MISTiC Winds: Midwave Infrared Sounding of Temperature and humidity in a Constellation for Winds

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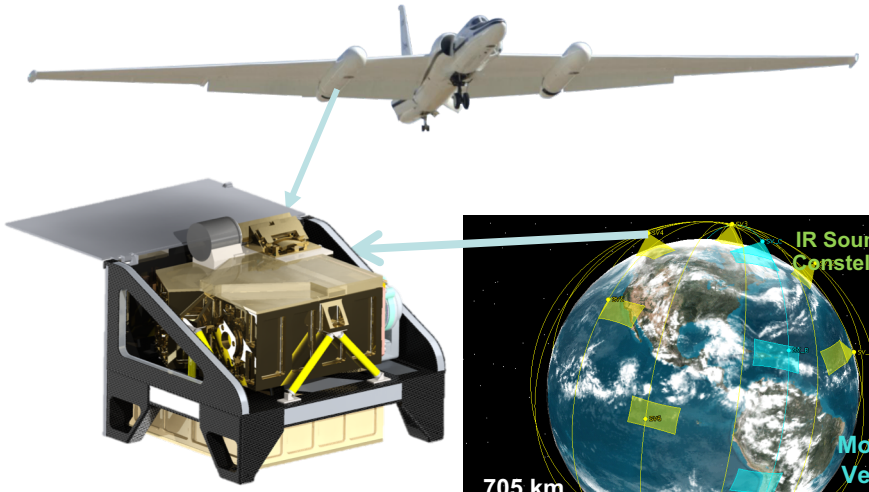
Objective

Advance the readiness of a miniature, high resolution, wide field, thermal emission imaging spectrometer to measure vertically resolved tropospheric profiles of temperature and humidity for deriving global vertically resolved wind observations.

- Provide ~ 2-3 km spatial resolution temperature and humidity soundings of the troposphere using an AIRS-like (Atmospheric Infra-red Sounding) method.
- Enable a LEO constellation approach that provides 3-D Wind field measurements, atmospheric state, and transport observations at low observing system total cost.
- Reduce technology risks with the Infrared Focal Plane Array (IRFPA) and spectrometer technologies critical for significant instrument size, weight and power reduction (20 x 30 x 30 cm, 15 kg, 50 W).



MISTiC Instrument will fit on a ESPA-class μ-Sat

Accomplishments

- Developed key instrument and mission requirements, Observing System architecture and instrument detailed concept design tailored to focus on dynamic weather characterization in the Troposphere with miniature instruments in a constellation
  - Cloud and water vapor motion vector winds with rms wind-speed errors < 2 m/s at 6+ levels in the troposphere
  - High resolution IR soundings of temperature and vertically resolved moisture gradients in the troposphere
  - 15 kg/50 W Instrument is 60x smaller in volume, 10x lower mass, and 4x lower power demand than NASA's AIRS instrument
- Performed critical technology risk reduction through laboratory and airborne testing:
  - APD-mode 640x480 IRFPA with Proton total dose tolerance for 4-year LEO mission life demonstrated
  - Ultra-Low distortion brassboard IR spectrometer assembly demonstrates >700:1 spectral resolving power and high spectral calibration temperature-stability (dI/dT < 2.5% of spectral response function FWHM per 100 mK)
- Conducted several flights on ER2 (~30 hours) multi-pass observations over land sites in southern California, and over the nearby ocean
- Analyzed the airborne data to show vertically resolved moisture gradients, and hyperspectral cloud AMVs that matched with NWS RAWINSONDE wind speed observations to < 2 m/s under challenging high wind-shear conditions

Co-Is/Partners: H. Aumann, JPL; J Susskind, NASA GSFC

TRL_{in}= 3 **TRL_{out}= 5**