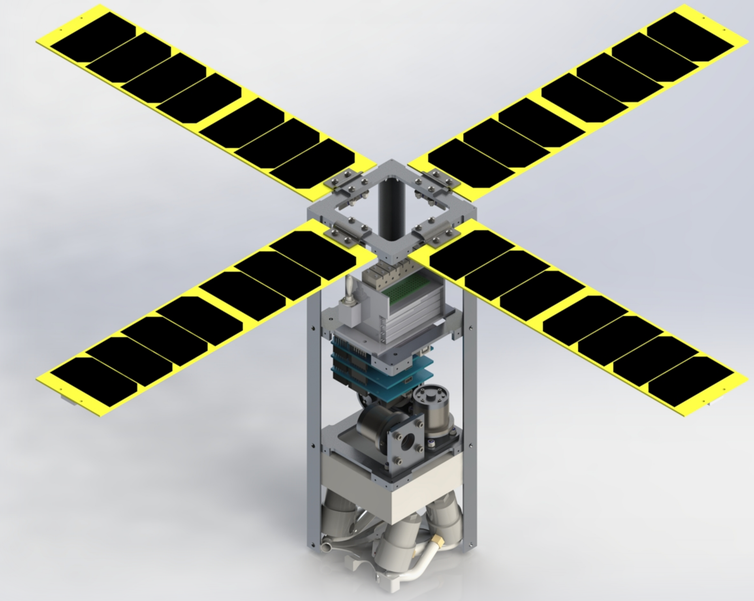
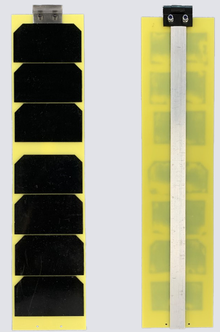
NANOSATELLITE:
DEPLOYABLE SOLAR PANELS



Proxy Solar Panels:

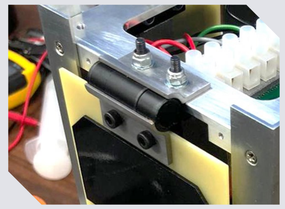
- Same inertial properties as standard 3U CubeSat panels
- 153g
- Components:
  - FR-4 proxy printed circuit board (PCB)
  - 7 ABS proxy photovoltaic (PV) cells
  - Aluminium 6082T6 Reinforcement
  - 3M 468 adhesive transfer tape to attach cells
- Reinforcement improves structural integrity of the solar panel, reducing deflections when stowed to ~ 0.5mm



Deployment Mechanism:

Deployment of the solar array relies on a torsion spring hinge which provides the actuating moment required to raise the panels.

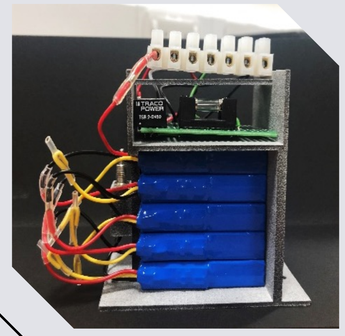
- Components:
  - Anodised Aluminium Spring-Loaded Hinge
  - 2 Steel Latches
- The generated torque varies between 0.35Nm in the stowed position to 0.23Nm when deployed.
- The latches ensure the motion of the panel is limited to the desired deployed position of 90°.

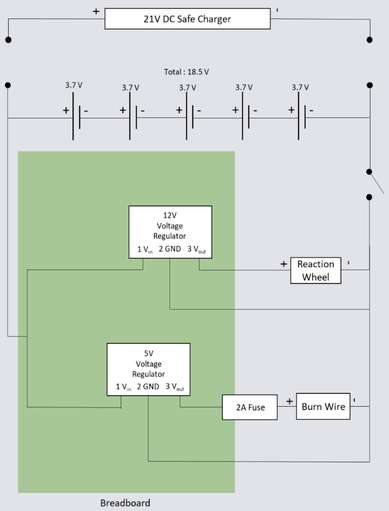


Electrical Power System (EPS):

The EPS is the heart of the satellite, storing and powering every functional component of the Satellite.

- Lithium-Ion Battery Array
  - 18.5V
  - Total capacity of 2050mAh
  - 5 x 3.7V batteries connected in series
- Electrical Circuit Components
  - 12V Voltage Regulator: Reaction Wheels
  - 5V Voltage Regulator: Burn Wire Mechanism

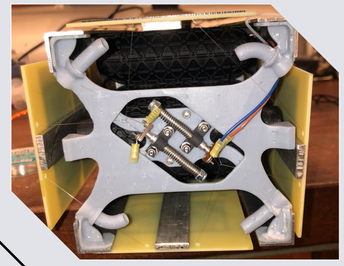


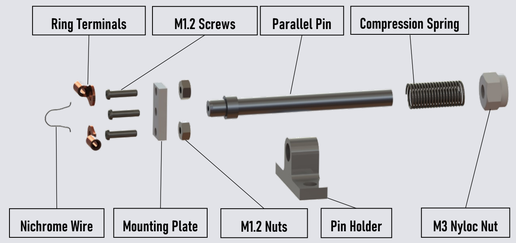


Hold & Release Mechanism:

This mechanism uses a nylon string to stow the panels, which is cut using a nichrome burn wire system, releasing the panels.

- Components:
  - Nylon String
  - Burn Wire Mechanism
- The compression spring ensures that the nylon string is kept taut by countering any slack due to thermal loading or vibrations.
- Nichrome wire reaches ~200°C, exceeding the melting temperature of the string
- A Vespel mounting plate could withstand the burn wire's max temperature, with adequate stiffness and insulating properties.

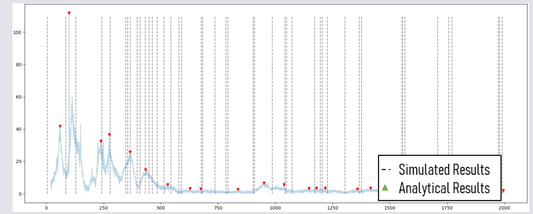




Project Aim:

To design a deployable solar array capable of supplying a constant power of 19W to the onboard systems of a 3U CubeSat during its lifetime.

Vibrations Test Results:



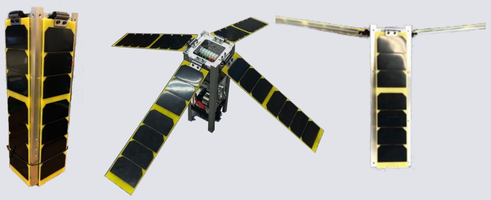
The vibrations test provided the FRF response of the satellites' sub-systems.

- Resonant peak registered at 100Hz. Simulations model these vibrations as flexural vibrations along the length of the panel.
- Redesign for increase in stiffness along the length of the panel to push first resonant frequency out of operating range.

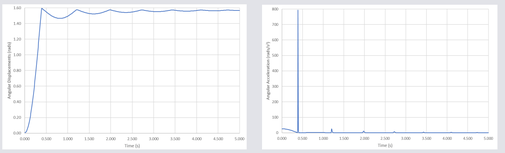
Deployment Test Results:

The deployment test provided practical data, validating the theoretical design of the deployable solar array.

- The panels successfully deploy and reach a steady state angle of 70° and 90° when subjected to Earth (with gravity) and space (without gravity) conditions respectively.



- The impact of the panels on the latches caused a force of 678N, which was the subject of one of the redesigns.



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