DIFFERENTIAL OPTICAL SHADOW SENSOR CUBESAT MISSION

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Drag-free Concept and Applications

- Cancel deviation from geodetic orbit

- Geodesy
- Aeronomy
- Autonomous orbit determination
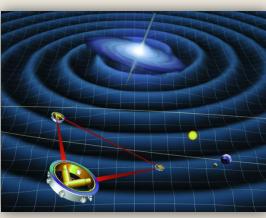- Fundamental Physics

Drag-free History

- TRIAD I (1972)
- GRACE (2002)*
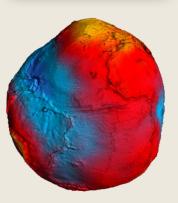- Gravity Probe B (2004)
- GOCE (2009)

- Planned:
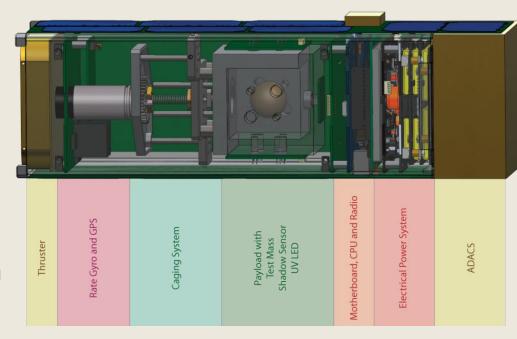 - LISA Pathfinder
  - LISA

* Accelerometer only

The Drag-free CubeSat

- 3U CubeSat
- Demonstrate fully integrated MGRS
- 2y development time
- Areas of Research:
  - Drag-free control algorithm
  - In-orbit performance evaluation
  - Environmental modeling and optimization (thermal, electro-magnetic)

Thruster

Rate Gyro and GPS

Caging System

Payload with Test Mass Shadow Sensor UV LED

Motherboard, CPU and Radio

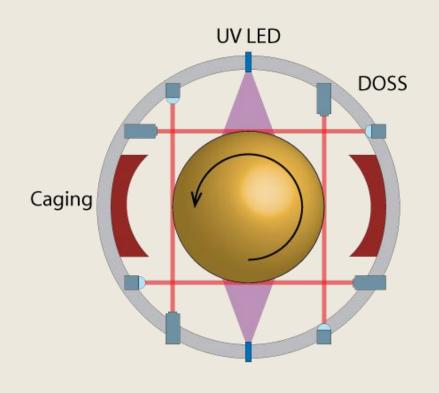Electrical Power System

ADACS

Modular Gravitational Reference Sensor (MGRS)

- Differential Optical Shadow Sensor (DOSS) to sense external disturbances
- UV LED for Charge Management to compensate internal disturbance
- Caging Mechanism designed for 200 N holding force
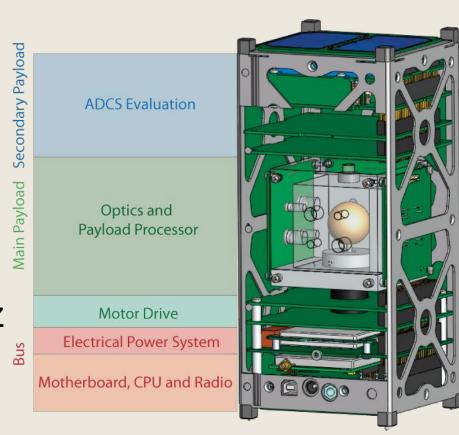- Spinning Sphere for spectral shift of disturbances

Differential Optical Shadow Sensor (DOSS)

- 2U CubeSat
- Raise TRL
- Test Attitude Control Algorithms
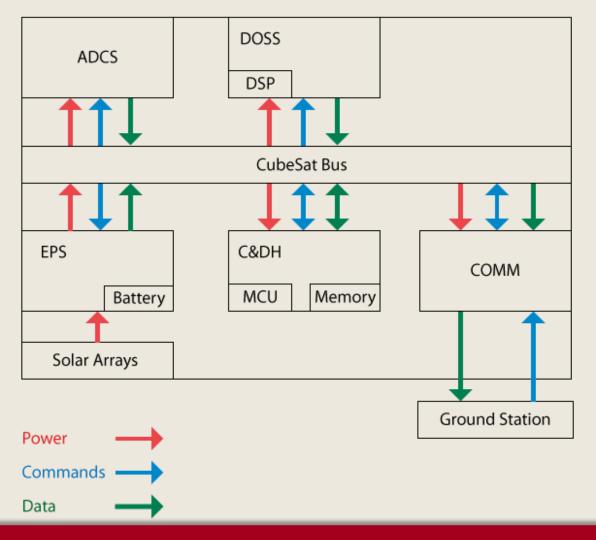- Designed for 1nm resolution at 10mHz-1Hz
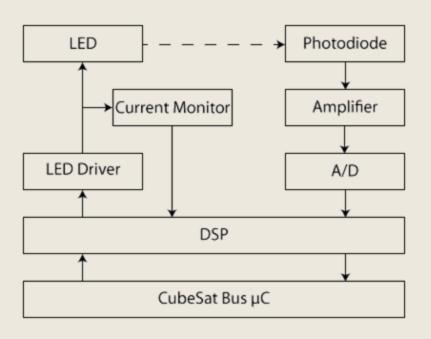- Completion: 2013

Subsystems

Shadow Sensor Electronics

- Low noise amplifier
- 8 channel 16-bit ADC
- DSP payload computer
- Low power design

Current Status

- COTS Parts:
  - CubeSat Kit purchased
- Custom Electronics:
  - First revision undergoes performance evaluation
- Sensor Housing:
  - Finalizing first design
- Space Qualification:
  - Shake and Bake scheduled end of summer