

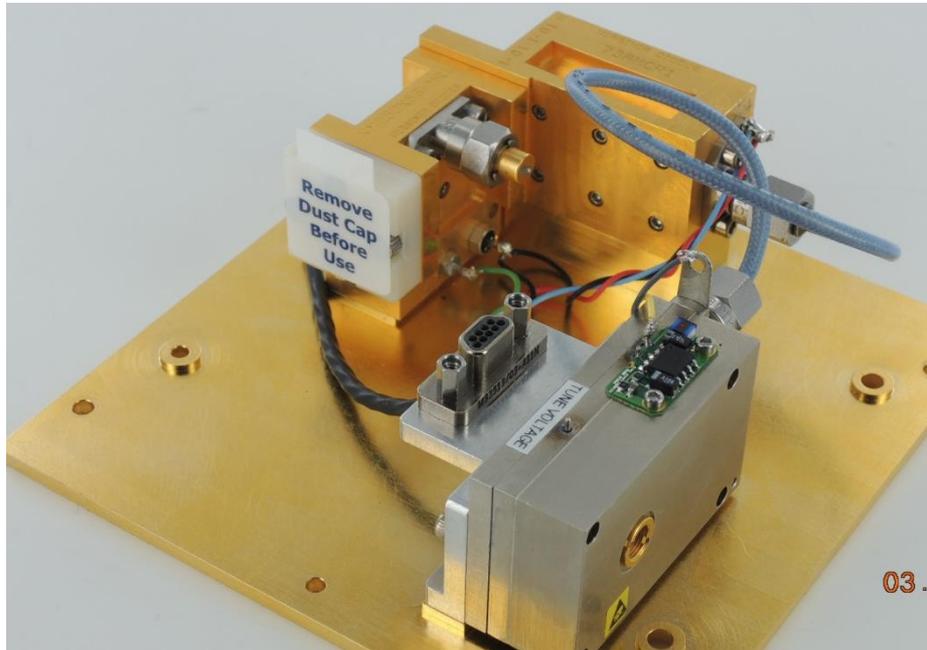
VDI CubeSat Projects

Virginia Diodes, Inc. (VDI) has recently been part of CubeSat projects with NASA Goddard Space Flight Center and MIT Lincoln Laboratory. The following information is a summary of both projects.

VDI continues to provide customized solutions for applications with strict electrical and mechanical specifications, like CubeSat's. Contact VDI for more information.



874 GHz Receiver for IceCube CubeSat



- 874 GHz radiometer for NASA IceCube CubeSat mission to measure cloud ice
- Includes DRO and x36 LO
- 6-12 GHz IF
- 4000K T_{mix} , 12dB L_{mix} (DSB)
- Plate is 9cm x 9cm
- 3.75W total DC (including DRO)

IceCube: Spaceflight Validation of an 874-GHz Submillimeter Wave Radiometer for Cloud Ice Remote Sensing

IceCube Objectives

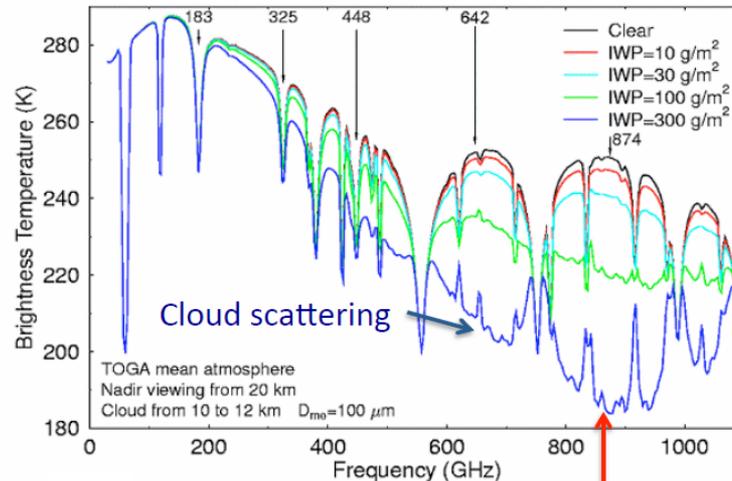


Climate Research Needs

- Accurate cloud ice measurements.
- Cost-effective, sensitive instruments for diurnal and global coverage.
- Mature technology

IceCube Objectives

- Raise overall TRL (5->7) of 874-GHz receiver technology
- Reduce instrument cost and risk by developing path-to-space for COTS submm-wave receiver systems
- Enable remote sensing of global cloud ice with advanced technologies and techniques



Pros

- Good sensitivity to small cloud ice
- Compact and mature receiver technology
- Day-night measurements

Cons

- Large attenuation from water vapor
- High power consumption

NASA Goddard Space Flight Center

D. L. Wu (P.I.)

IceCube: Spaceflight Validation of an 874-GHz Submillimeter Wave Radiometer for Cloud Ice Remote Sensing



National Aeronautics and Space Administration
Goddard Space Flight Center



Measurement and Mission Requirements

874-GHz measurement requirements:

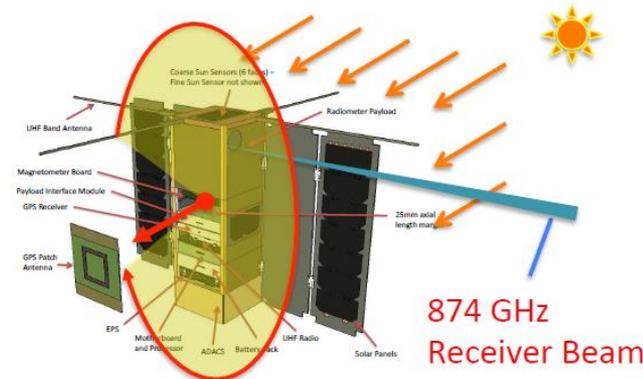
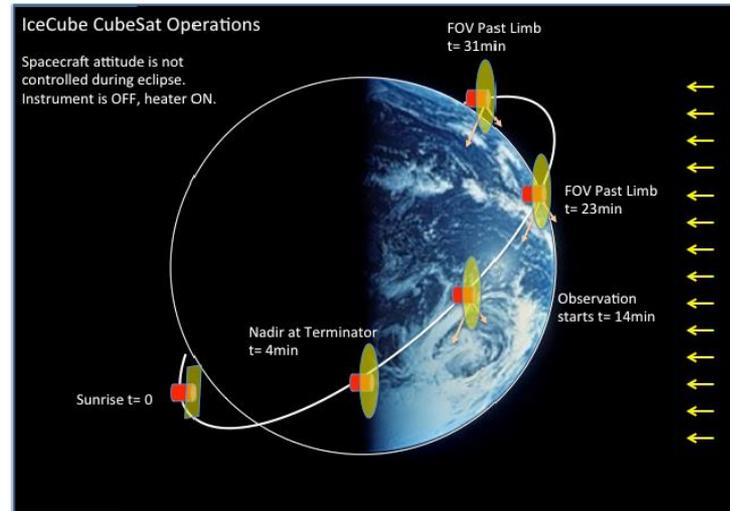
- Accuracy < 2 K
- Precision (NEdT) < 0.25 K
- Spatial resolution < 15 km

Mission requirements:

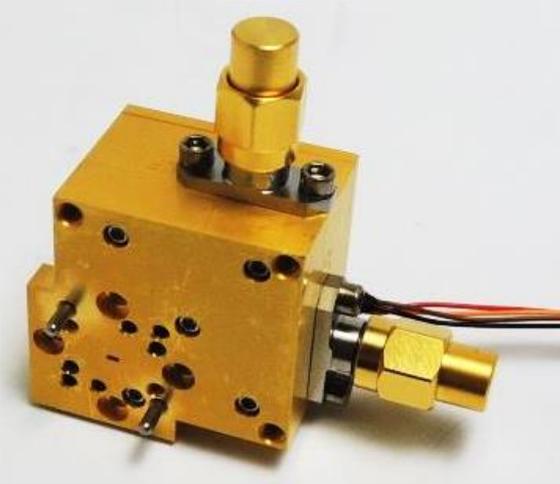
- In-flight operation 28 days
- Periodical views of Earth (science) and space (calibration) within an orbit
- Science data 30+% (8+h /day)
- Pointing knowledge < 25 km

Validation plan:

- Lab measurement and verification
- Modeled vs observed clear-sky radiances for accuracy verification
- Space-view radiances for precision



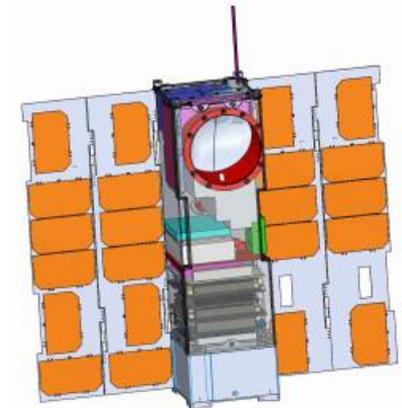
183 GHz Receiver for Mirata CubeSat



- 183 GHz water vapor / cloud ice radiometer receiver for Mirata CubeSat
- Includes x12 LO chain, LO power detector, and mixer
- 0-28 GHz IF
- 600K T_{mix} , 6dB L_{mix} (DSB)
- 1.0" x 1.0" x 0.75"
- +3.5V, 170mA
- Includes integrated detector to monitor LO power for calibration

Microwave Radiometer Technology Acceleration (MiRaTA)

- **3U (10 cm x 10 cm x 34 cm) tri-band radiometer**
 - Temperature, water vapor, and cloud ice
 - Absolute calibration better than 1 K
- **Calibration proof of concept using limb measurements and GPS-RO**
 - Observe coincidental radiometric and GPS-RO atmospheric density information
 - Enabled by high-performance COTS GPS receivers with low size, weight, and power
- **Funded by NASA Earth Science Technology Office (ESTO)**



- 4 kg total mass
- 6 W avg power
- 5 kbps max data rate
- 0.5° pointing accuracy

MIT Lincoln Laboratory
W. Blackwell (P.I.)