

CubeSat Camera - Project Proposal

Overview

Developing a bespoke low-resolution camera for a 1U CubeSat to capture imagery of cities from low Earth orbit (LEO) as part of the CubeSat 1 mission.

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1 Context

CubeSats have revolutionised space-based observation by providing cost-effective solutions for Earth imaging. This project aims to design, develop, and deploy a custom-built optical imaging payload within a 1U CubeSat for capturing low-resolution images of urban cities on a future High Altitude Balloon mission. This project will serve as a platform to learn more about camera systems, interfaces, applications as well as the mechanical, electrical and computing aspects of camera engineering.

2 Scope

Instead of using off-the-shelf cameras, this project will focus on developing a C2S that meets CubeSat 1 specifications and requirements. The project encompasses the design, fabrication, integration, and testing of a low-resolution camera system for a 1U CubeSat. Key focus areas include:

- Optical system design for imaging urban cities.
- Integration with EPS.
- Onboard image processing and storage capabilities.
- Complying with universal standards and interfaces.
- Communicating and passing information to systems such as STARCOMM and FFS.
- Compliance with space environment constraints such as radiation and thermal conditions.

3 Anticipated Challenges

Several challenges must be addressed to ensure mission success:

- **Power and size limitations:** The CubeSat's small form factor restricts available power for the camera system, as well as how much space can be occupied by the camera.
- **Data storage and transmission:** High-resolution images require efficient storage and downlink solutions.
- **Orbital constraints:** The satellite's orbit affects image acquisition timing and coverage.
- **Thermal management:** Space conditions necessitate effective heat dissipation strategies for the camera.

4 Responsibilities

The project will involve multiple stakeholders with defined roles:

- **Optics:** Design and optimise the imaging system.
- **Software:** Develop onboard image processing algorithms.
- **Electrical:** Ensure power and data management efficiency.

5 Project Personnel Expectations

Team members are expected to contribute to their respective responsibility and communicate to all other members in the project. Key expectations include:

- Adherence to project timelines and milestones.
- Regular reporting and documentation of progress.
- Compliance with industry standards and best practices.
- Participation in testing and mission simulation activities.

6 Project Outcome Expectations

The successful execution of this project should result in:

- A functional and space-ready CubeSat camera system that can communicate with the CubeSat interface.
- Captured low-resolution imagery of cities on a future High Altitude Balloon mission.
- Documentation of findings on the effectiveness of the CubeSat imaging system as well as future improvements.

7 Project Resources

With the upcoming wave of new PAST members it is difficult to conclude on a definite timeline. However, it can be estimated that the project will follow main stages:

- Literature Review
- Schematic Drafting for optics and circuit boards.
- Manufacturing and testing.

Regarding cost, the camera system itself should cost between \$250-\$500AUD. This cost is limited to a final iteration however and is not inclusive of different versions. To develop a functioning prototype inclusive of testing various iterations, an estimated upper budget of \$1500AUD would be required.