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SETEC LAB'S SMALL SATELLITE PROGRAM FOR ENVIRONMENTAL MONITORING

Abstract

Costa Rica is known worldwide for its efforts regarding conservation and utilization of environmental resources, which have been considerably affected over the last few years due to climate change. To aid the country's efforts on environmental preservation, the Small Satellite Program for Environmental Monitoring (SS-PEM) was created at the Space Systems Laboratory of the Costa Rica Institute of Technology (SETEC Lab). The objective of the program is to use small satellites for Earth observation, generating valuable data to analyze the effects of climate change in the country. The program focuses on the development of CubeSat Store and Forward (CSF) Systems, which consists of three components: (1) ground sensors that provide in situ data, (2) a CubeSat to collect the data transmitted by the sensors and (3) a ground station that will receive the data forwarded by the CubeSat for analysis and processing. The laboratory is currently developing two flagship projects as part of its program: Irazú and GWSat. Irazú consists of using a 1U CubeSat to monitor Costa Rican forest growth to calculate carbon fixation, aiding in the country's goal of becoming a carbon neutral entity by 2021. The project is a joint effort by the Costa Rica Institute of Technology (TEC) and the Central American Association of Aeronautics and Space (ACAE). Ground sensors measuring tree diameter growth will be placed in a remote experimental site, and will use the CubeSat to forward the data to a research center located in the TEC campus. It will be deployed from the International Space Station in April 2018 for a 6-month operation. GWSat is a project led by The George Washington University (GWU) in collaboration with TEC and the United States Naval Academy. It consists of using a 3U CubeSat to test GWU's Micro-Cathode Arc Thruster technology that is being developed at GWU's Micro-Propulsion and Nanotechnology Laboratory. Furthermore, the satellite will act as a CSF system that will monitor Costa Rican wetlands, collecting data from ground sensors and images from an onboard camera. The satellite is projected to launch by the end of 2019 for a 9-month operation. In this paper, an overview of the program is presented, along with lessons learned to establish a sustainable satellite program in an emerging space nation. Furthermore, the benefits of using small satellite technology for climate change monitoring is presented, along with a strategic plan on how to implement this technology at a global scale.