OreSat Deployable Antennas

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Canted Turnstile Array

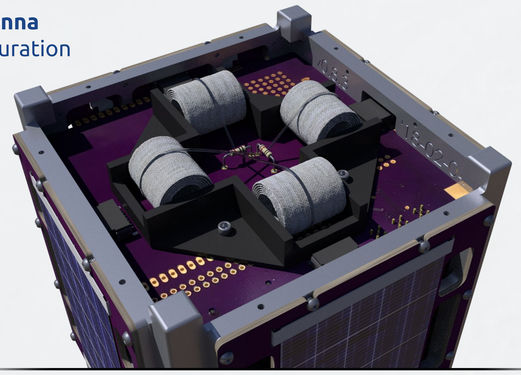
- deployment is mission critical
- enables OreSat's primary objective to establish baseline communication with groundstation-- necessary for bringing control systems online
- consists of four poles-- each with four embedded antennas-- fixed at 90 degree intervals
- each pole canted to 35 degrees
- emits an omni-directional, 436.5 MHz low gain radio signal

bistable, fiberglass tape spring
with four embedded antenna wires

Structural Elements

- four non-conductive, bistable, fiberglass tape springs
- bistability of the springs allow each pole to be rolled into a flat cylinder held for stowage using a monofilament line known as a burn wire
- burn wires are held in tension with resistors
- deployment is triggered when the burn wires are caused to fail by overloading the resistors

turnstile antenna
stowed configuration



Mission

Design and manufacture two separate antenna deployment systems for Oregon's first satellite

OreSat is ramping up to be Oregon's first educational nanosatellite! It's a CubeSat-- a standard form factor for nanosatellites consisting of a 10 cm cube per unit. Thanks to NASA's CubeSat Launch Initiative, we will be sending our satellite to the International Space Station where it will be released into low Earth orbit.

For more information, visit oresat.org

Special Thanks

Andrew Greenberg and Glenn LeBrasseur
for sponsoring the project and herding all of the electrons

Gerald Recktenwald
for providing fantastic guidance as our faculty advisor

Dependable Springs
for the precise manufacturing of our helical antennas

HP Dynamics Lab
for their generous assistance with all things vibration

HP Model Shop
for supplying high-quality 3D prints of our design prototypes

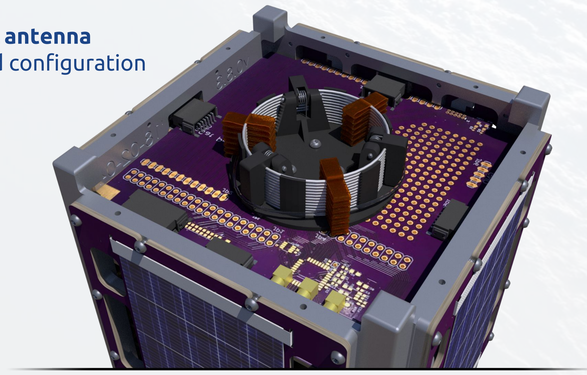
S Band Helical Antenna

- enables OreSat's secondary mission of space-based STEM outreach
- highly directional, relies on attitude control system to point at Oregon as it flies overhead
- transmits a high definition video signal to handheld receivers built by high school students
- high gain WiFi-based (802.11b) 2.4 GHz signal

Mechanical Design

- must be compressed to 15 mm when stowed and released to 460 mm during operation
- competing commercial designs are costly, relatively complex, and too bulky
- bonded polyamide tethers keep the antenna partially compressed, accurately defining the deployed length and providing structural rigidity
- three spring-loaded hinges constrain the spring during the intense launch vibrations
- must withstand the extreme temperatures and vacuum of space

helical antenna
stowed configuration



Portland State UNIVERSITY

Oregon Small Satellite Project