Three-Band Cloud and Precipitation Radar (3CPR)

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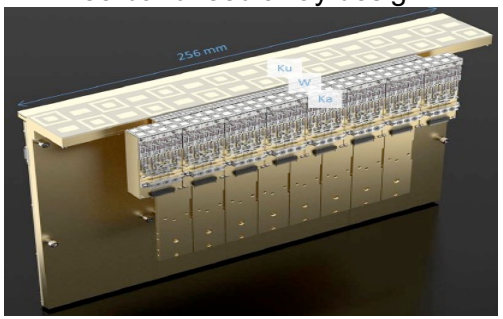
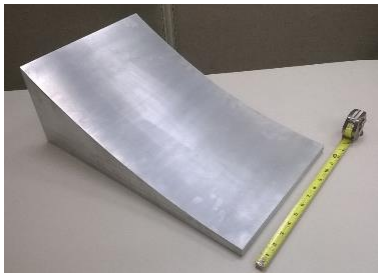
Objective

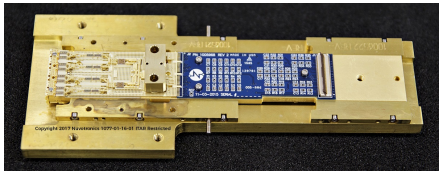
- Develop the instrument design for a spaceborne three-band (Ku/Ka/W-band) 3CPR capable of simultaneous three-frequency, Doppler, cross-track scanning, and polarimetric measurements of hydrometeors (clouds, rainfall, snowfall). 3CPR will:
  - Enable global characterization of cloud-precipitation processes and their correct representation in weather and climate models.
  - Fulfill all radar requirements for the ACE measurement concept, the anticipated radar requirements in the post-GPM mission era, and those set by snowfall science community.
- Develop and demonstrate the key enabling technology for 3CPR – Advanced Cloud and Precipitation Radar Antenna (ACPRA) – a W-band electronic scanning antenna

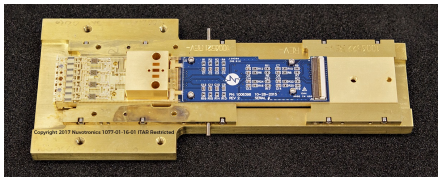
Three-band feed array design



As-built reflector







As-built W-band scanning array tile: transmit (L) and receive (R) side

Accomplishments

- Developed the radar system design that provides a documented feasible path for spaceborne implementation
- Optimized the W-band radiators, feed and reflector geometry
- Developed 30cm x 50cm W-band cylindrical parabolic reflector, 1/10 scale of spaceborne design, suitable for aircraft demonstration.
- Designed and fabricated eight W-band Scanning Array Tiles (SATs) consisting of GaN power amplifiers and low noise amplifiers, 2 × 8 radiator tile and the associated interconnects
  - 16 receive channels, 8 transmit channels, in a very small package (5mm x 20mm x 130mm)
  - Two revisions of SAT were developed in order to optimize performance and manufacturability
  - Successfully demonstrated electronic beam steering
- Developed 64 × 2 subarray W-band electronics for control, RF power division/combination, DC power distribution, and thermal control

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