PRE-LAUNCH CALIBRATION AND PERFORMANCE STUDY OF THE POLARCUBE 3U TEMPERATURE SOUNDING RADIOMETER MISSION

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The positive impact of passive microwave observations of tropospheric temperature, water vapor and surface variables on short-term weather forecasts has been clearly demonstrated in recent forecast anomaly growth studies. The development of a fleet of such passive microwave sensors especially at V-band and higher frequencies in low earth orbit using 3U and 6U CubeSats could help accomplish the aforementioned objectives at low system cost and risk as well as provide for regularly updated radiometer technology. The University of Colorado's 3U CubeSat, PolarCube is intended to serve as a demonstrator for such a fleet of passive sounders and imagers. PolarCube supports MiniRad, an eight channel, double sideband 118.7503 GHz passive microwave sounder. The mission is focused primarily on sounding in Arctic and Antarctic regions with the following key remote sensing science and engineering objectives: (i) Collect coincident tropospheric temperature profiles above sea ice, open polar ocean, and partially open areas to develop joint sea ice concentration and lower tropospheric temperature mapping capabilities in clear and cloudy atmospheric conditions. This goal will be accomplished in conjunction with data from existing passive microwave sensors operating at complementary bands; and (ii) Assess the capabilities of small passive microwave satellite sensors for environmental monitoring in support of the future development of inexpensive Earth science missions.

The instrument, MiniRad is anticipated to fly as part of NASA's IceBridge mission on the DC-8 airborne science laboratory in late October. Aircraft imagery from this mission demonstrating the instrument's pre-launch performance will be presented. Other data detailing the status of the payload/spacecraft from pre-launch calibration such as (i) characterization of the antenna sub-system comprising of an offset 3D printed feedhorn and spinning parabolic reflector and impact of the antenna efficiencies on radiometer performance, (ii) characterization of MiniRad's RF/IF hardware with respect to temperature fluctuations and their impact on atmospheric temperature weighting functions and receiver sensitivity, and (iii) results of vibration and thermal-vacuum testing of the 3U spacecraft will also be provided.