

Miniature Satellite: Main Structure

Department of Mechanical Engineering

Group 2B: Jinge He, Bavaharsan Nagarajah, Wern Shynn Soon, Justin Wong

Supervisors: Dr Liliang Wang, Xi Luan

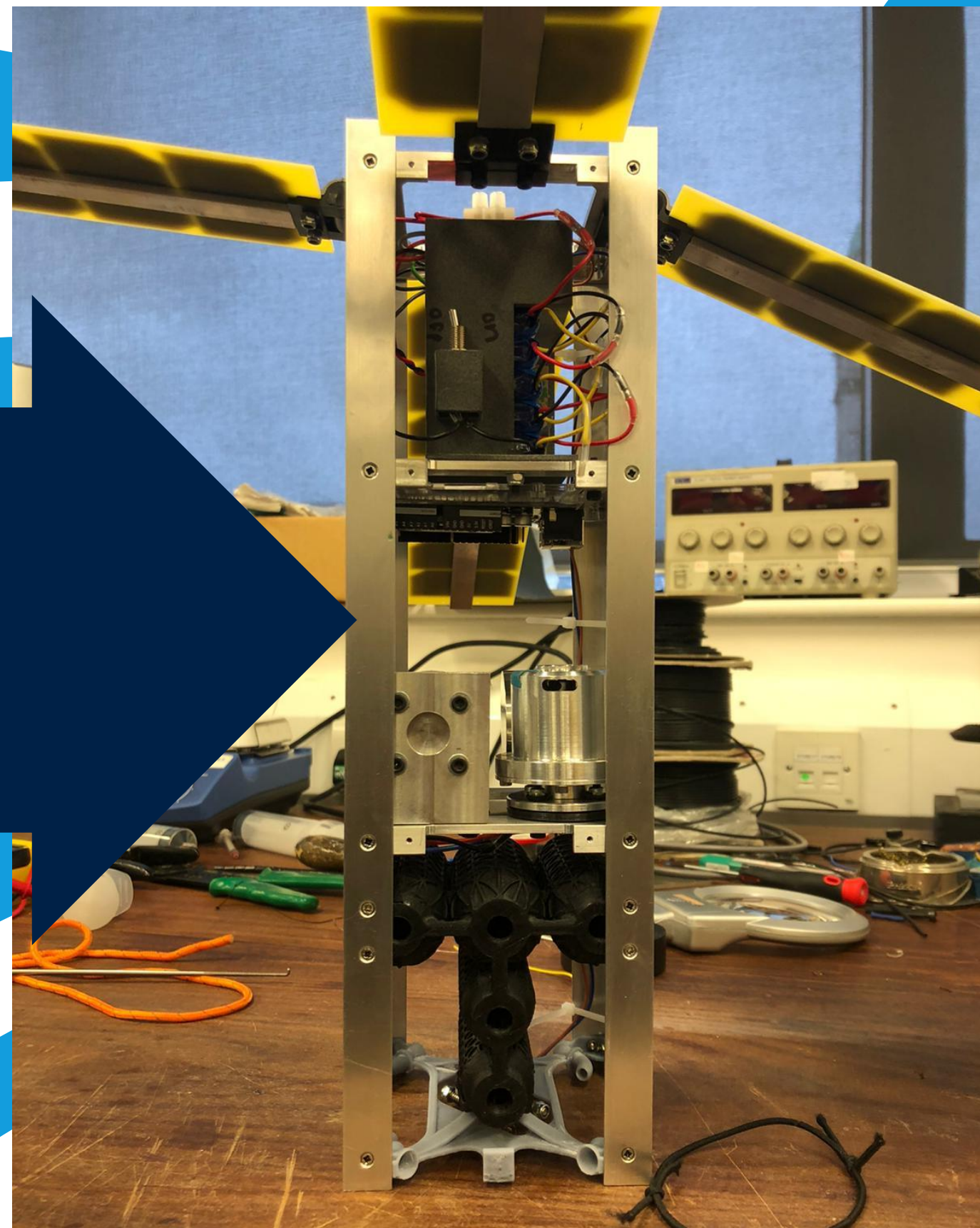
Our project

Miniature satellites have risen in popularity, due to their low-cost and flexibility. The CubeSat Design Specification is the most popular standard followed.

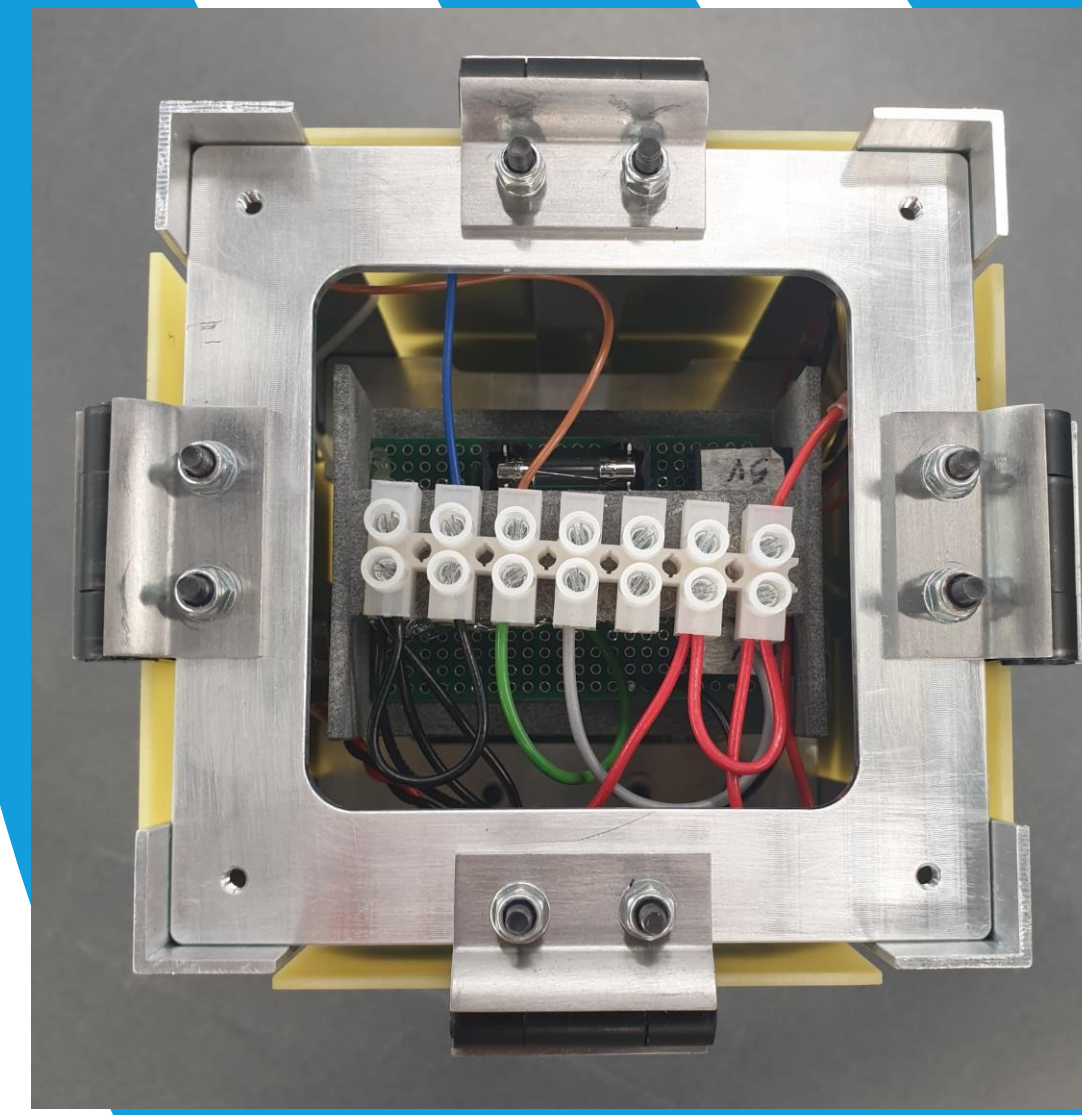
Our project follows the **design, manufacture and testing of the main structure of a 3-Unit CubeSat satellite**, which is required to provide a **safe and structurally stable platform** for integration of the other sub-systems.

The main focuses during the design process were:

- **cost-reduction**
- **ease of manufacture**
- **weight reduction**
- **maximising internal volume**
- **surviving the mechanical and thermomechanical stresses experienced at launch.**



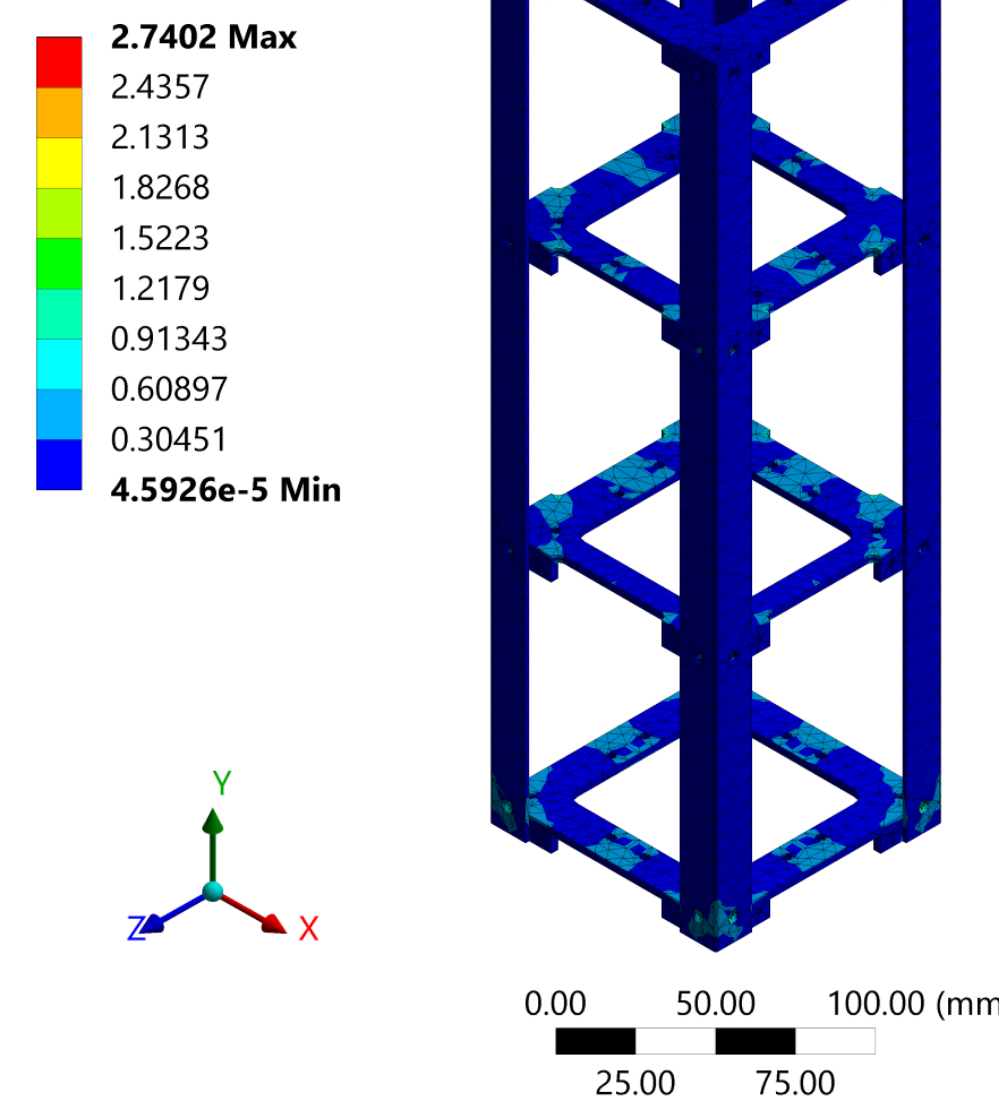
Whilst the image above showcases the complete satellite, our **main structure consists of the pillars and the mounting brackets** upon which the various sub-components are mounted.



Design for Manufacture

- Mounting brackets & rails have been CNC milled from **aluminium 6082-T6**.
- Side and top panels have been laser cut from a 1 mm sheet of **aluminium 5251-H22**.
- **Loctite 290 Green thread locker** used to ensure security of fasteners.
- Total cost of main structure: **£1141.44**

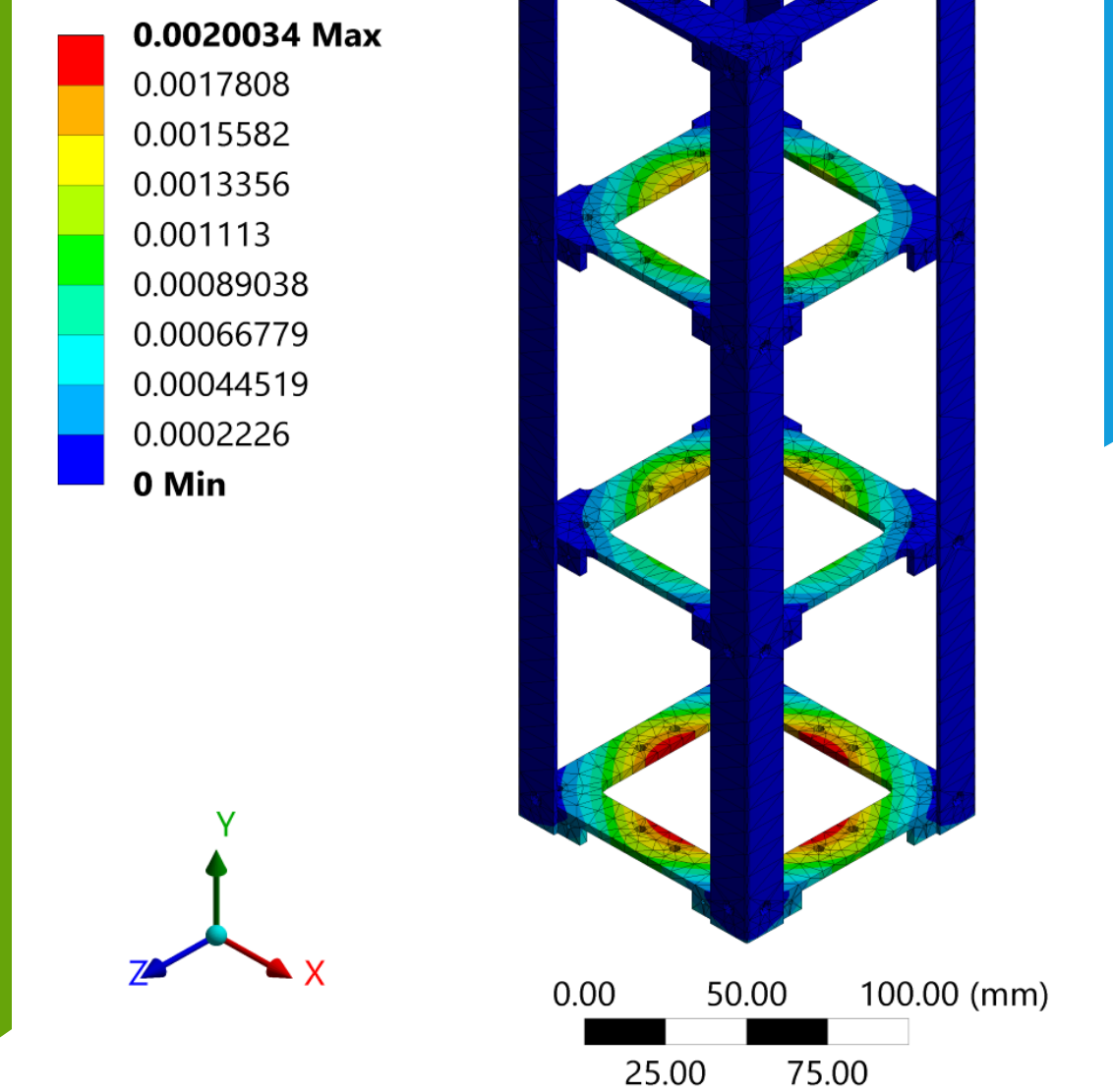
B: Static Structural
Figure
Type: Equivalent (von-Mises) Stress
Unit: MPa
Time: 1
03/06/2021 23:10



Finite-Element Analysis

- **ANSYS** used to validate design and material choice throughout design iteration.
- FEA under simulated launch conditions shows that **deformations are negligible** and equivalent stresses are far below yield strength of material.

B: Static Structural
Figure
Type: Total Deformation
Unit: mm
Time: 1
03/06/2021 23:11



Testing

- **Random vibration testing** conducted, simulating maximum vibration frequencies experienced at launch (20 to 2000 Hz)
- Full satellite assembly mounted onto vibration plate
- **No significant deformations or fracture observed** upon completion of testing; confirms that our design is appropriate and suitable for the support, protection and integration of the satellite's sub-systems and other constituents.

