Project Imua: A UHCC Four-Campus Enterprise for Small Satellite Development

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Project Imua (to move forward in Hawaiian) is a joint faculty-student enterprise of four campuses within the University of Hawai‘i Community College system (Honolulu, Kapi‘olani, Kaua‘i and Windward Community Colleges) dedicated to designing, fabricating and testing small payloads for launch into space. This multi-campus project is funded by a two-year $500,000 grant awarded to the Hawai‘i Space Grant Consortium under the NASA Space Grant Competitive Opportunity for Partnerships with Community Colleges and Technical Schools. This grant includes $200,000 in student internships.

Sixteen students are involved in Project Imua’s first mission, which is scheduled in August for sub-orbital flight through the RockSat-X program. The Kaua‘i campus developed the payload’s scientific instrumentation, consisting of a ultraviolet spectrometer for measuring solar irradiance above the atmosphere. Students from the Honolulu campus fabricated the payload’s electronic circuitry as well as two engineering experiments — a 9-axis motion tracking device (accelerometer, gyro and magnetometer) and an array of photosensors for determining the orientation of the sun to the payload. The Kapi‘olani campus designed the print circuit board for the system’s power and telemetry. Students from the Windward campus were responsible for integrating all subsystem components together, performing full mission simulation tests and conducting various environmental static tests on the assembled payload. The payload’s aluminum mechanical housing, which measures approximately 8” x 8” x 5”, was developed jointly by the Kaua‘i and Windward campuses.

Coordinating such a multi-campus/multi-island project presents its own special challenges. Organizationally the program operates under the guidance of a project manager, campus mentors and several technical consultants. Communication networks among the campuses incorporate Google Hangouts and local telecon sessions as well as Google Drive, emails and other social media. Face-to-face meetings were also built into the demanding one-year schedule. Students furthermore participated in periodic teleconferences with the RockSat-X coordinators in Colorado. These benchmark review sessions simulate the same procedures required by NASA employees and its sub-contractors, thus providing students with a valuable experience in aerospace engineering protocols.

In preparation for its August launch, the assembled payload first was subjected to vibration and pressure tests at UH Mānoa’s Hawai‘i Space Flight Laboratory (HSFL). Later in June seven members of the Project Imua team traveled to NASA Wallops Flight Facility (WFF) in Virginia to conduct additional environmental tests, including spin, vibration, balance, moment of inertia and skirt deployment. The UHCC students also assisted with the
integration their payload onto the RockSat-X structure carrying the other six experiments from various other universities.

Project Imua’s first payload named PIP is scheduled for sub-orbital flight on August 11, 2015 aboard a Terrier Improved Malemute sounding rocket from WFF. Eleven Imua team members are traveling to Wallops to witness this historic launch, which marks the first ever space flight of a payload fully developed by UHCC undergraduates. The flight’s sub-orbital trajectory will carry the payload to an altitude of approximately 100 miles, where the onboard spectrometer that will measure the sun’s ultraviolet radiation. Data from this experiment will contribute to an understanding of the variations of the sun’s UV irradiance. With extremes varying from solar sunspot maximum to solar minimum, the nature of this change is still not well known and may have significant impact on the earth’s upper atmosphere (thermosphere and ionosphere) and climate.

Upon completion of this two-year project, the lessons learned and partnerships established will provide the UHCC campuses a proven platform for moving forward (imua) in playing a major role in the development and support of HSFL’s CubeSat missions slated for launch at the Pacific Missile Range Facility on Kaua’i. Most importantly, Project Imua will offer undergraduate students the opportunity to gain practical hands-on STEM skills and experience through the real-world, project-based activities that are associated with the development of satellite payloads.