The ALOFT Field Campaign: Hunting for Gamma-rays from Thunderstorms

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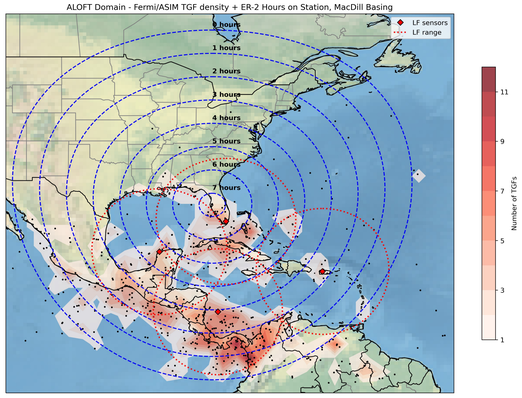
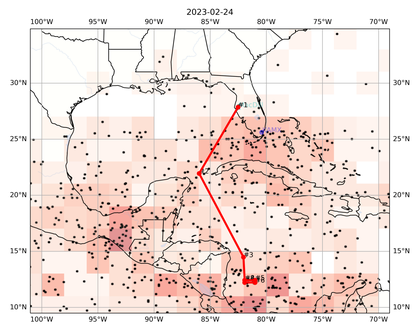
https://www.uib.no/en/aloft

The ALOFT* field campaign is a collaboration between NASA, the University of Bergen (Norway), and other institutions. ALOFT will hunt for terrestrial gamma-ray flashes (TGFs) and gamma-ray glows using the NASA ER-2 aircraft. The science goals of ALOFT are the following:

1. Observe TGFs in one of the most TGF-intense regions on the planet.
2. Observe gamma-ray glows in thunderstorms and their relation to TGFs.
3. Perform International Space Station Lightning Imaging Sensor (ISS LIS) and Geostationary Lightning Mapper (GLM) validation using improved suborbital instrumentation.
4. Evaluate new design concepts for next-generation spaceborne lightning mappers (e.g., CubeSpark).
5. Make combined microwave and lightning measurements of tropical convection from a suborbital platform.

**ALOFT = Airborne Lightning Observatory for FEGS and TGFs*
FEGS = Fly's Eye GLM Simulator



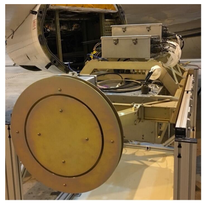


Draft flight plan to sample storms near San Andres Island (Colombia)

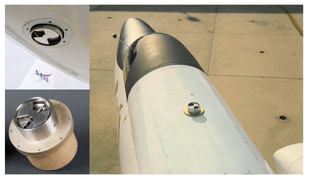
The ALOFT campaign will take place during 1-30 July 2023 out of MacDill Air Force Base (AFB) in Tampa, Florida, USA.

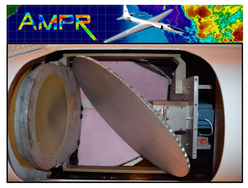
The ER-2 will fly in range of a variety of ground-based lightning observatories scattered around Florida and the southeastern USA, the Gulf of Mexico, Central America, and the northeast Caribbean.

Flights will be planned to sample forecasted thunderstorms in regions favored to produce TGFs and will consist of a mixture of shorter-duration (e.g., FL) and longer-duration (e.g., southern Central America) missions.



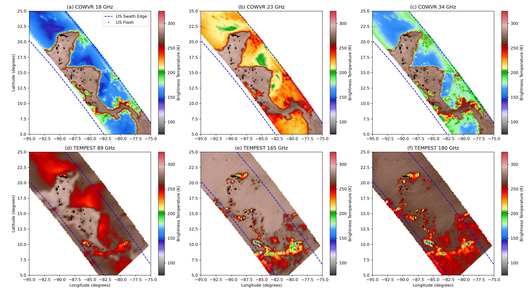
MSFC ALOFT Instruments
FEGS (top)
EFCM (left)
LIP (below)
AMPR (bottom)



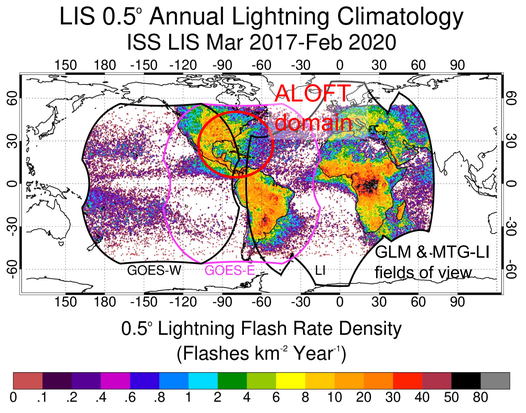


The ALOFT aircraft payload is aimed at observing gamma-rays, lightning, electric fields, as well as thunderstorm kinematic and microphysical structure. MSFC is providing science leadership & multiple instruments.

- UIB-BGO: University of Bergen (UIB) gamma-ray scintillator with realtime downlink to identify glows
- iSTORM: Naval Research Laboratory (NRL) gamma-ray scintillator
- Fly's Eye GLM Simulator (FEGS): Multi-spectral (incl. 337, 500, 777, 868, & 1600 nm) optical lightning photometer, spectrometer, and camera array
- Electric Field Change Meter (EFCM): Combined fast and slow electric field change antenna
- Lightning Instrument Package (LIP): Set of up to 7 field mills that together provide three-dimensional (3D) electric field information
- Cloud Radar System (CRS): GSFC Doppler W-band radar
- X-Band Radar (EXRAD): GSFC Doppler X-band radar
- Advanced Microwave Precipitation Radiometer (AMPR): Cross-track scanning polarimetric radiometer that observes in the 10.7-85.5 GHz range
- Configurable Scanning Submillimeter-wave Imager/Radiometer (CoSSIR): GSFC polarimetric radiometer that observes in the 170-684 GHz range



COWVR, TEMPEST, and LIS observations of Central American storms during overpass



Underflights of NASA, NOAA, and other lightning and gamma-ray observatories in low-Earth and geostationary orbits are planned.

ISS (which includes LIS, the COWVR/TEMPEST microwave radiometers, and the TGF-detecting ASIM) and Fermi Gamma-ray Space Telescope overpasses of thunderstorms within the ALOFT domain will be targeted.

Underflights of GLM-16, GLM-18, and Meteosat Third Generation Lightning Imager (MTG-LI) are also planned. ALOFT should provide a rich validation dataset for spaceborne TGF & lightning sensors!