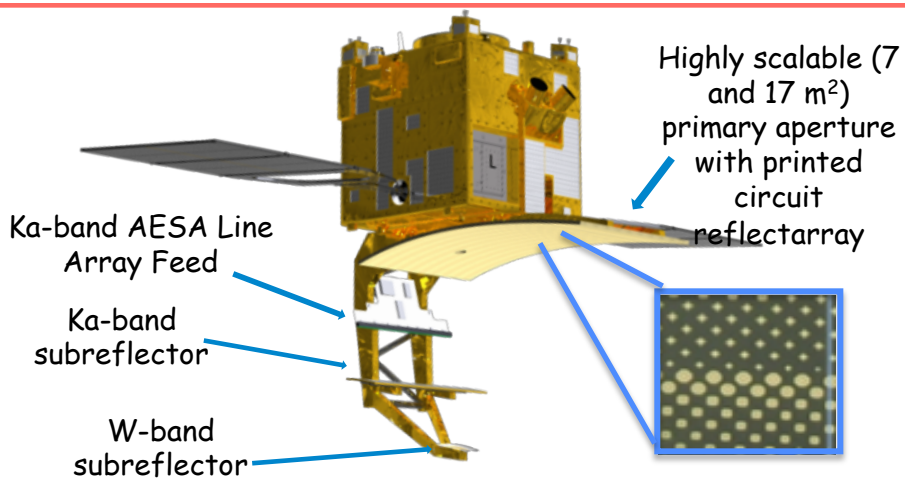
Antenna Technologies for 3-D Wide Swath Imaging Supporting ACE

PI: Paul Racette, NASA GSFC

Objective

- Provide an advanced 3-D cloud imaging capability for the ACE concept by enabling wide swath imaging via electronic beam scanning using single aperture for dual band (Ka and W) operation
- Develop antenna technologies to reduce payload size, weight, power, and cost, by developing:
- Dual-band (Ka and W) aperture design with a reflector/ reflectarray
- Ka-band Active Electronically Scanned Array (AESA) feed for wide scan swath on the ACE radar using GaN Monolithic Microwave Integrated Circuit (MMIC)
- Demonstrate subscale reflector/reflectarray antenna integrated with GSFC Cloud Radar System (CRS) on airborne flight.



Dual Ka- and W-band reflectarray shared antenna aperture with AESA feed for wide swath scan ACE mission radar

Accomplishments

- Developed modeling and simulation tools used for reflectarray antenna design
  - Validated tools through test coupon measurements using cross-dipole and hybrid loop elements on Rogers 6002 and Kapton substrates. Demonstrated low-loss hybrid element reflectarray with low ~0.8 dB phase and amplitude loss
  - Applied tools to design subscale airborne (0.25 m^2) and full scale antennas at two point designs (7 and 17 m^2)
- Designed, fabricated, and tested subscale antenna. Verified antenna performance with range testing; W-band fixed-beam gain of ~51.7 dB; Ka-band gain of ~31.5 dB across 0° – 10° scan angles.
- Flew the subscale reflector/reflectarray antenna for 20 flights with CRS on ER-2 operating at W-band during the Integrated Precipitation and Hydrology EXperiment (IPHEX)
- Designed, fabricated, and wafer tested GaN high power amplifier MMIC with 38 dBm output
- Designed detailed full scale antenna, full scale Ka feed, Ka TR module and full scale radar.

Co-Is/Partners: Gerry Heymsfield, Lihua Li, GSFC; Michael Cooley, Richard Park, Northrop Grumman Electronic Systems

TRL_{in}= 3 TRL_{out}= 4