



Curtin University



Faculty of Science and Engineering

2020 Australian Government Research Training Program Scholarships

Strategic Project Profile

PROJECT TITLE: Advanced Communications Techniques for Small Satellites

FIELD OF RESEARCH CODE: 0201

PROJECT SYNOPSIS:

This project will explore the miniaturization of revolutionary advances in communications for use in small satellites. Several techniques and technologies that have emerged over the past decade show promise in transforming space communications. In a heavily used and regulated radio-frequency spectrum, advances in antenna design and signal encoding will be fundamental in more efficient use of this limited resource for high speed communication.

In the optical domain, developing laser and sensor technologies provide a viable alternative and promise to provide the fastest data links with optical communication. Quantum communication is rapidly becoming the focus of data security and encryption research, by taking advantage of photons relayed in a state of quantum superposition to distribute encryption keys. Satellite based delivery of the quantum entangled photons is currently projected to be the path to large quantum networks and secure data transmission.

Each of these advances primarily consists of technologies that are currently large and power hungry and require large satellites to host them. This project will make a significant contribution by exploring the adaption of these technologies for use in CubeSats, a form factor of satellite that typically weigh in under 10kg.

The aim of this work will be providing secure high-speed datalink for small satellites, in a low power and volume package, for Earth orbit and deep space.

As part of the CubeSat Program with the Space Science and Technology Centre (SSTC), this project will consist of electronic design, communications theory and a combination of laboratory and inflight testing. The project will take advantage of the CubeSat bus developed at Curtin for the Binar Satellite to test a variety of innovations in Low Earth Orbit and eventually in Lunar Orbit.

FEASIBILITY AND RESOURCING – DESCRIPTION OF THE SUPPORT THIS PROJECT WILL RECEIVE:

The CubeSat team in the SSTC currently comprises 12 staff and PhD students. Within the team there is significant experience in electronic design, mission hardware and spacecraft software development. Dedicated lab space, provided by the Faculty, is equipped with a variety of space environment test equipment. Additionally, past collaborations with the Curtin Institute of Radio Astronomy have provided access to RF equipment and expertise. This project falls within the strategic Emerging Research area of “Space Engineering – Curtin CubeSats” in the Space Science and Technology Centre (SSTC).

WHAT MINIMAL ATTRIBUTES AND SKILLS EXPECTED BY THE CANDIDATE BE COMPETITIVE:

An undergraduate degree in engineering or physics is essential.

A competitive candidate will also have a strong background in radio communications and experience in RF design.

Skills in electronic design and programming in C are also highly desirable.

THE SIGNIFICANCE OF THE PROJECT/ PROGRAM FOR THE ENROLLING SCHOOL OR INSTITUTION:

This project falls within the SSTC strategic plan. Deep space communications are one of the key challenges, globally, for the success of small satellites and this will allow the growth of the program to design CubeSat missions to a multiple planetary bodies, including achieving Lunar Orbit in the near future, ultimately contributing to understanding the formation of the solar system.

In addition, developing an Australian capability in advanced communications is a key goal of the SmartSat CRC. In addition to allowing us to fulfil independent strategic goals, this capability can give us access to significant funding.

Students are advised to contact the Project Lead listed below prior to submission of their scholarship application to discuss their suitability to be involved in this strategic project.

PROJECT LEAD CONTACT

NAME: Professor Phil Bland, Faculty of Science and Engineering

EMAIL: p.a.bland@curtin.edu.au

CONTACT NUMBER: +61 8 9266 9763

CO-SUPERVISOR

NAME: Jonathan Paxman

EMAIL: J.Paxman@curtin.edu.au