CubeSat Standard Updates

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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, ....)
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 detailed in the CDS Rev. 13
• 64 mm Diameter, 36 mm from –Z rail standoffs
• Flight proven design
CG Requirements

- CDS Rev. 13 will allow for greater CG tolerance

<table>
<thead>
<tr>
<th>CubeSat Size</th>
<th>X and Y</th>
<th>Z</th>
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</thead>
<tbody>
<tr>
<td>1U</td>
<td>+/- 2.0 cm</td>
<td>+/- 2.0 cm</td>
</tr>
<tr>
<td>1.5U</td>
<td>+/- 2.0 cm</td>
<td>+/- 3.0 cm</td>
</tr>
<tr>
<td>2U</td>
<td>+/- 2.0 cm</td>
<td>+/- 4.5 cm</td>
</tr>
<tr>
<td>3U / 3U+</td>
<td>+/- 2.0 cm</td>
<td>+/- 7.0 cm</td>
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</tbody>
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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**: Orbital Debris Assessment Report
  - 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**: National Oceanic and Atmospheric Administration
  - 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 be found on CubeSat.org
- 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 10\textsuperscript{th} 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
Questions?

• Contact Information

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