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I-INSPIRE - AUSTRALIA'S FIRST UNIVERSITY PICO-SATELLITE MISSION

Abstract

The i-INSPIRE (initial - INtegrated SPectrograph, Imager and Radiation Explorer) satellite is intended to be the first satellite from an Australian University to be designed, built, and actually launched and operated in space. Scheduled for launch in 2013, i-INSPIRE will carry a novel photonics-based spectrograph, an imaging camera, and a radiation detector. The satellite and instruments (except the imaging camera) are being designed and built at the University of Sydney, with testing there, ANSTO and elsewhere.

The satellite body is cylindrical with a 9 cm diameter and 13 cm height. Since it has a tubular shape, this satellite is called a TubeSat. Satellite platform distributes the power, communication and on board data handling (OBDH) subsystems into three individual PCBs (Printed Circuit Board). As the key of whole system, OBDH subsystem consists of one low power consumption MSP430 microcontroller for main data processing and independent AX.25 encoder/decoder for downlink/uplink communication. Observational data from payloads will be collected and stored in an MMC (Multi Media Card) device. A FM transceiver, the main part of the communication subsystem, works in the UHF (Ultrahigh Frequency) band and AFSK modulation is applied in transmitting. The addition of MEMS (Micro Electronic Mechanical System) IMU (Inertial Measurement Unit) is being considered to determine the current attitude of i-INSPIRE, in order to confirm the pointing inferred from the imaging camera.

INSPIRE is a pico-satellite with a mass less than 1 kg .This makes it a great challenge to fit real scientific instruments. The photonics-based spectrograph, Nanospec, involves bringing visible light from 8 optical fibres as thin as a human hair to a diffraction grating and dispersing each fibre's light spatially as a function of wavelength onto a separate region of a camera's detection array. This fundamentally new device has the potential to have world-leading wavelength resolution and diffraction-limited optics in a device weighing less than 1 kg. Myriad applications are envisaged, especially in conjunction with imaging. The radiation detector is a small Geiger counter that detects the number of energetic electrons, protons, and other "cosmic rays" passing through the detector. It is a modified version of a commercial device, miniaturized to our design and integrated on payload PCB. The imaging camera is an off-the-shelf device. The total cost of the satellite and instruments, is less than $10,000, and the i-INSPIRE project will be a prototype for future larger and more complex scientific mission.