

### Deployable Boom Technologies for CubeSats and SmallSats

### **MMA** Space

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# **MMA Space**

- Location: Broomfield, Colorado USA
- Founded in 2007
- Employees: 50
- Space Systems Solutions & Products
  - Antennas
  - De-orbit dragsails or solar sails
  - Solar arrays
  - Deployable booms (e.g. instrument/magnetometer booms)
- Our Value:
  - Cutting-edge technologies that provide maximum capability for Size, Weight, Power, and Cost (SWaP-C).
  - We are Agile!



Space Solar Power







Solar Arrays



De-orbit (dragsails)

Antennas

## **Solar Arrays** (see presentation from 2024 CubeSat Developers Workshop)





### Antennas



### UHF Log-Periodic Dipole Array





Sinuous L-band Lidar Membrane Antenna S-band (non-deployable) Antenna Array





Deployable High Gain Reflectarray DaHGR<sup>TM</sup> Antennas

### MMA Space Drag/Solar Sail Technologies



dragNET<sup>TM</sup> De-orbit (Stowed)



### **Furlable High Strain Composite Solutions**







### Tape Deployer Assemblies (TDAs)





### Slit-tube Boom and Deployer Controller Unit (DCU)

- Motor driven deployment actuator via tape deployer assembly (TDA)
- As shown: 1 inch diameter slit-tube boom
  - O Carbon/fiberglass as-shown (all glass and all-carbon options)
  - O Deployed length of up to 1.5m
  - O Tip attachment supports wide array of payloads
  - O Mass ~0.75 kg (TDA + DCU)

### Deployment Control Unit (DCU) drives the TDA

- O Approximately 0.1U Electronics package including enclosure
- O FPGA Rad-tolerant electronics
- O Array of telemetry/customizable features



Payload Attachment

Interface

10cm

(height)

10cm x 10cm x 1.1cm





## **Camera Mast**







Caltech Solar Power Demonstration DOLCE mission

Launch Restraint

## Instrument/Camera Boom



- 3 open cross-section fiberglass tapes with a single/common motor base actuation drivetrain for synchronized deployment
- High bending and torsional rigidity
- Integrated deployment controller electronics (DCU)
- Tip plate supports payload (not shown)
- Mass 0.75kg
- Stows in 1U volume when fully retracted (including electronics!)
- Actuating force >5lbf at 0.5 m deployed length



## Closed (or pseudo-closed cross-section) Deployable Boom Technologies







SHEARLIPS cross-section

## Deployable VHF Crossed Dipole





#### Structural, Dimensional and Performance

Mass (kg) 4.97 Stowed Envelope (cm) 25cm x 20cm x 15cm Deployed Envelope (cm) 5210cm x 5210cm x 15cm Stowed First Mode (Hz) ~253Hz Deployed First Mode (Hz) >1Hz Antenna Frequency 2-30 MHz

#### **System Highlights**

Boom Type SHEARLIPS Launch Restraint MMA Space Pin-puller Flight Qualification & Delivery March 2024 First-flight 2025



### SHEARLIPS Outrigger Deployment









# **Thank You!**

Learn more at: https://mmadesignllc.com/

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