Nanosat Technology And Managed Risk: An Update Of The CYGNSS Microsatellite Constellation Mission Development

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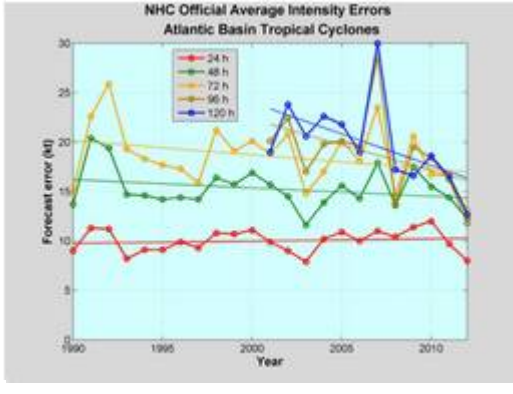
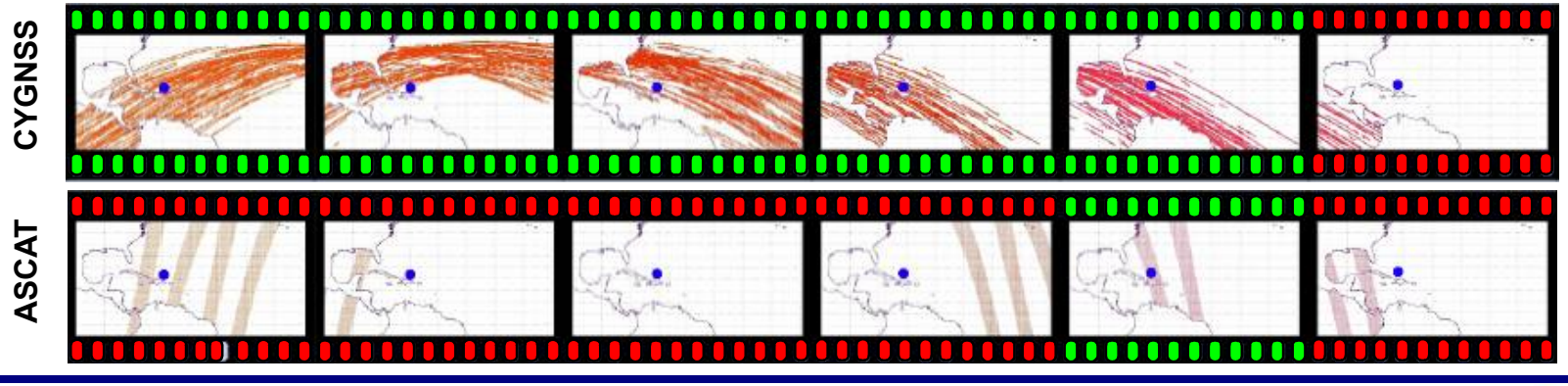
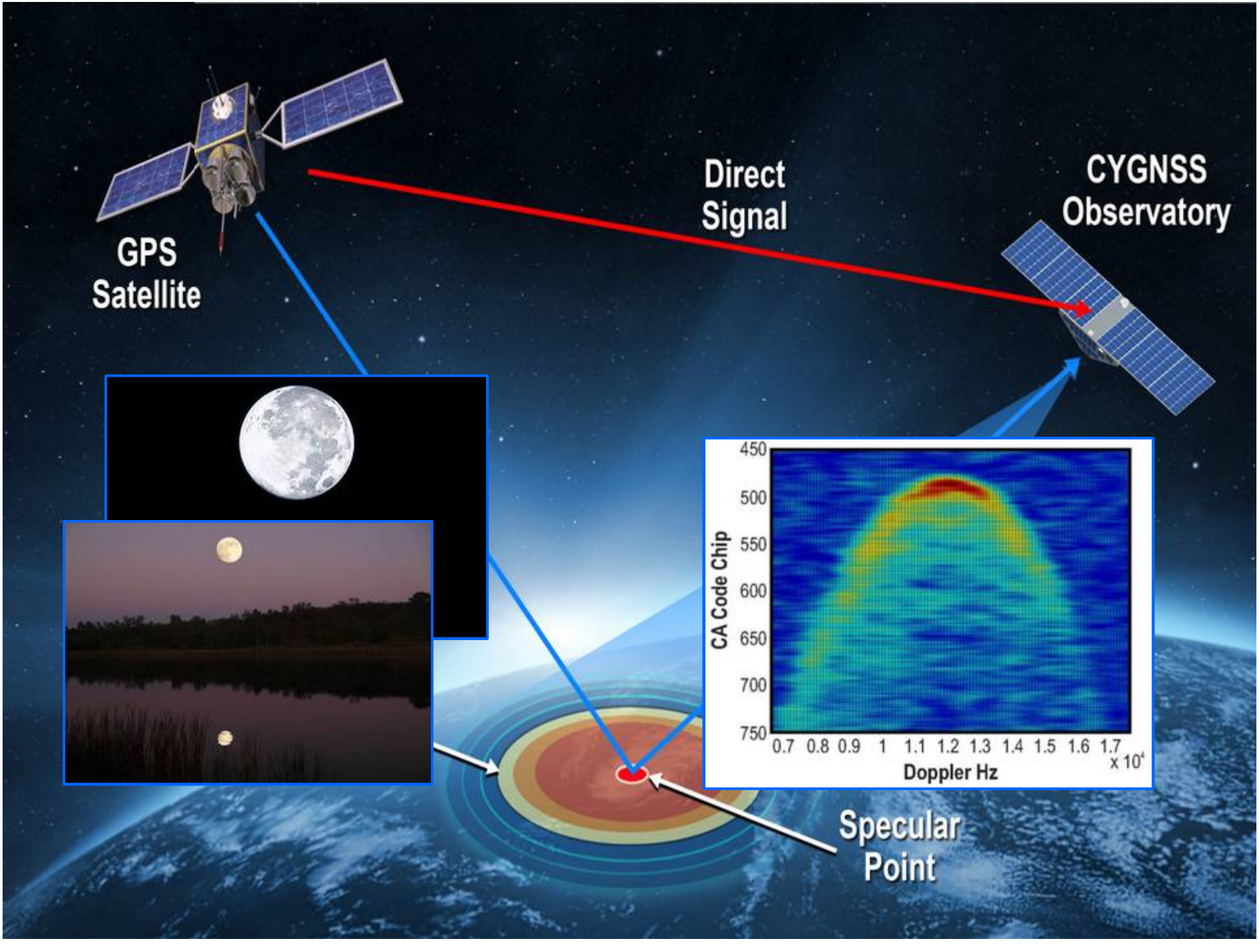
Closing the Gap in Understanding TC Intensity by Closing Gaps in Science Coverage

- We know where the Tropical Cyclones are going….
  - We don't know what their intensity will be when they get there
- Most existing spaceborne ocean wind observatories located in near-polar low Earth orbits
  - Maximize global coverage
  - Result in large gaps in coverage and low sample rates
- Use active radar systems
  - Require significant power for pulse transmission
  - Require large aperture antennas
  - C- and Ku-band signals are obscured by heavy precipitation



Time (3hr increments beginning at 00:00Z on 02Sep2004

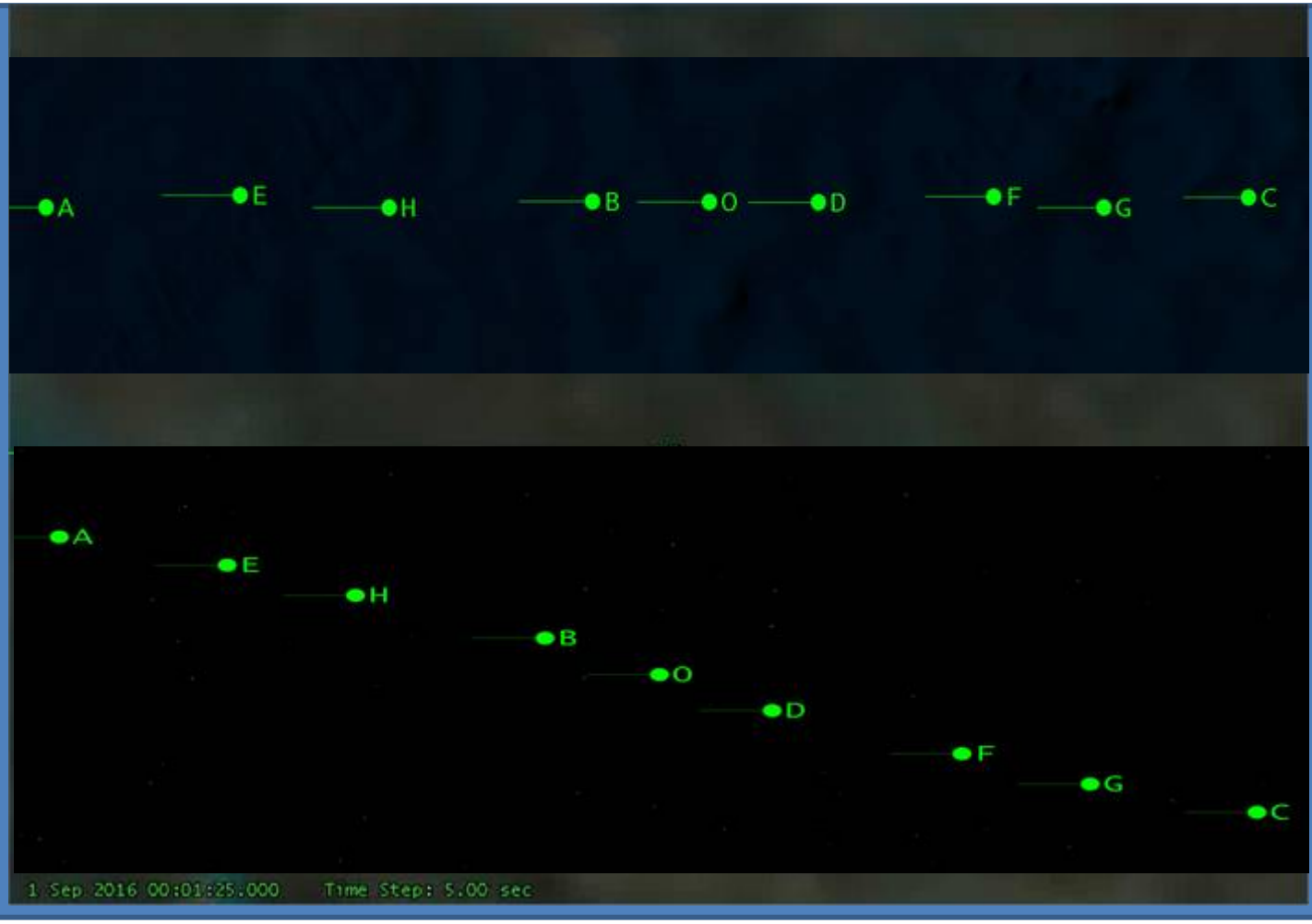



GPS
Satellite
Direct
Signal
CYGNSS
Observatory
CA Code Chip
450
500
550
600
650
700
750
0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6 1.7
x 10⁴
Doppler Hz
Specular
Point

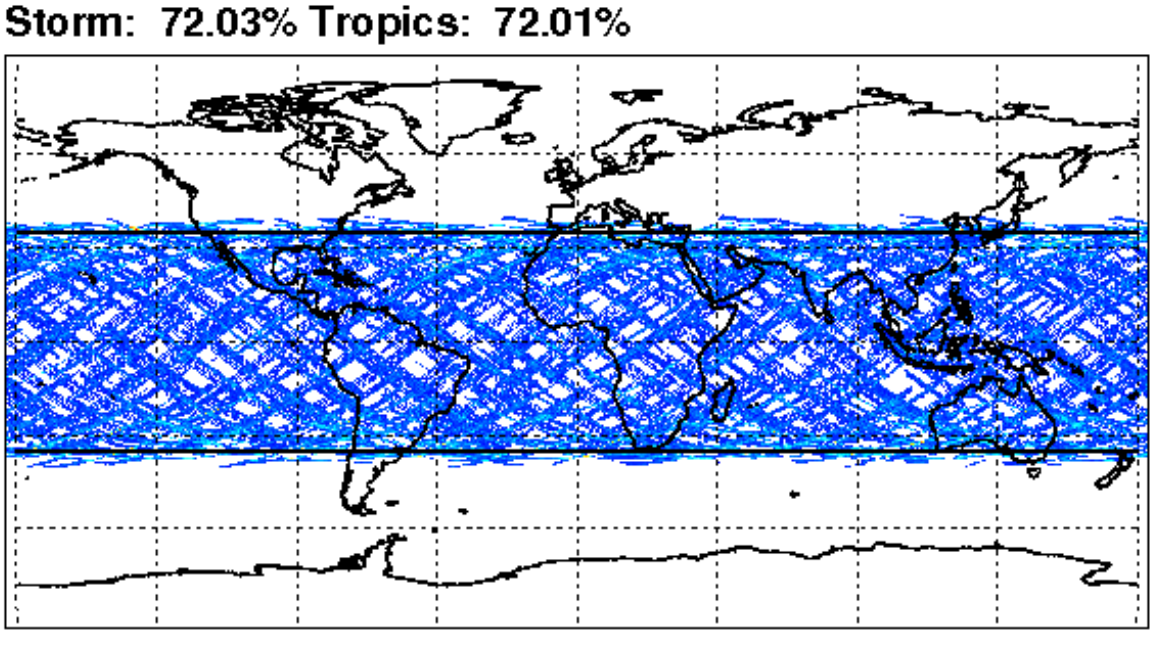
Constellation Separation

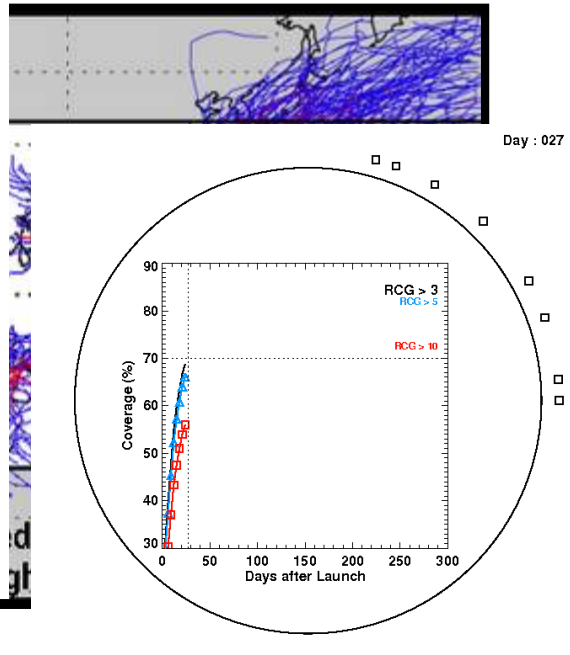
Top View

Side View



CYGNSS Orbit was Chosen to Enhance Coverage of Tropical Storm Development





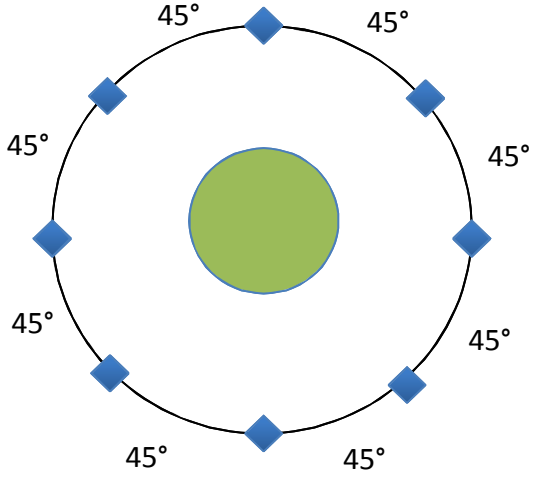
Day 27 of CYGNSS Coverage: Spatial Coverage in 24 hr Period Meets Requirements

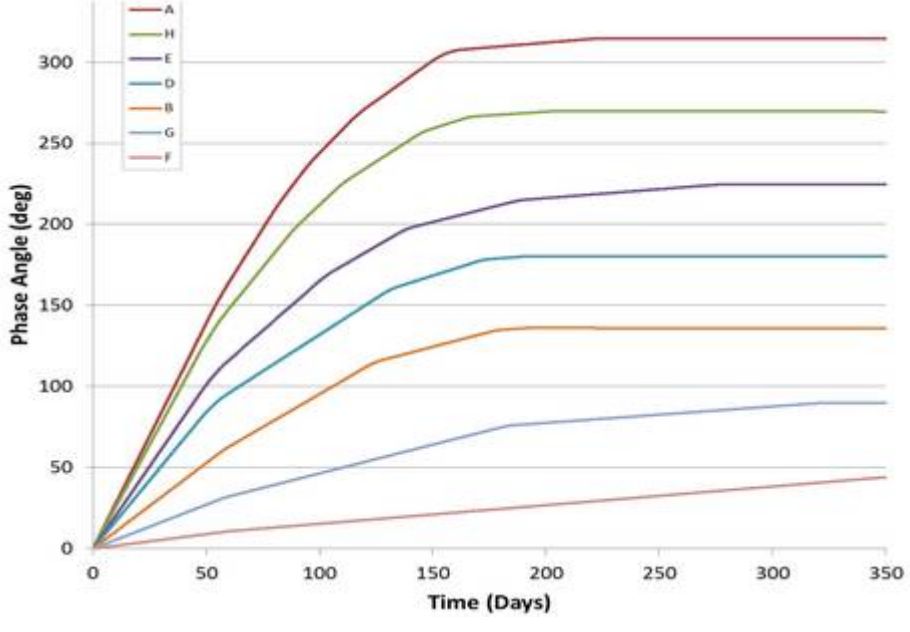
CYGNSS Coverage Versus Time Tropical Storm Track Overlay

5

Controlled Constellation Configuration

- Orbital control is implemented using Observatory differential drag
- At the completion of Orbit Configuration Observatories will reside at N*45 degrees +/- 10 degrees around the orbit



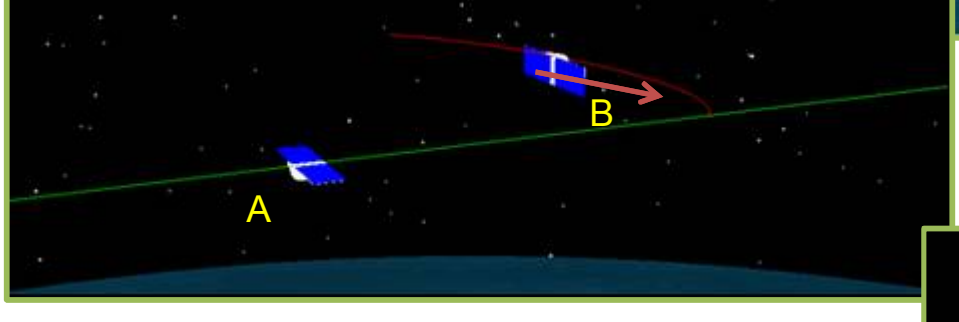


Provides a predictable operational configuration while meeting science coverage requirements

Orbit Adjust Sequence Using Differential Drag

Initial State – A follows B

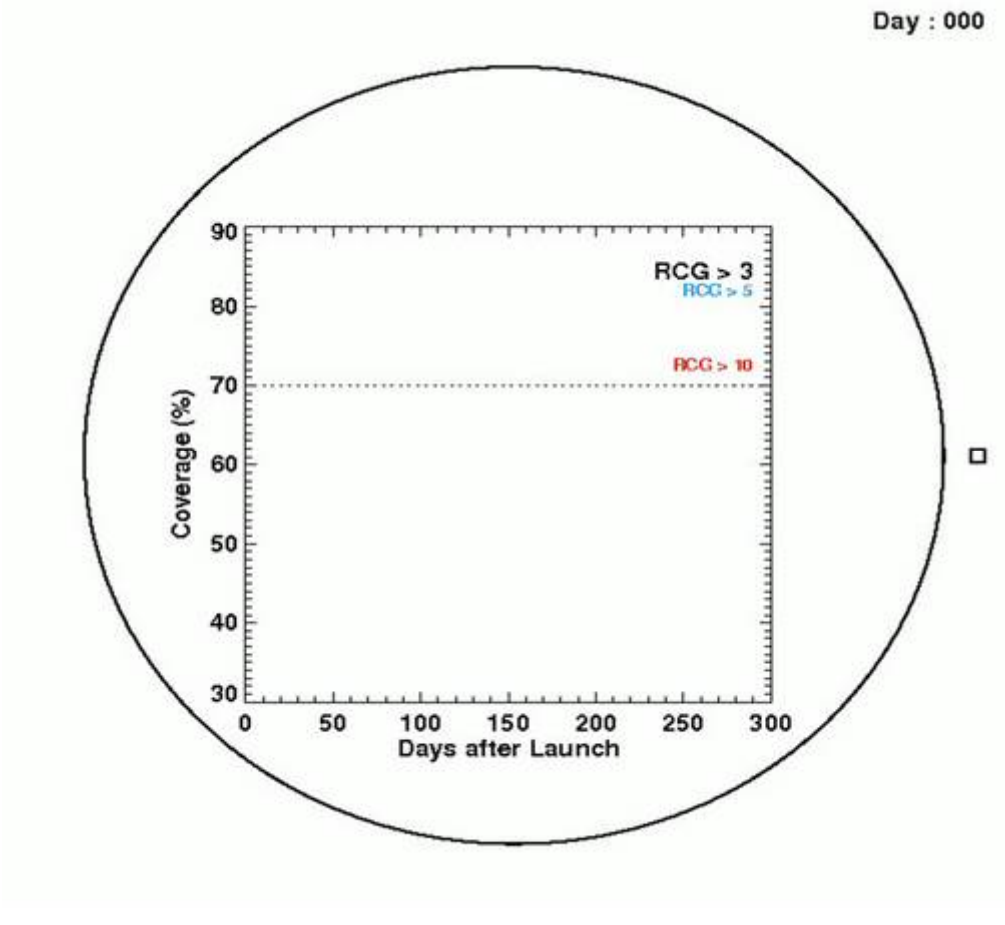
A performs high-drag maneuver and decays below B. A advances on B



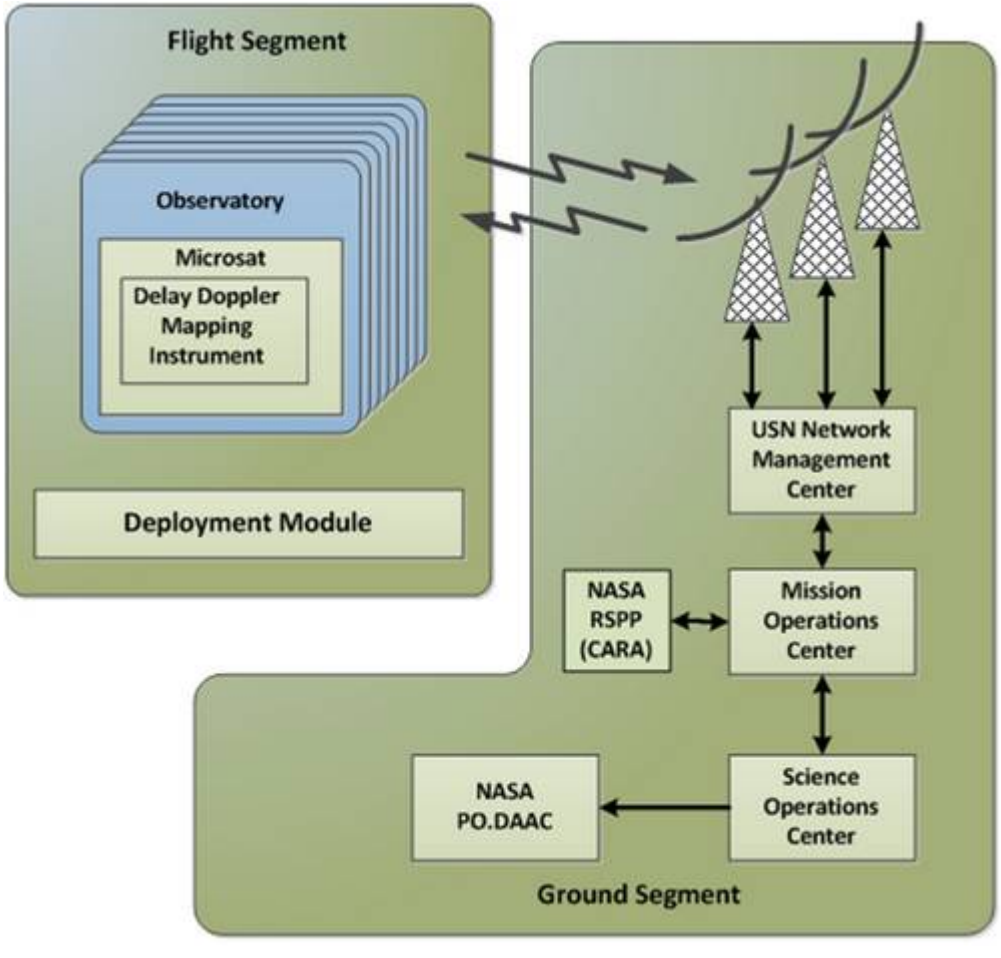
A returns to nominal drag. B performs High Drag until it decays to match A

Both satellites return to fixed Configuration at the same altitude but now A leads B

CYGNSS Spatial Sampling Evolution (requirement is 70%)

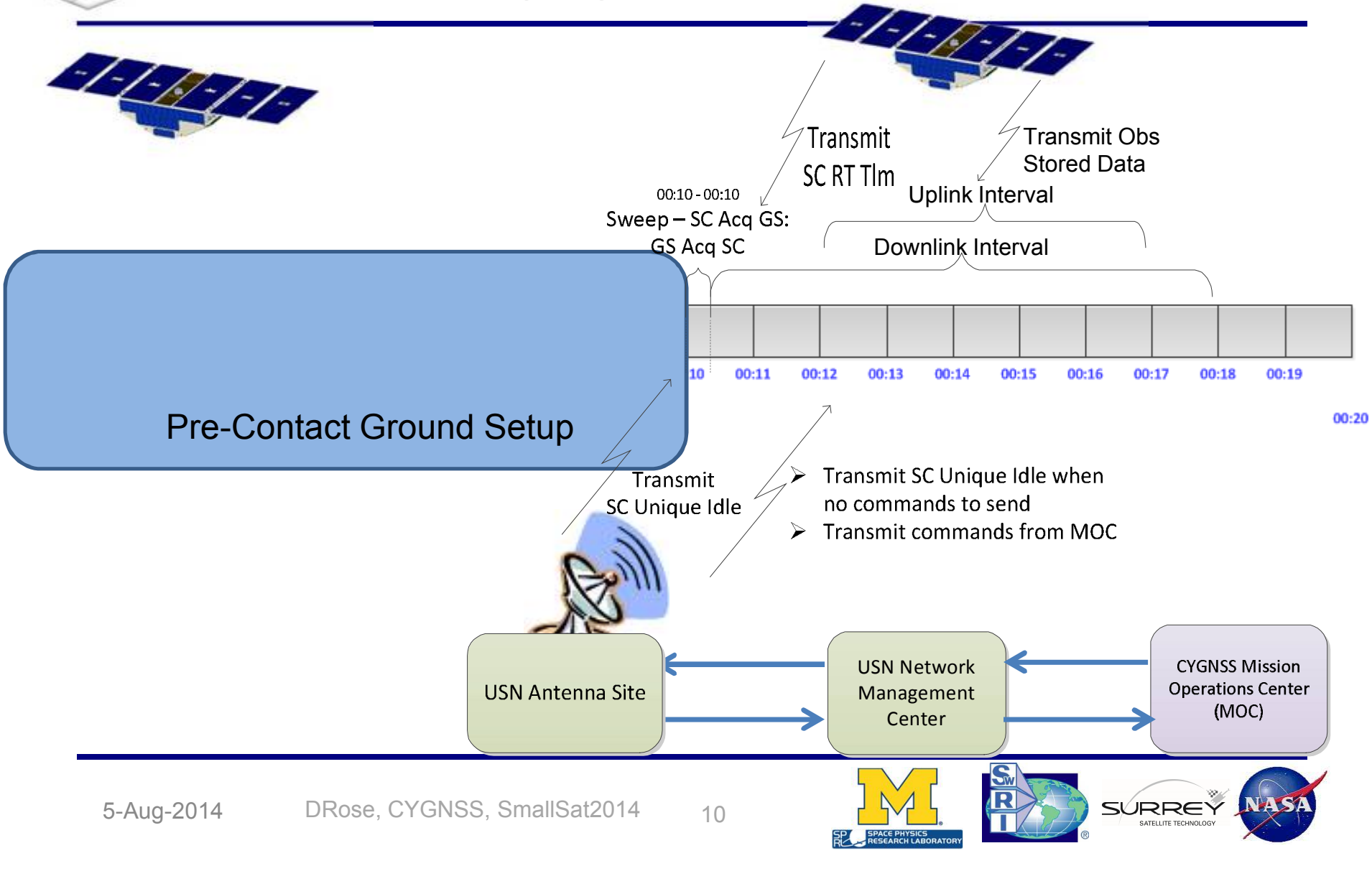


Flight and Ground - Combine to Keep Operations Streamlined

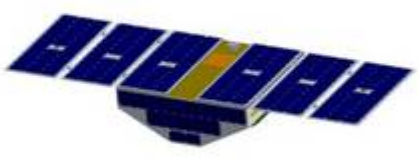


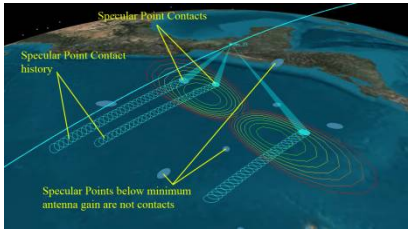
- No time-tag command sequences necessary for:
  - Science Data Collection and Compression
  - Data Transmission over Ground Station

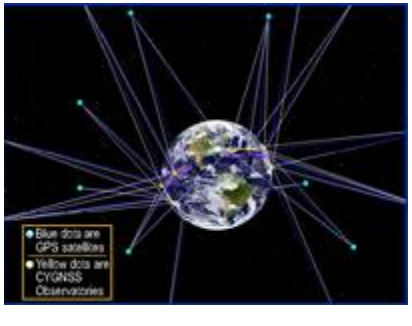
Cooperative Flight-Ground Operations: Bringing the Data Down



CYGNSS in Action!







Questions