
SPORT

The Scintillation Prediction Observations Research Task: Mission Overview

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SPORT

- **Joint United States / Brazil Science Mission Concept**

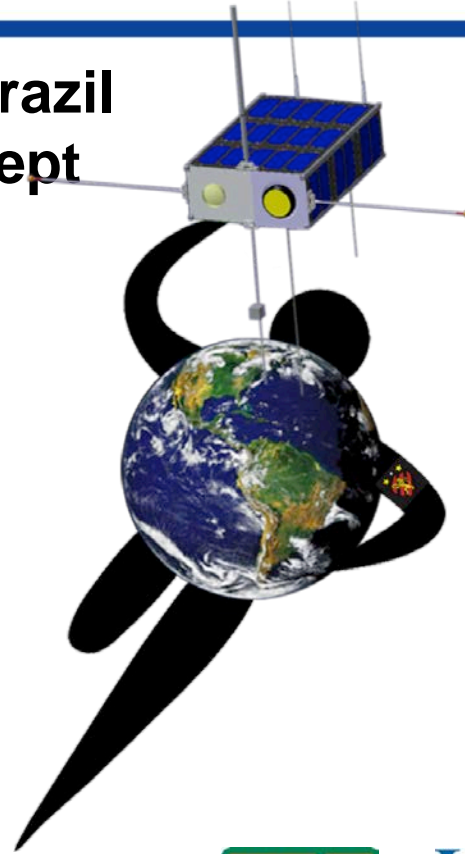
- **United States**

- Science Instruments

- **Brazil**

- Spacecraft

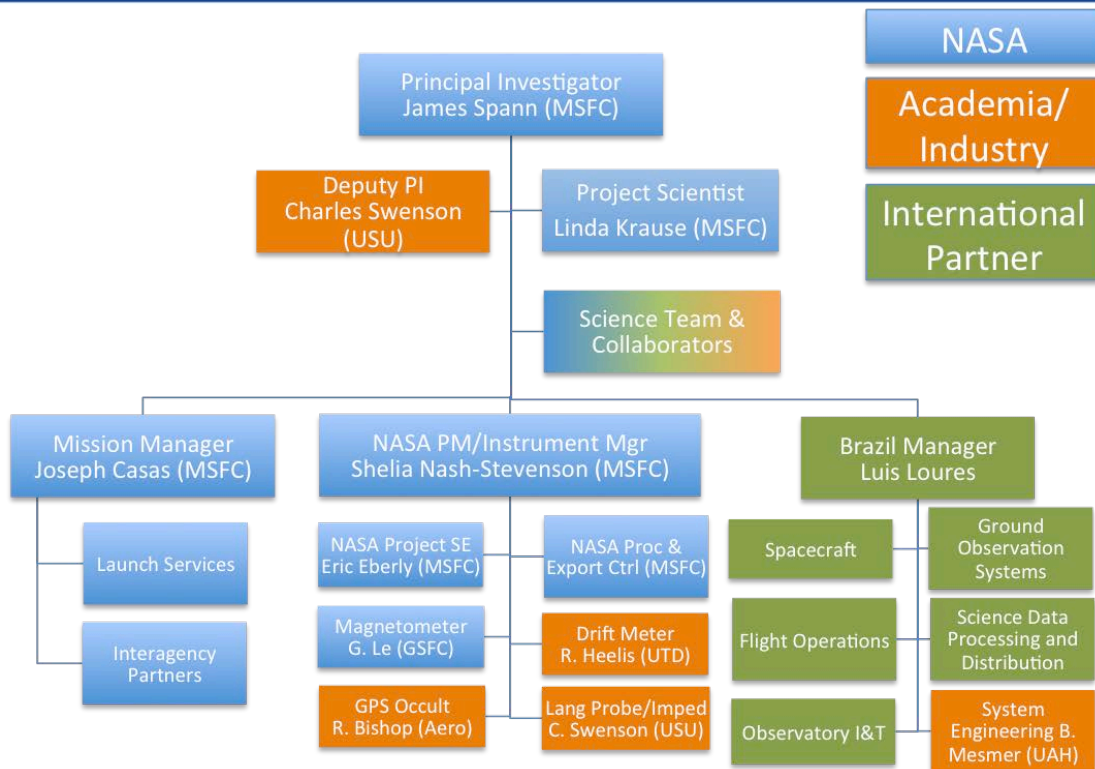
- Operations



Joint Science Data Analysis

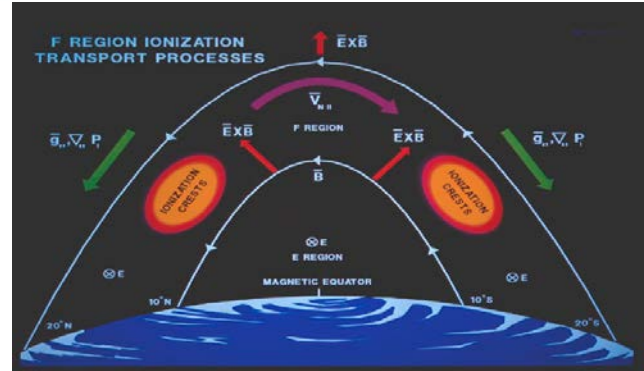


Organization



Science

- The equatorial ionization anomalies



Bela Fejer, The Equatorial Ionosphere: A Tutorial
CEDAR Meeting, Seattle Washington, 2015

- Plasma Bubbles

GUVI (Same Local Time, Different Longitudes)

Why do bubbles sometimes form, and sometimes not, at Different Longitudes?



Kil, Hyosub, et al. "Coincident equatorial bubble detection by TIMED/GUVI and ROCSAT-1." Geophysical research letters 31.3 (2004).



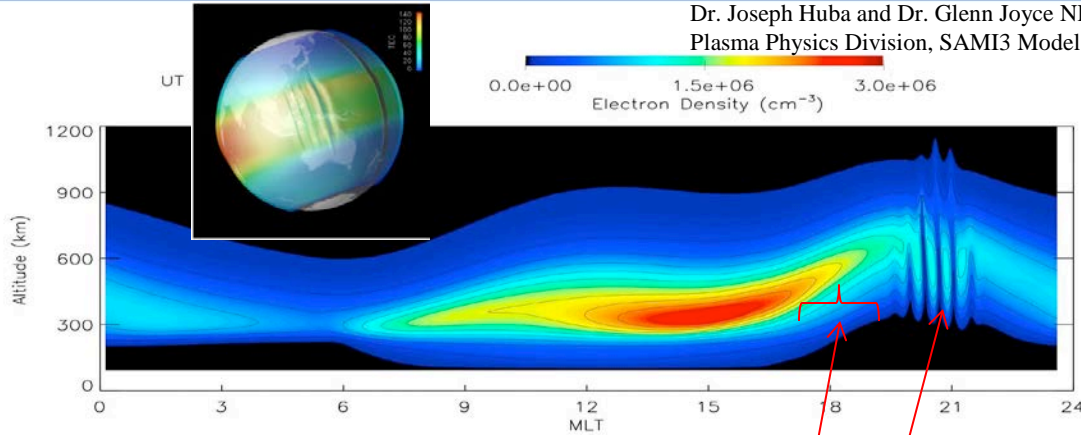
Science Goals

- 1) What is the state of the ionosphere that gives rise to the growth of plasma bubbles that extend into and above the F-peak at different longitudes?
- 2) How are plasma irregularities at satellite altitudes related to the radio scintillations observed passing through these regions?



Plasma Bubbles

About 1.5 Hours to form a bubble

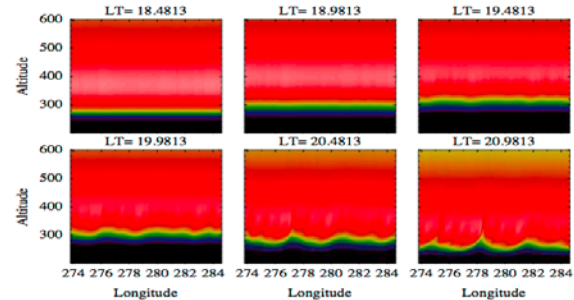
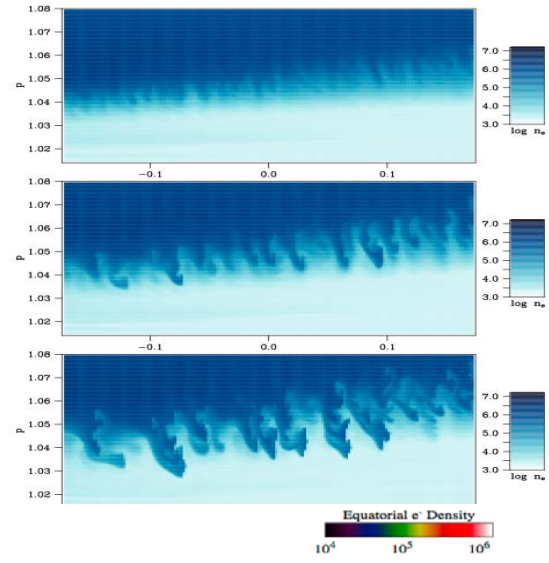


What is the state of the ionosphere here?

That leads to bubbles here ?

When bottom side seeding perturbations
seem to always be present

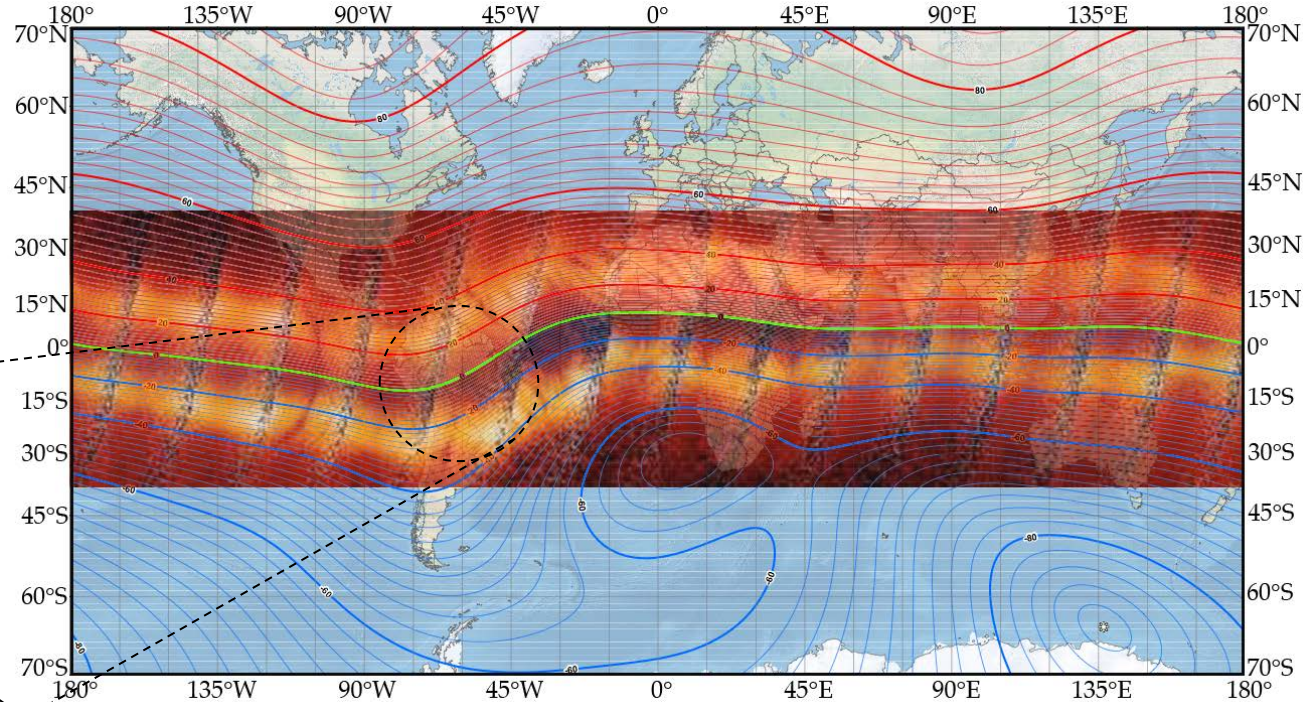
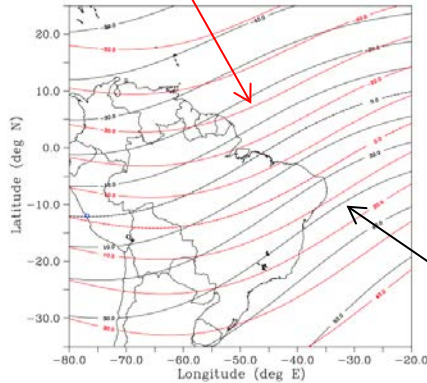
Retterer, J. M., and P. Roddy. "Faith in a seed: on the origins of equatorial plasma bubbles." *Annales Geophysicae*. Vol. 32. No. 5. Copernicus GmbH, 2014.



Magnetic Field

Most ground/radar observations come from the American sector of unique magnetic geometry

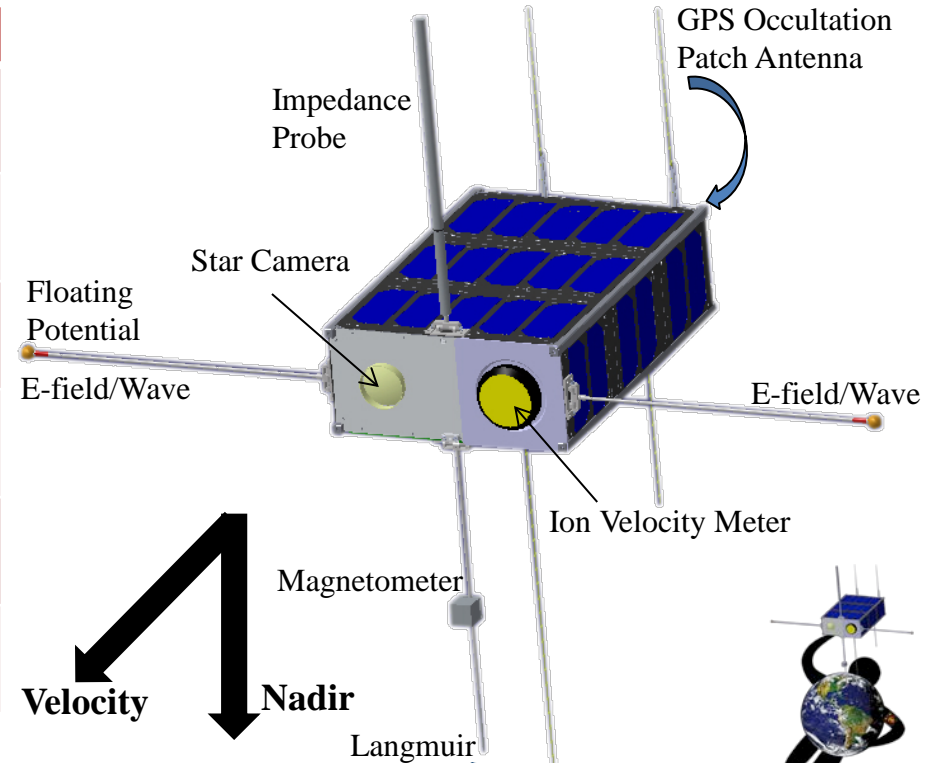
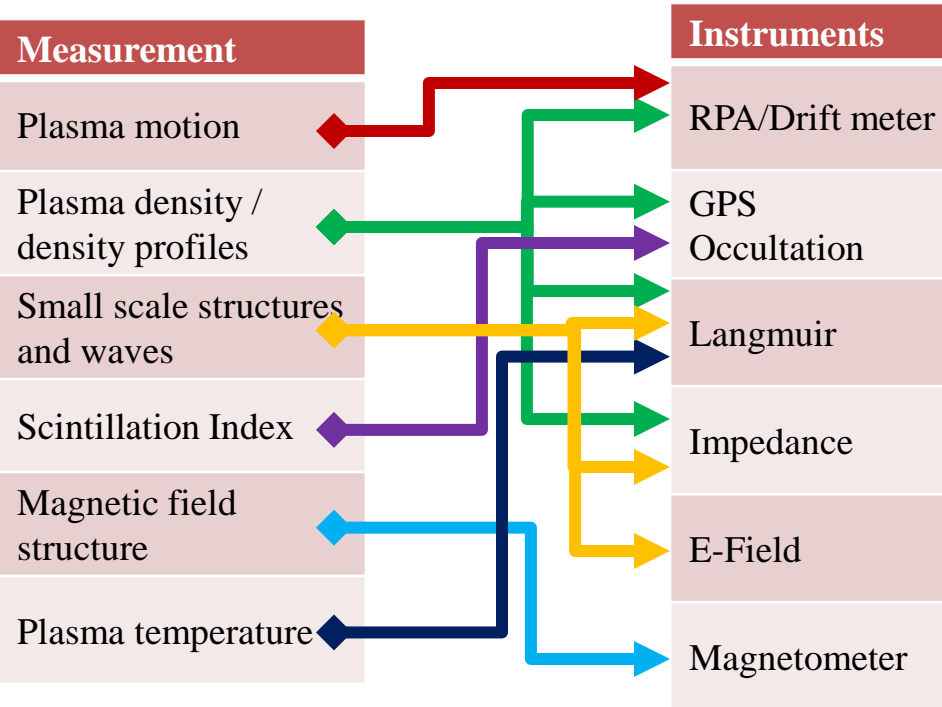
IRGF 1960



IRGF 2010



Measurement and Instrumentation

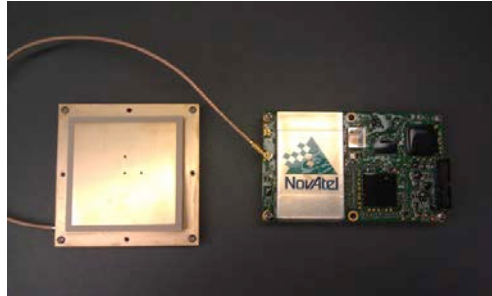


SPORT Instruments

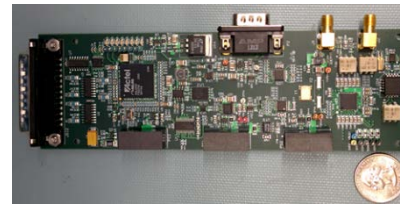
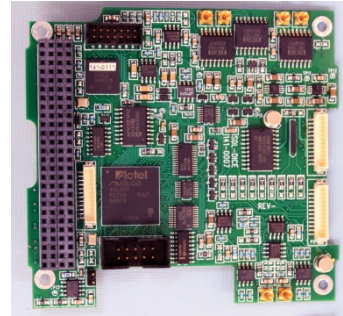
Ion Velocity Meter
UTD



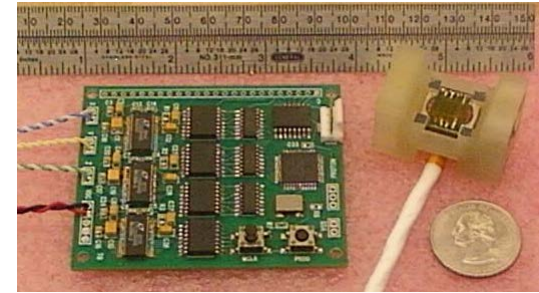
GPS Occultation
Receiver
Aerospace



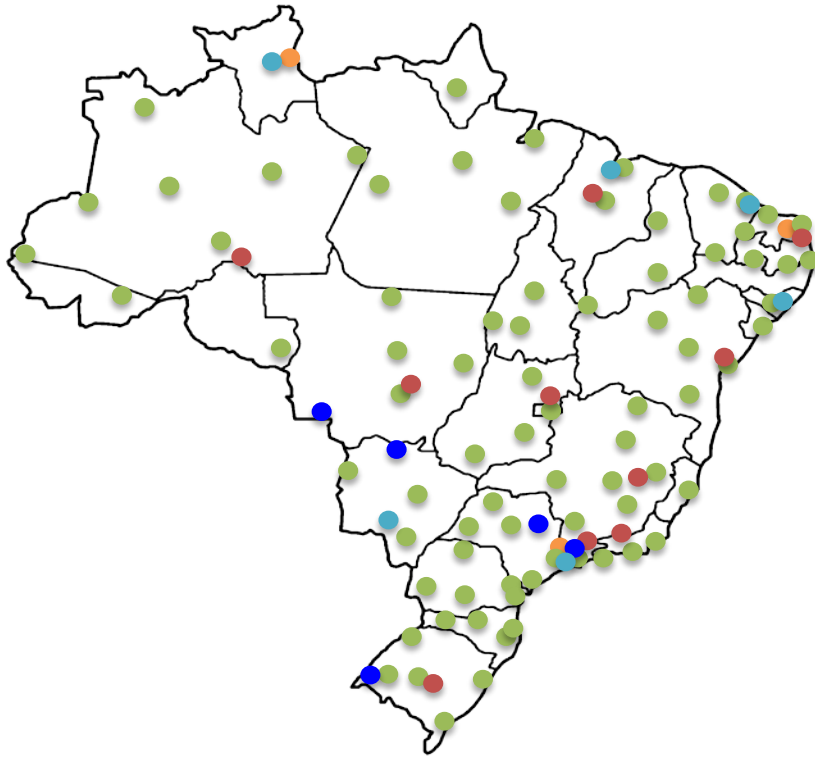
Langmuir, E-field,
Impedance Probe
USU



Fluxgate Magnetometer
NASA Goddard



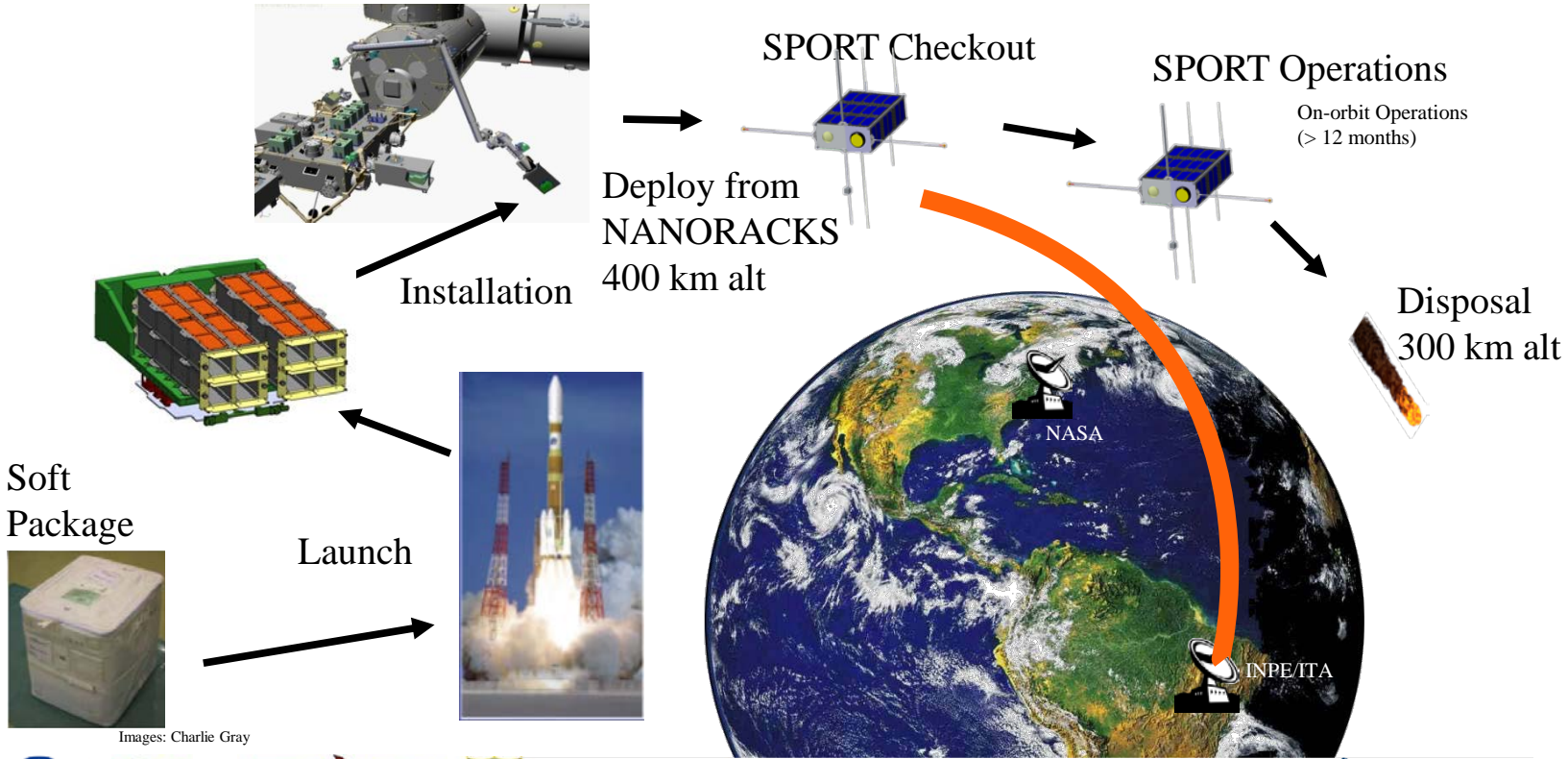
Ground Network



- Magnetometers
- Scintillation sensors
- TEC stations
- Imagers
- Ionosondes



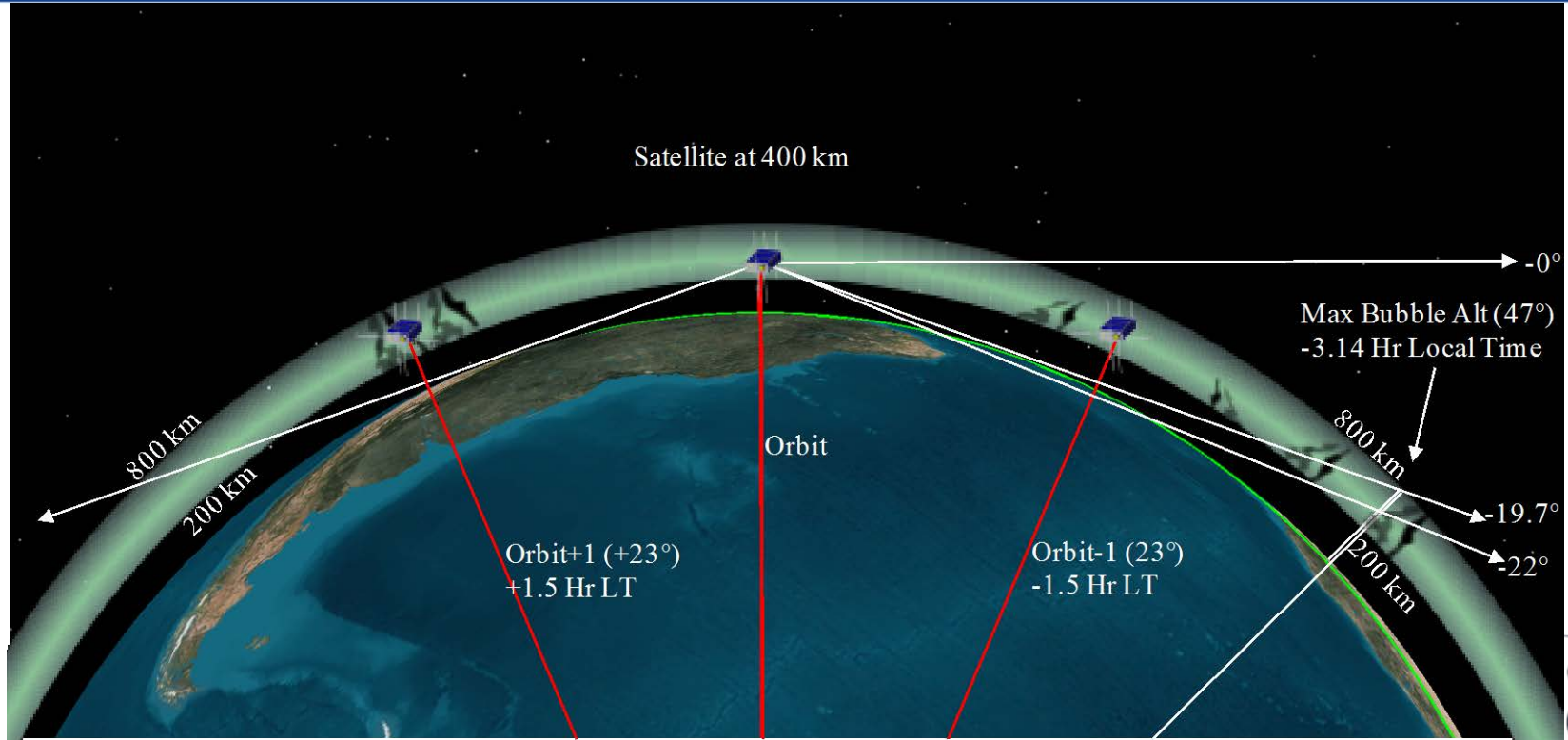
Mission ConOps



Images: Charlie Gray

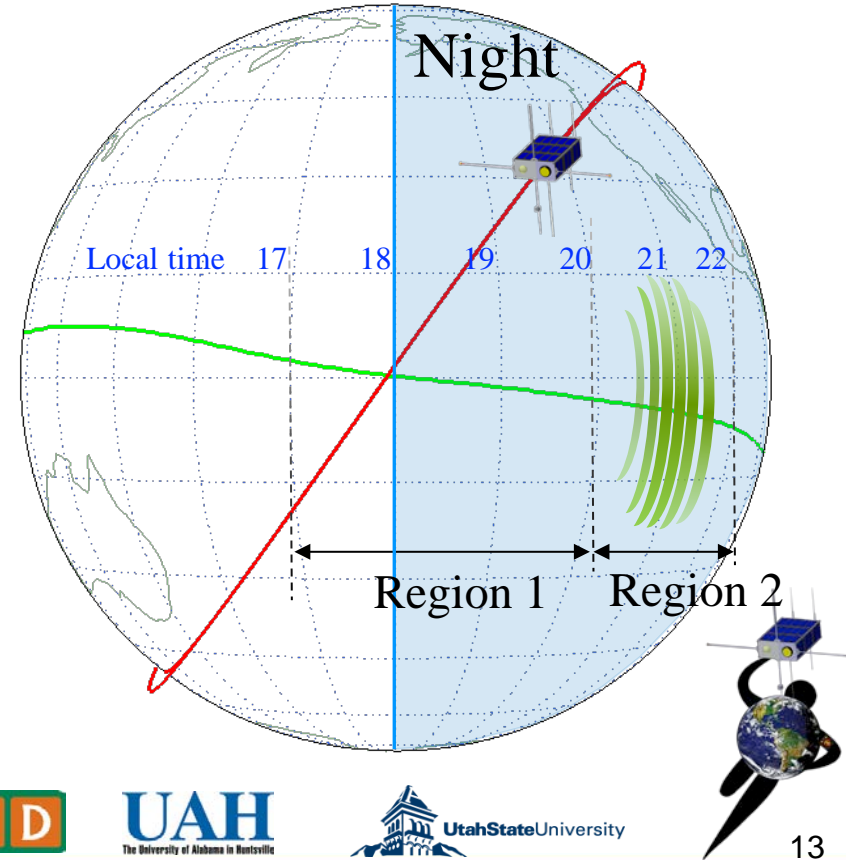


GPS Radio Occultation and Scintillation

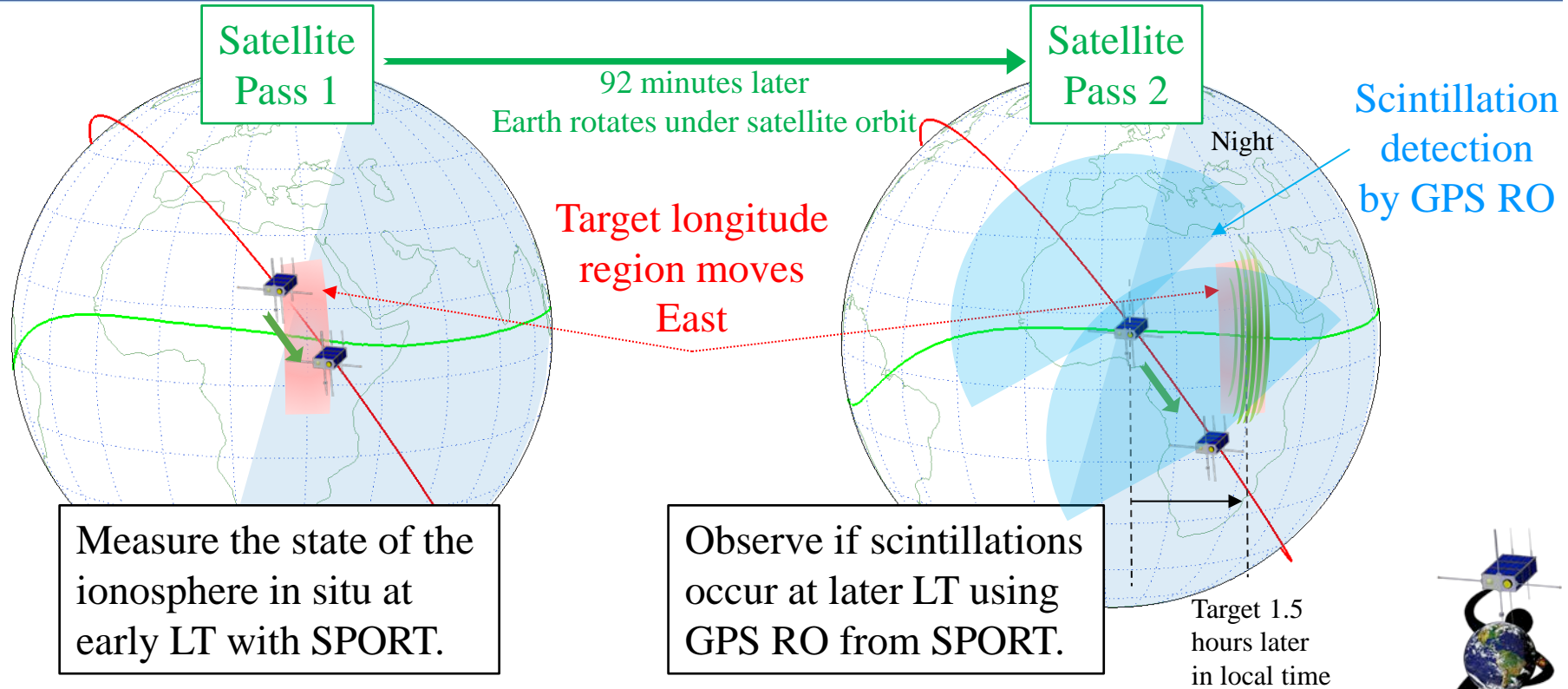


SPORT Methodology

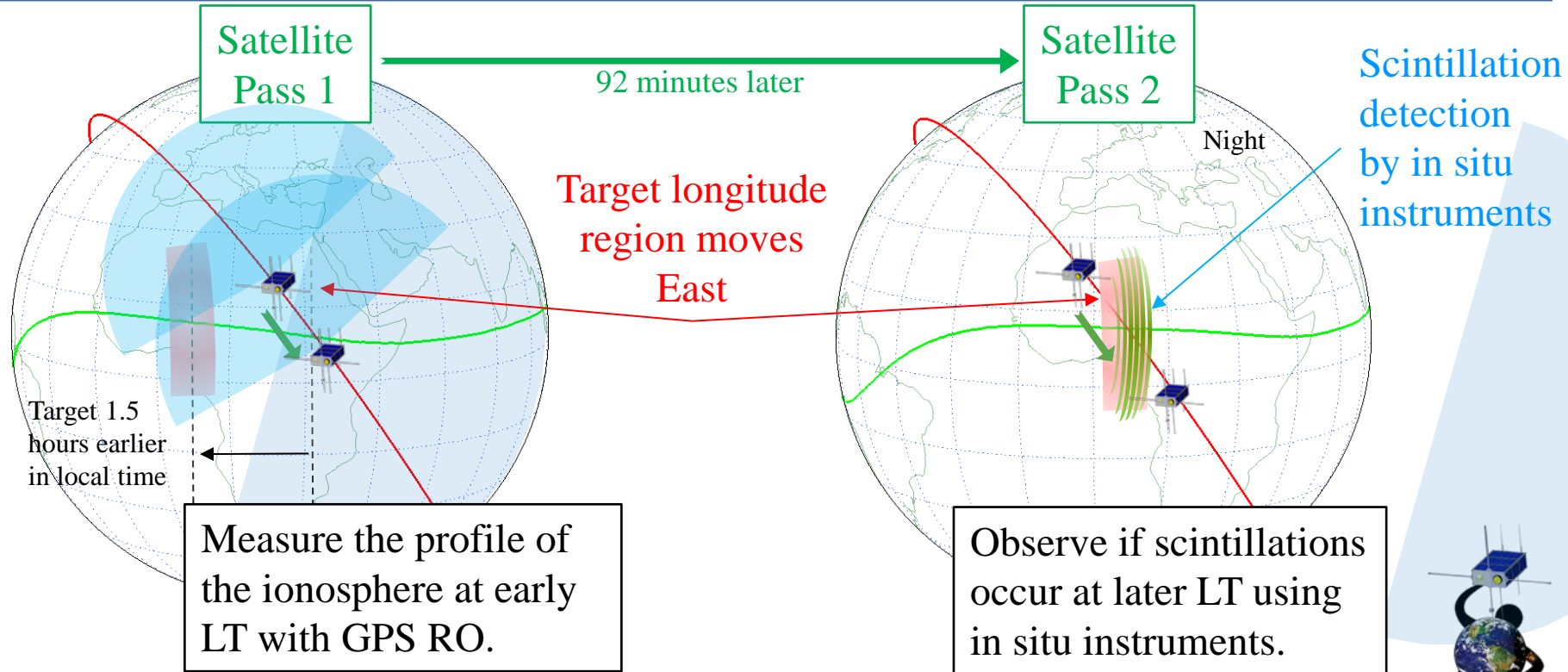
- The occurrence of scintillations at later local times is related to the state of the ionosphere at early local times.
 - How does this relation vary with longitude?
- Use case studies when SPORT ascending or descending node is within 17 to 24 LT sector.
- Examine ~15 degree longitude sectors



Methodology Strategy 1



Methodology Strategy 2



Conclusions

- **CubeSat missions can be developed with a full/regular suite of science instruments.**
- **Mid inclination ISS orbits allow for the deconvolution of local time and longitude at low-latitudes**
- **A String of pearls mission to increase time resolution**

