15th SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Earth Observation Missions (4)

Author: Dr. Robert Wright
University of Hawaii, United States, wright@higp.hawaii.edu

Dr. Paul Lucey
University of Hawaii, United States, lucey@higp.hawaii.edu
Dr. Keith Horton
University of Hawaii, United States, keith@higp.hawaii.edu
Mr. Mark Wood
University of Hawaii, United States, mark@higp.hawaii.edu
Mr. Harold Garbeil
University of Hawaii, United States, harold@higp.hawaii.edu
Ms. Sarah Crites
University of Hawaii, United States, scrites@hawaii.edu

THE THERMAL HYPERSPECTRAL IMAGER: AN INSTRUMENT FOR REMOTE SENSING OF EARTH'S SURFACE, OCEANS, AND ATMOSPHERE, FROM A MICRO SATELLITE PLATFORM

Abstract

The Thermal Hyperspectral Imager (THI) is a low cost, low mass, power efficient instrument designed to acquire hyperspectral remote sensing data in the long-wave infrared. The instrument has been designed to satisfy mass, volume, and power constraints necessary to allow for its accommodation in a 95 kg micro-satellite bus, designed by staff and students at the University of Hawaii. THI acquires approximately 30 separate spectral bands in the 8 to 14 μm wavelength region, at 10 wavenumber resolution. Rather than using filtering or dispersion to generate the spectral information, THI uses an interferometric technique. Light from the scene is focused onto an uncooled microbolometer detector array through a stationary interferometer, causing the light incident at each detector at any instant in time to be phase shifted by an optical path difference which varies linearly across the array in the along-track dimension. As platform motion translates the detector array in the along-track direction at a rate of approximately one pixel per frame (the camera acquires data at 30 Hz) the radiance from each scene element can be sampled at each OPD, thus generating an interferogram. Spectral radiance as a function of wavelength is subsequently obtained for each scene element using standard Fourier transform techniques. Housed in a pressure vessel to shield COTS parts from the space environment, the total instrument has a mass of 15 kg. Peak power consumption, largely associated with the calibration procedure, is <90 W. From a nominal altitude of 550 km the resulting data would have a spatial resolution of approximately 300 m. Although an individual imaging event yields approximately 1 Gbit of raw uncompressed data, onboard processing (to convert the interferograms into a conventional spectral hypercube) can reduce this to tens of Mbits per scene. In this presentation we will describe a) the rationale for the project, b) the instrument design, and c) how the data are processed. Finally we will present data acquired by THI from a small aircraft to demonstrate the spectro-radiometric quality of the data that the instrument can provide.