Wide-swath Shared-Aperture Cloud Radar (WiSCR)

PI: Lihua Li, NASA GSFC

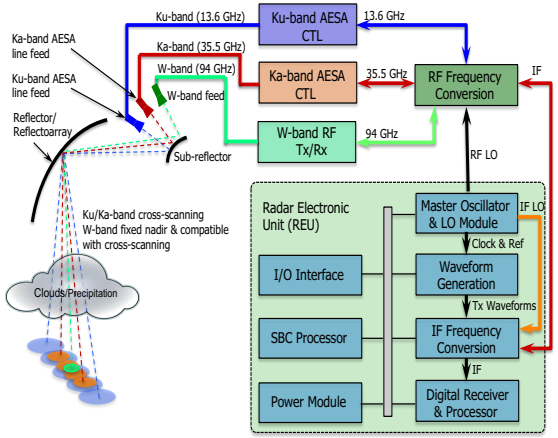
Objective

Develop and mature WiSCR technologies to enable concurrent multi-frequency measurements of clouds and precipitation:

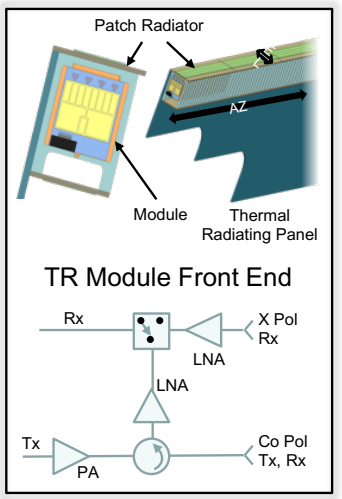
- Ka-band Active Electronically Scanned Array (AESA) T/R module package, which is key to scanning feed for reflector/reflectarray to enable a wide swath imaging cloud radar
- Tri-band shared aperture antenna trade study and concept design
- Frequency Diversity Pulse Pair (FDPP) algorithm to enable spaceborne Doppler measurements of weather targets
- Multi-channel Arbitrary Waveform Generator (MAWG) firmware and Multi-channel Frequency Conversion Modules (MFCM) to enable a versatile waveform and reduced SWaP for multi-frequency radar hardware

Develop concept design for tri-frequency radar (Ku/Ka/W-band) to assess potential for next generation cloud, convection, and precipitation mission

Demonstrate FDPP technique for airborne radars as well as MAWG and MFCM modules in lab and environmental chamber



WiSCR spaceborne triple frequency shared aperture antenna concept



4 channel Ka-band T/R module – AESA feed

Accomplishments

- Developed conceptual design for tri-frequency radar (Ku/Ka/W-band) for potential future cloud, convection, and precipitation mission.
- Developed and matured critical WiSCR technologies to enable concurrent multi-frequency measurements of clouds and precipitation including:
  - Tri-band shared aperture antenna architecture design
  - Designed, fabricated and tested Ka-band T/R MMIC and ASIC components.
  - Developed test structures that are compatible with Ka-band T/R module package.
  - Developed low temperature co-fired ceramic module package with four integrated circulators.
- Developed and tested MAWG based on the space-qualified SpaceCube 2.0 card.
  - Completed MFCM prototype design and fabrication. Tested MFCM and MAWG with airborne HIWRAP transceiver
- Completed FDPP technique trade study, Monte-Carlo simulation, and FDPP implementation on GSFC W-band Cloud Radar System (CRS)
- Demonstrated FDPP technique with CRS during OLYMPEX/RADEX and NOAA GOES-R cal/val flight campaigns.

Co-Is/Partners: Michael Cooley, Peter Stenger, Thomas Hand, Richard Park, Shane Keane, Northrop Grumman Mission Systems; Paul Racette, Gerald Heymsfield, Matthew McLinden, NASA GSFC

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