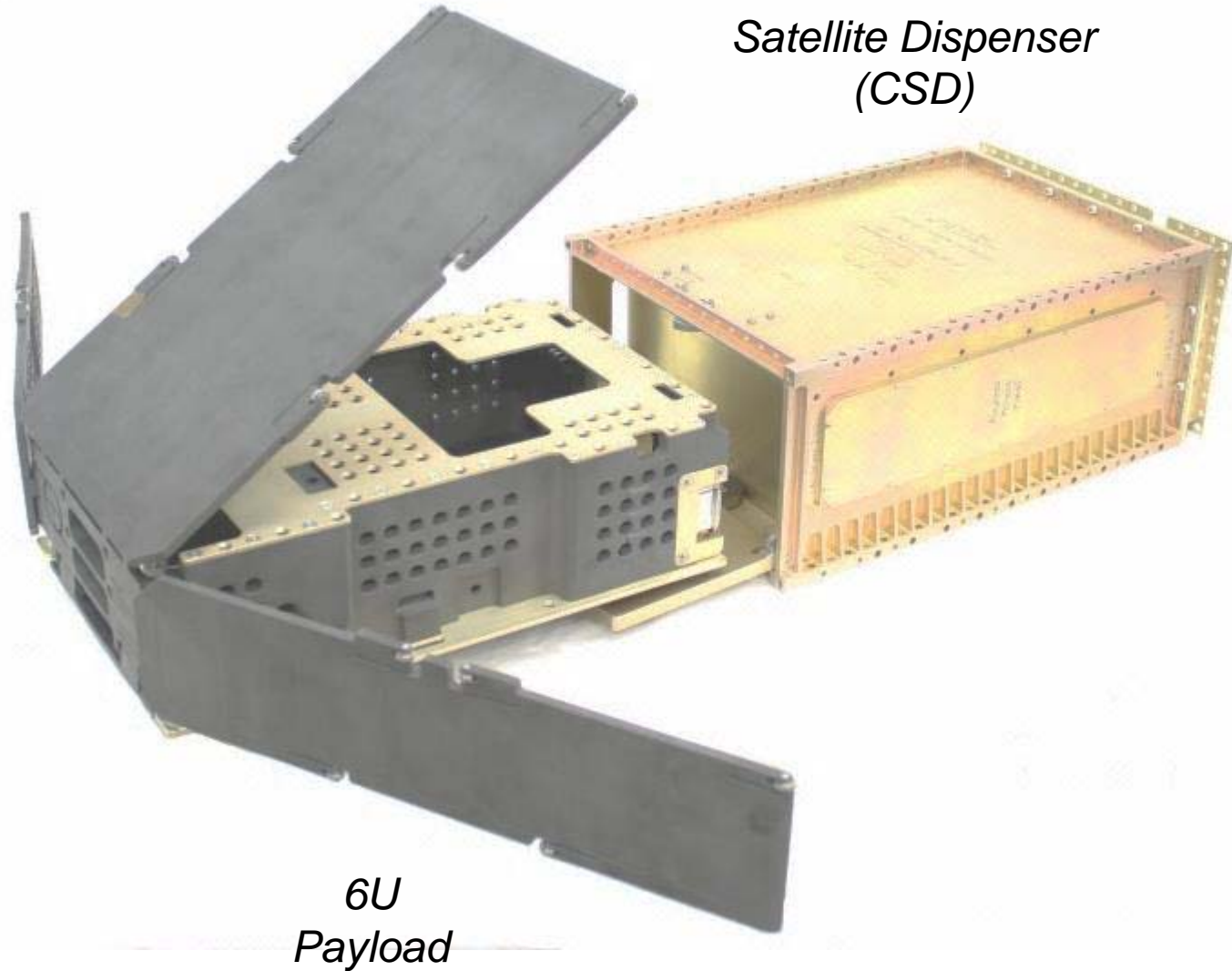


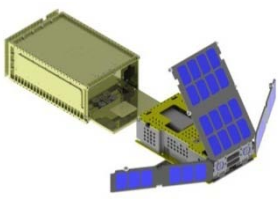
Achievements in Developing an Advanced Standard for CubeSats

10th Annual
CubeSat Workshop

Ryan Williams,
Engineer (presenting)
Ryan Hevner, PSC

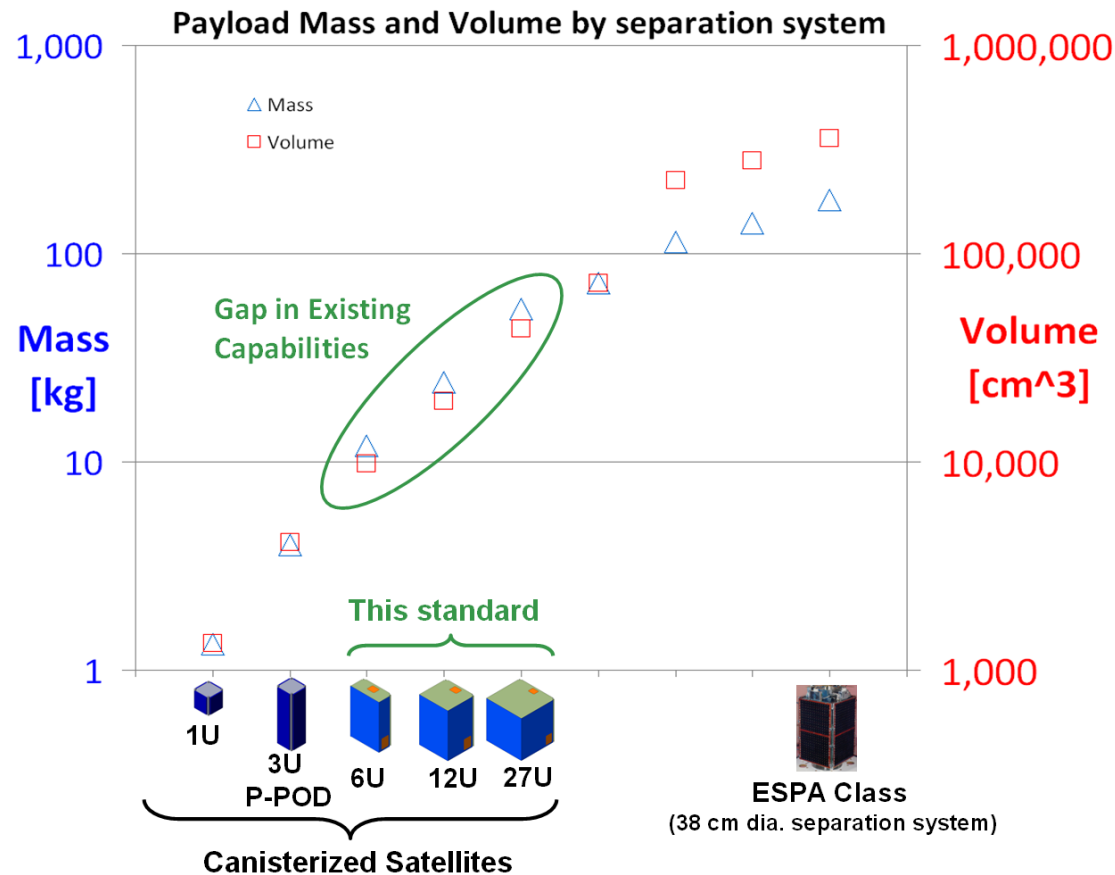
Planetary Systems
Corporation
25 April 2013

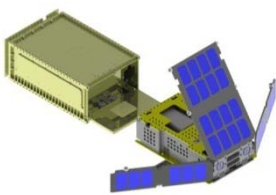




Advanced Standards are Important and Urgent

- Gap in existing capabilities
 - Commercial and government missions can benefit from larger CubeSats
- Lots of advanced developers
 - Designing or building 6U+ Payloads and CSDs
 - CubeSat integrators
 - Launch services for CubeSats
- Standards maximize market opportunity
 - Payloaders have best choices





Published Standards for Three New Sizes: 6U, 12U and 27U

Standard for the Payloads....

...and a data sheet for the Canisterized Satellite Dispensers (CSD) the payloads go in

PAYLOAD SPECIFICATION FOR 3U, 6U, 12U AND 27U

This is a standalone specification intended for payload designers.

DESCRIPTION

These payloads are designed to be fully contained within a Canisterized Satellite Dispenser (CSD or canister) during launch. A CSD encapsulates the payload during launch and dispenses it on orbit. CSDs reduce risk to the primary payload and so maximize potential launch opportunity. They also ease restrictions on payload materials and components. This specification currently encompasses four payload sizes, 3U, 6U, 12U and 27U.

The payloads incorporate two tabs running the length of the ejection axis. The CSD may grip these tabs, providing a secure, modelable, preloaded junction.

The payload may use the CSD to restrain deployables. The allowable contact zones are defined.

REVISION HISTORY

Revision	Release Date	Created By	Reviewed By
-	25-Jul-2012	RH	WH

Changes from previous revision: N/A (Initial release)

This document supersedes 2002206 Rev A Payload Specification for 0U, 12U and 27U.

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CANISTERIZED SATELLITE DISPENSER (CSD) DATA SHEET

FEATURES AND BENEFITS

- **Preloaded Payload Tabs** create a predictable load path to and from the payload.
- **CSD Constrained Deployables** eliminate payload's need for complex restraint mechanisms.
- **Six Mountable Sides** increase integration options and greatly reduce need for adjoining structures and interface plates leading to lightest overall mass.
- **Motor Driven Initiator** creates a reliable and testable deployment mechanism that automatically resets without consumables.
- **Robust Structural Design** is able to withstand extreme environments.
- **Separation Electrical Connector** allows communication and charging between payload and launch vehicle.
- **Conductive External Surfaces** prevent surface charging.
- **Completely Reusable Door Latch** allows extensive testing to prove reliability.
- **Manual Door Release** allows door to be opened without electrical interface.
- **Mechanical Interface Compatible with P-Pod Interface** ensuring compatibility with existing structures.
- **Full Length Ejection Spring** ensures positive force margin throughout payload ejection.
- **Lowest External Volume** versus existing designs increases packaging density on launch vehicle.
- **Largest Internal Volume** versus existing designs accommodates larger payloads.
- **Safe/Arm Access on Front Door** ensures payload access at all times.

COMPATIBILITY

The CSD is compatible with Payloads that meet specification 2002367 Rev - (Ref. 3). The 3U CSD is also compatible with the 3U CubeSat standard payload.

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2002337 Rev - 25 July 2012

PLANETARY SYSTEMS CORPORATION

planetarysys.com

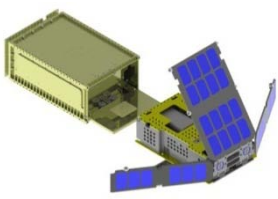
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www.planetarysystemscorp.com/#!/__downloads



Payload Features and Advancements

- Tabs – preempt a load path problem as CubeSats get bigger

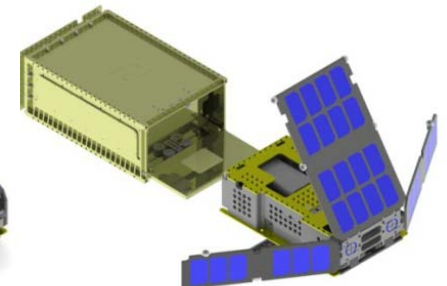
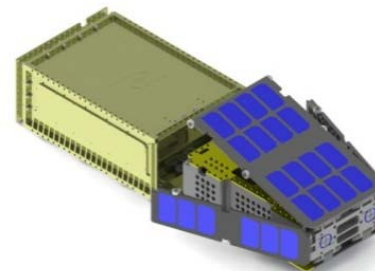
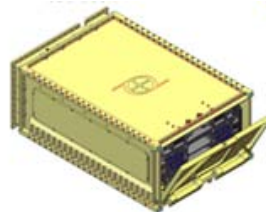
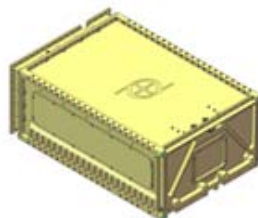
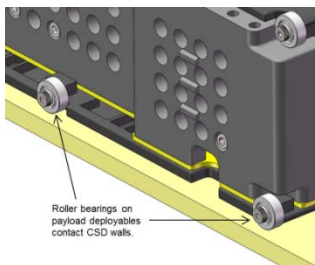
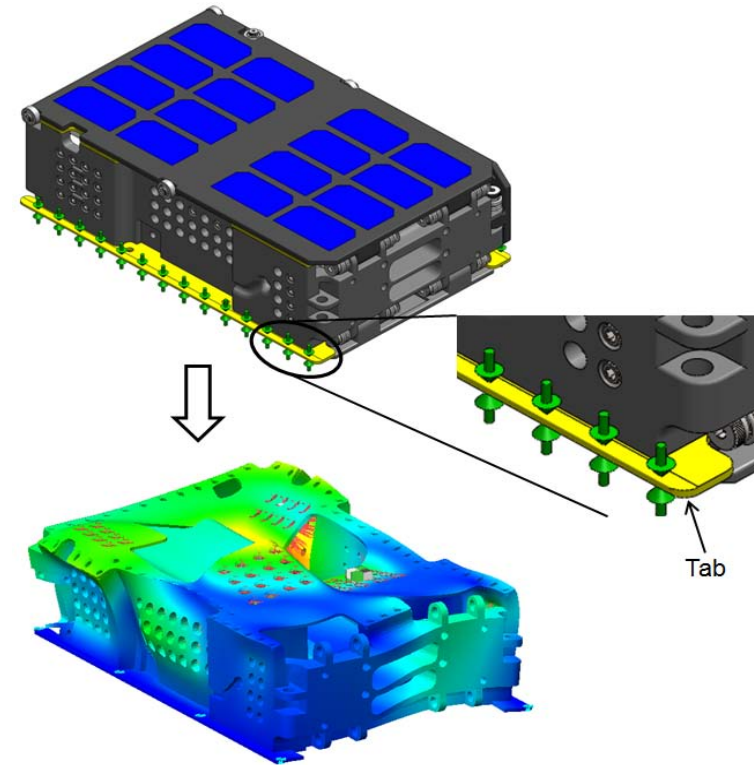
PROBLEM: Payload can rattle in dispenser

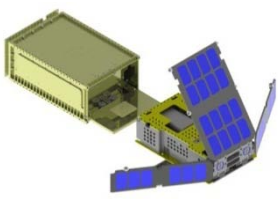
SOLUTION: Preloaded tabs guarantee invariant load path

- Increased mass capabilities to 2kg per U

- Electrical interface to dispenser/LV
 - Payload adds an optional 15 pin in flight disconnect (Separation Connector)

- Allow dispenser constrained deployables
 - Payload designers no longer need release mechanisms for deployables





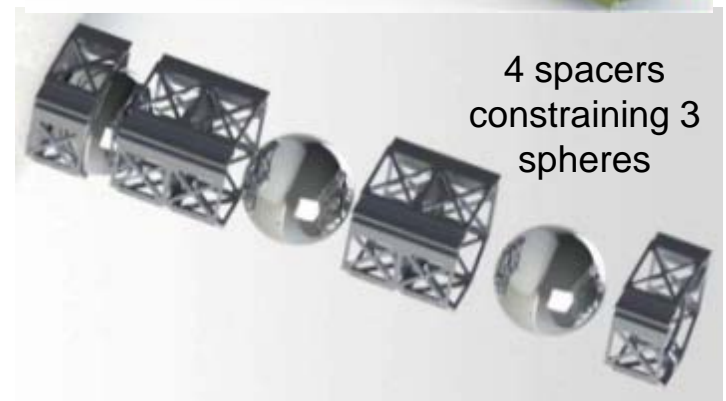
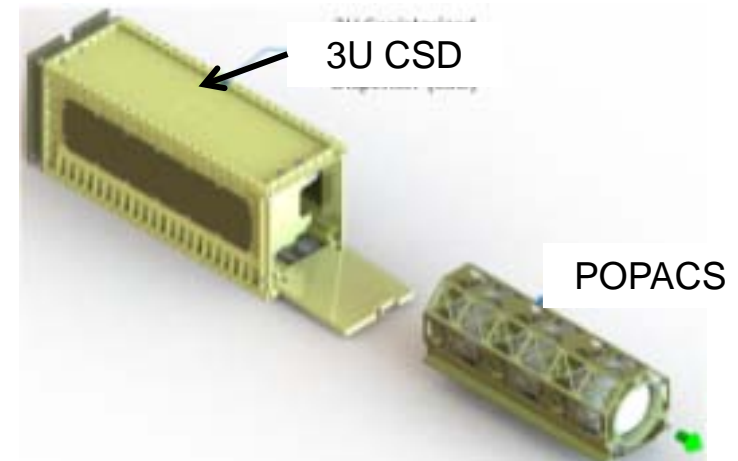
Upcoming Changes to the Payload Specification

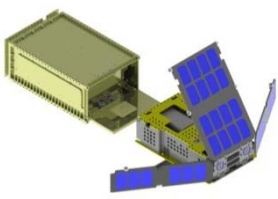
Known Changes

- Aluminum tabs that interface with the CSD shall be hard anodized
 - Provides better surface than bare aluminum
 - Conductive path to CSD via optional 15-pin Separation Connector

Potential Changes

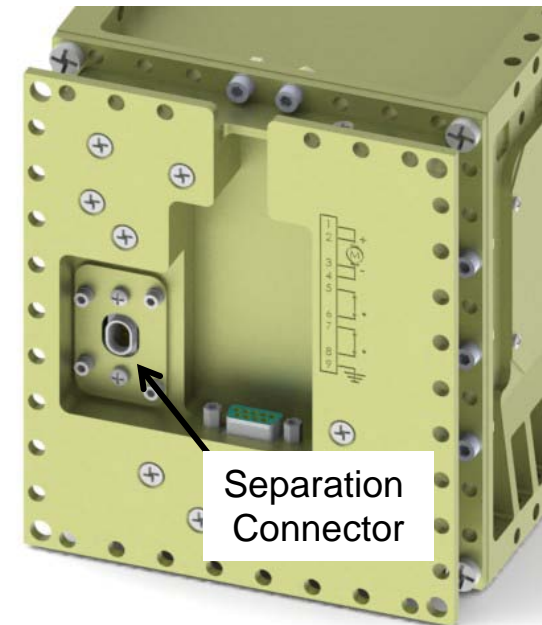
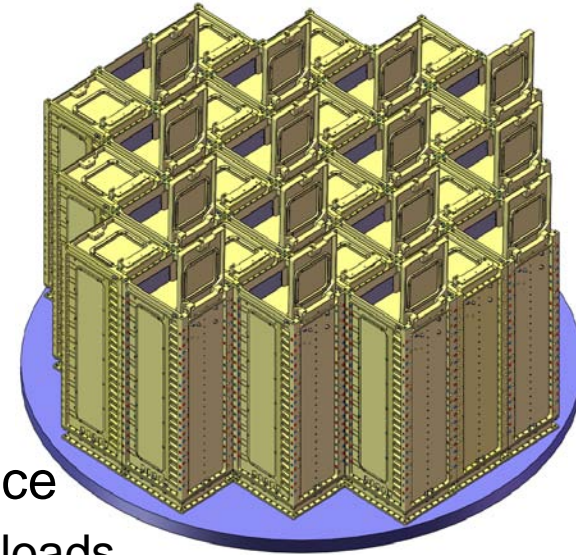
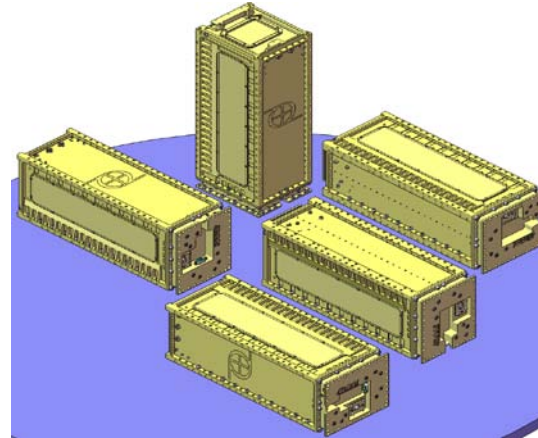
- Add increased height (+Y) to 3U and 6U
 - Allows conversion of current 3U hardware to tab design
- Conductive path to dispenser through – Z payload face
- Accommodating a non-singular tab design
 - Payloads can be modular

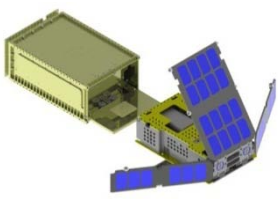




CSD Features

- 6 Mounting faces
 - Eliminates the need for adapters
 - Eliminates blind interfaces
 - Ability to easily bolt-on features
- Door and initiator does not protrude past mounting surface
 - Can eliminate interference with LV surfaces or nearby payloads
- 15-pin separation electrical connector
- Automatically resets
 - Motor driven, no consumables, truly test like you fly
- Additional payload access via door and side panels
- Accommodates existing 3U CubeSats via adapter kit



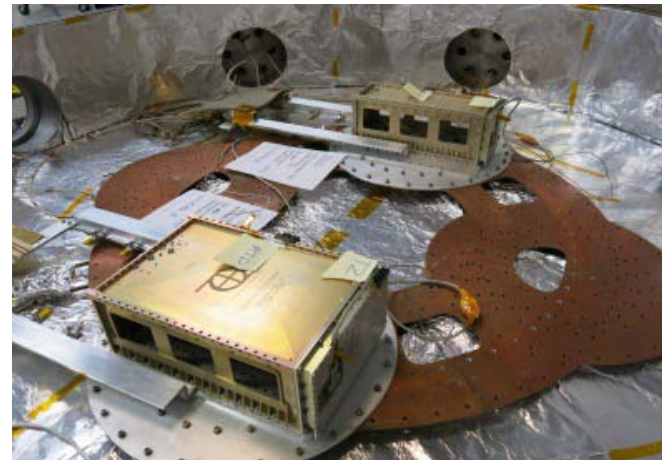


CSD Qualification Testing Summary

PSC has successfully completed qualification testing of 3U and 6U CSDs

- Thermal Vacuum

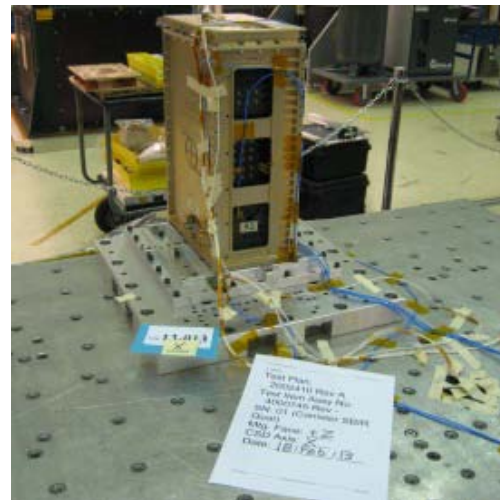
- CSD operated successfully at initiation voltages extremes at high and low thermal limits.



Thermal Vacuum testing the 3U and 6U CSDs simultaneously

- Vibration

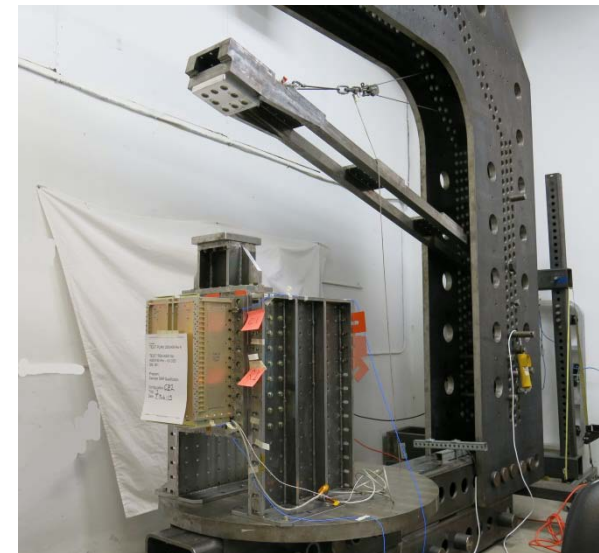
- Random excitation in all 3 axis and multiple mounting configurations.



Random Vibration and Strength testing on an EDE

- Strength

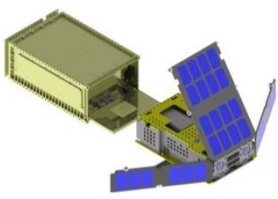
- Performed as sine burst.



Shock testing to simulate pyrotechnic shock

- Shock

- High level excitation in all 3 axis and multiple mounting configurations.



What's Next?

- Launch CSDs
 - Summer 2013: A 3U CSD will deploy the POPACS mission on a Falcon 9
 - Two 6U CSDs manifested on two DOD missions
- Potential updates to the Payload specification and CSD design
 - Increase 3U height by 3mm to accommodate tabs on existing CubeSats
- Complete qualification testing of the 12U CSD

