Status of the MicroMAS-2 and TROPICS CubeSat Missions

W. J. Blackwell and R. Vincent Leslie
Lincoln Laboratory, Massachusetts Institute of Technology
244 Wood St., Lexington, MA 02420-9185 U.S.A; 781-981-7973
wjb@LL.MIT.EDU

ABSTRACT

There has been much recent progress with CubeSat-hosted microwave instrumentation for atmospheric sensing. The Microsized Microwave Atmospheric Satellite Version 2a (MicroMAS-2a), launched on January 11, 2018 and has successfully demonstrated temperature sounding using channels near 118 GHz and humidity sounding using channels near 183 GHz. A second MicroMAS-2 flight unit (MicroMAS-2b) will be launched in late 2018 as part of ELANA-XX. Building on the MicroMAS-2 successes, the Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of Smallsats (TROPICS) mission, selected by NASA in 2016 as part of the Earth Venture–Instrument (EVI-3) program, will provide nearly all-weather observations of 3-D temperature and humidity, as well as cloud ice and precipitation horizontal structure, at high temporal resolution to conduct high-value science investigations of tropical cyclones. TROPICS will provide rapid-refresh microwave measurements (median refresh rate of approximately 40 minutes for the baseline mission) over the tropics that can be used to observe the thermodynamics of the troposphere and precipitation structure for storm systems at the mesoscale and synoptic scale over the entire storm lifecycle. TROPICS comprises a constellation of six CubeSats in three low-Earth orbital planes. Each CubeSat will host a high performance radiometer to provide temperature profiles using seven channels near the 118.75 GHz oxygen absorption line, water vapor profiles using three channels near the 183 GHz water vapor absorption line, imagery in a single channel near 90 GHz for precipitation measurements (when combined with higher resolution water vapor channels), and a single channel at 205 GHz that is more sensitive to precipitation-sized ice particles. TROPICS spatial resolution and measurement sensitivity is comparable with current state-of-the-art observing platforms. TROPICS flight hardware development is on track for a 2019 delivery. This presentation will describe the formulation, execution, and interaction of these two very different missions in the context of technology development as an enabler for groundbreaking science missions performed from relatively low-cost small satellite platforms.