

24th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)  
Small Satellite Operations (3)

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CYGNSS OPERATIONS: MANAGING A CONSTELLATION OF 8 MICRO-SATELLITES IN LOW  
EARTH ORBIT

**Abstract**

The NASA EV-2 Cyclone Global Navigation Satellite System (CYGNSS) measures the ocean surface wind field with unprecedented temporal resolution and spatial coverage, under all precipitating conditions, and over the full dynamic range of wind speeds experienced in a Tropical Cyclone (TC). It does so by combining the all-weather performance of GNSS bistatic ocean surface scatterometry with the sampling properties of a  $\mu$ satellite constellation. The CYGNSS  $\mu$ satellites have limited ground contact view periods based on their Low Earth Orbit (LEO) location. During nominal nadir pointed operations, CYGNSS' view periods for contacts will be around 500 seconds in length. Due to the limited contact time, the majority of CYGNSS operations will occur out of contact through the execution of commands loaded in an Absolute Time Sequence (ATS). Each CYGNSS  $\mu$ satellite can collect, compress, and store the nominal DDMs with no commanding required. Flowing data from each  $\mu$ satellite to the ground segment is the predominant operational activity during the science acquisition mission phase. To streamline operations, the CYGNSS  $\mu$ satellites are designed to support initiation of ground contacts without ATS or ground commands. This design supports adding or moving a contact by simply coordinating the appropriate ground segment resources. Contact operation control, command uplink to the CYGNSS  $\mu$ satellites, and reception, processing, and assessing real-time and stored engineering telemetry from the  $\mu$ satellites is implemented with the Galaxy tool set. The Galaxy tool set includes the Schedule Executor program which enables ground commands to be sent to a  $\mu$ satellite as well as data to be downlinked and routed from a  $\mu$ satellite without a Flight Controller being on-console.