Innovative Uses of the Canisterized Satellite Dispenser (CSD)

By Walter Holemans (PSC), Ryan Williams (PSC), Andrew Kalman (Pumpkin), Robert Twiggs (Moorehead State University), Rex Ridenoure (Ecliptic Enterprises Corporation), Tom Walkinshaw (Pocketcubeshop), Ryan Hevner (PSC), and Floyd Azure (PSC)
What is CSD?

• **A high performance Cubesat dispenser**
  - **Preloaded Payload Tabs** create a predictable load path to and from the payload.
  - **CSD Constrained Deployables** eliminate the payload’s need for complex restraint mechanisms.
  - **Six Mountable Sides** increase integration options
  - **Motor Driven Initiator** creates a reliable and testable deployment mechanism that automatically resets without consumables.
  - **Separation Electrical Connector** allows communication and charging between payload and launch vehicle.
  - **P-Pod Compatible Mechanical Interface** ensures compatibility with existing Cubesats.
  - **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.
Dispensing PocketQubs

- 3 part encapsulant holds 8 PocketQubs in a ~1U
  - The 3U CSD is 1 inch longer internally allowing the extra length of the encapsulants, allowing 24 PocketQubs

Similar to encapsulation of POPACS spheres
6U Structure

- Designed by Pumpkin, Inc.
  - Holds six standard CubeSats as subsystems in larger 6U CubeSat

Aluminum structure

Tab: load path to CSD

6 x 1U CubeSat

Separation connector to LV

204 Watt PV panel can drive electric propulsion to the planets

Motors drive PV panels

2.87 m (113 in)

361 [14.21]

239 [9.41]
Arbitrary Length Payloads

- 3U CSD constrains and dispenses 5 CubeSats
- Total length does not have to fill CSD
Dispensing Hosted Payloads from large spacecraft

- Dispensing spacecraft from geostationary spacecraft allows electric propulsion to Moon, Mars etc.
  - Need 1.6 km/sec to Moon from Geostationary: about 1 kg of propellant at an Isp of 1,500 sec

Stabilize in 30 minutes
- RF communication to Earth
- Verify state of health of subsystems
- Await propulsion enable

In CSD: Trickle charge, thermal control and state of health telemetry via separation connector for days, months or years

PV panels and RF antenna automatically fully deploy in 10 seconds

T+ 0.5 seconds, \( \Delta V = 1.0 \) m/sec

To the Moon, Mars, etc.
Dispensing from the inside of ESPA

- A simple, flat Interface Plate allows rapid and robust integration to ESPA

CSD is cantilevered off of Interface Plate
Sequencing Electronics and Camera in 3U CSD

- Sequencer (By Ecliptic) initiates the dispensers once launch vehicle (LV) enables.
- Camera(s) records:
  - Initial conditions of missions
    - Tumble rates and velocity
    - Shape of deployables
    - CubeSat constellation shape
  - Proximity operations

- Connectors to ESPA Grande aluminum plate (tab to CSD)
- Battery if LV does not supply power
- Separation connector to LV
- Door opens to expose camera
- SAFE/ARM connector

Sequencer and camera mount to aluminum plate (tab to CSD)
Optical or IR camera, RADAR/LIDAR
Battery if LV does not supply power
(Sequencer does not dispense itself)