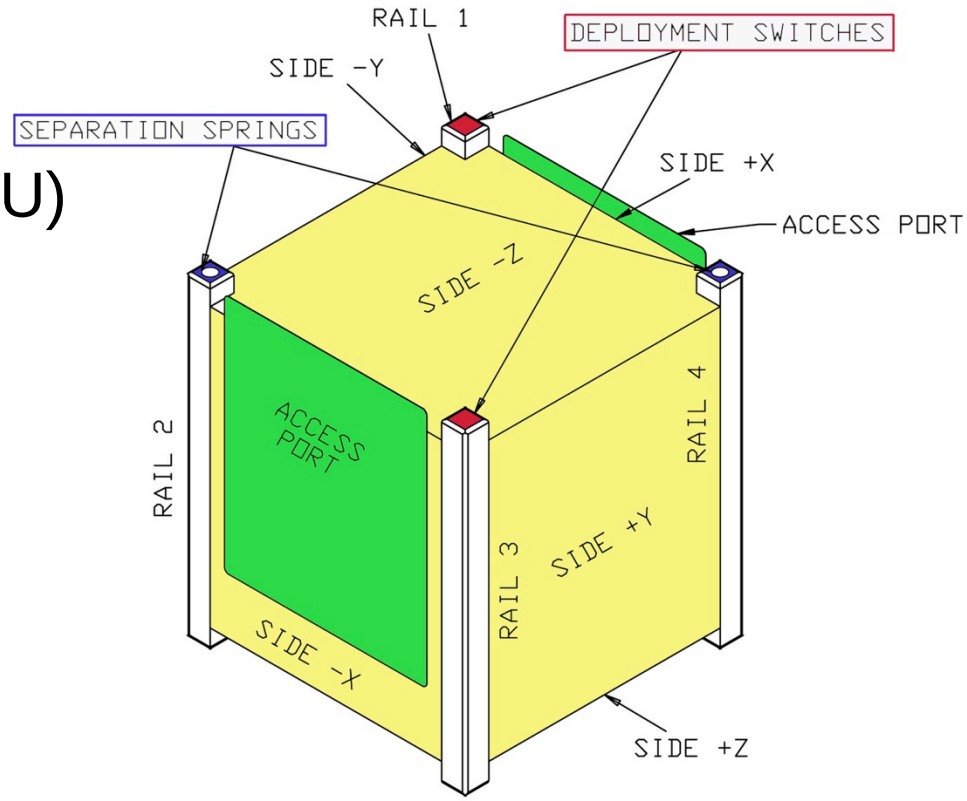
Logan, UT

Agenda

- The CubeSat Standard
- Motivation for Updates
- CDS Rev. 12 to Rev. 13 Changes
- CubeSat Launch Opportunities

The CubeSat Standard

- Shape and size (10 cm cube = 1 Unit, or 1U)
- Mass (up to 1.33 kg per 1U)
- Interface to P-POD
  - Rails
  - Access ports
- Materials and tolerances
- Operations
  - Deployables
  - Communication
- Different configurations possible (1U, 1.5U….)



1U CubeSat Form Factor

Motivation for Updates

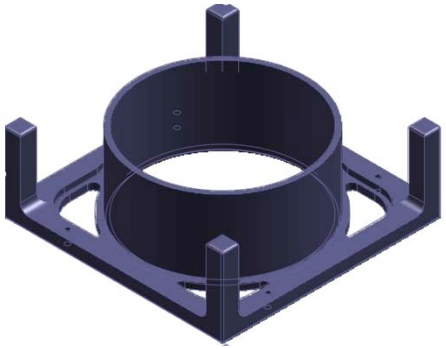
- Maintain protection of Launch Vehicle and Primary Spacecraft
  - CubeSat launch opportunities are growing
  - Higher profile Primaries / LVs are willing and actively supporting CubeSats
  - Maximize launch opportunities for all CubeSats
- Maximize CubeSat capability
  - Allow for CubeSat innovation
- Support CubeSat developers with launch requirements and regulations

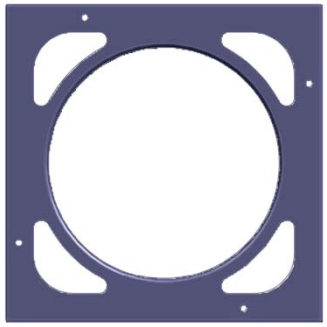
CDS Rev. 12 to Rev. 13 Changes

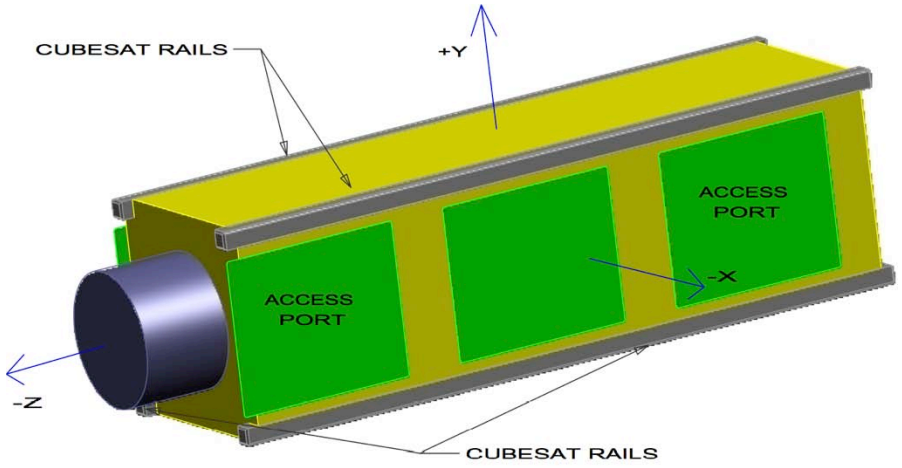
- 3U+ CubeSat Form Factor
- CG Requirements
- Propulsion Systems
- Real Time Clocks
- Magnets
- Allowable Mass
- CubeSat Separation Springs
- ODAR and NOAA
- Rev. 13 Provisional Period

3U+ Form Factor

- The P-POD has been modified to make use of volume internal to the Main Spring
- This additional volume can be made use of by the new 3U+ form factor, which is is detailed in the CDS Rev. 13
- 64 mm Diameter, 43.5 mm from –Z rail standoffs
- Flight proven design







CG Requirements

- CDS Rev. 13 will allow for greater CG tolerance

CubeSat Size	X and Y	Z
1U	+/- 2.0 cm	+/- 2.0 cm
1.5U	+/- 2.0 cm	+/- 3.0 cm
2U	+/- 2.0 cm	+/- 4.5 cm
3U / 3U+	+/- 2.0 cm	+/- 7.0 cm

Propulsion Systems

- Cal Poly is working with launch stakeholders to allow propulsion systems
  - Emphasis will be placed on safety and inhibit structure working with the Launch Vehicle, Primary Payload, and Range Safety stakeholders
  - Propulsion systems shall have at least 3 independent inhibits to activation
- Propulsion systems will be evaluated on a case by case basis
  - CubeSat propulsion systems have flown in the past on certain missions
  - Even though this effort is ongoing, CubeSat propulsion systems may limit available launch opportunities

Real Time Clocks

- Cal Poly is currently working with the Launch Vehicle, Primary Payload, and Range Safety stakeholders to include power on of Real Time Clocks (RTC) during launch

- RTC systems will be evaluated on a case by case basis
  - Active RTCs have flown in the past on certain launches
  - Even though this effort is ongoing, RTC systems may limit available launch opportunities

Magnets

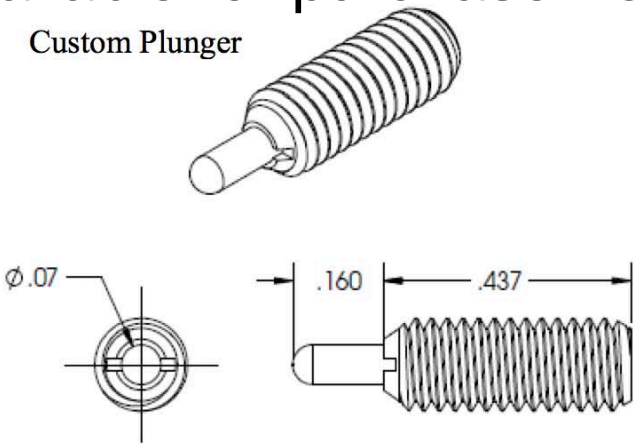
- CubeSats are now required to limit the strength of passive magnets
- The magnetic field is requirements are currently being investigated
  - This requirement flowed down from LV's
- Helps ensure separation of multiple CubeSats post P-POD deployment
- Recommended field strength of 0.5 gauss at CubeSat static envelope

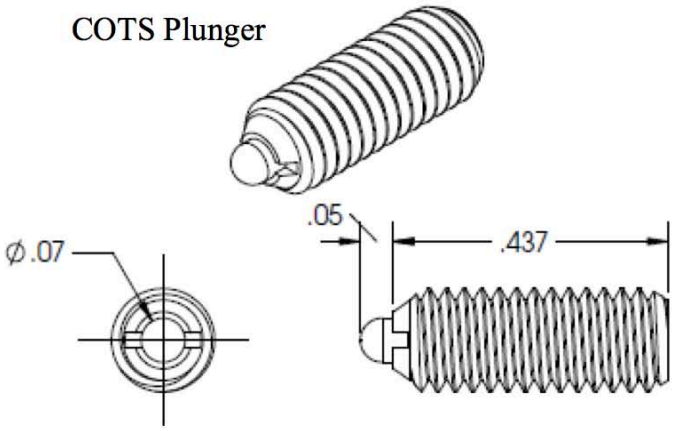
Allowable Mass

- Mass limit for CubeSats baselined at 1.33 Kg per 1U payload volume (Total of 4Kg per P-POD)
  - All current launch opportunities can accommodate this mass
- P-POD is capable of deploying heavier payloads, however this mass capability is evaluated on a mission to mission basis

CubeSat Separation Springs

- Custom separation spring developed
  - COTS supplier created the custom plunger for CubeSats
  - A drop in replacement for the spring plungers specified in CDS Rev. 12
- Improves CubeSat to CubeSat separation velocities
- Not necessary for 3U form factors
- Available for purchase from Cal Poly





ODAR and NOAA

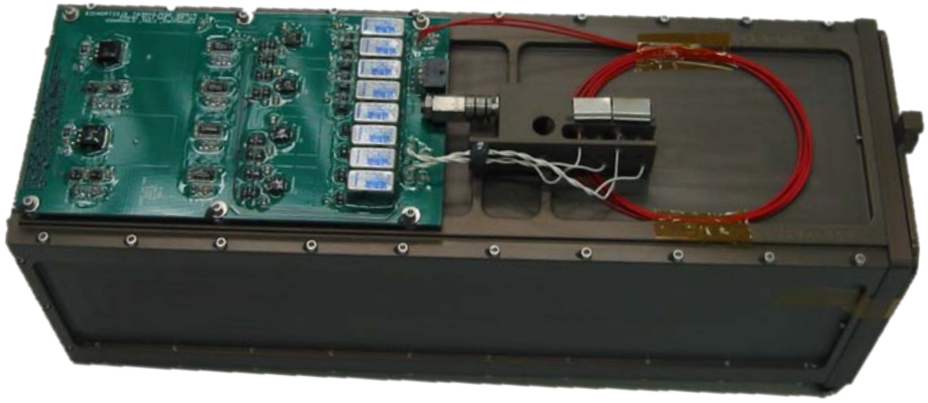
- ODAR: **O**rbital **D**ebris **A**ssessment **R**eport
  - The ODAR is used to determine orbital lifetime, collision, and re-entry probabilities
  - NPR 8715.6 – NASA Requirements to Limit Orbital Debris
  - NASA DAS (Debris Assessment Software) Users Guide identifies how to satisfy these requirements
  - CubeSat component will re-enter with less than 15 Joules
- NOAA: **N**ational **O**ceanic and **A**tmospheric **A**dministration
  - NOAA Licenses imagers for commercial satellites
  - Easy to use one-pager initial contact form
  - After initial contact, NOAA evaluates if a license is required or not
- CDS rev. 13 provides guidelines to CubeSat developers on how to work with the ODAR and NOAA

Rev. 13 Provisional Period

- CDS Rev. 13 is currently released to the public, and can found on CubeSat.org
  - http://cubesat.org/index.php/documents/developers
- The “Provisional” CDS will be open for community feedback before the official new CDS Release
- Community feedback will be accepted until January 2014

CubeSat Launch Opportunities

- This year marks the 10th anniversary of the first CubeSat in space!
  - 12 Launches, 39 Cal Poly P-PODs, 70 CubeSats
  - 4 Launches in queue for 2013!
  - More to come from LEO to Interplanetary in 2014-15!
- NASA, DoD, Commercial, and International launches available
  - Please contact us for details



Mk. I P-POD

Questions?

- Contact Information

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- See you all at the Developers Workshop held at Cal Poly in April 2014