**2025 NOAA/AOML/HRD Hurricane Field Program - APHEX**

**SATELLITE VALIDATION EXPERIMENT**
***Flight Pattern Description***

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**Experiment/Module:** TROPICS Satellite Validation Module

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**Requirements:** No requirements: flown at any stage of the TC lifecycle

**Satellite Validation Science Objective(s) Addressed:**

1. Test new (or improved) satellite technologies with the potential to fill gaps, both spatially and temporally, in the existing suite of airborne measurements in TCs. These measurements include improved three-dimensional representation of the hurricane wind field and thermodynamic structure and more accurate measurements of ocean surface winds and underlying ocean conditions [APHEX Goal 2]

**P-3 Pattern #1**

**What to Target:** Coordinated underflights of TROPICS satellites in the TC inner core (R ≤ 150 km), near environment (R = 150-300 km), and far environment (R > 300 km) in a variety of conditions, including precipitation, cloud cover, and dry air intrusions.

**When to Target:** P-3 flight patterns will be adjusted (when possible) to coordinate temporal and spatial overlap with overpasses by the TROPICS satellite. GPS dropsonde and P-3 tail-Doppler radar (TDR) sampling should be timed to be ≤ 30 min and ≤ 400 n mi (750 km) from satellite nadir. NASA's MTS aircraft software should be used to coordinate the underflight with TROPICS orbits.

**Pattern:** This can be a standalone mission or a breakaway module that involves a straight-line leg that underflies the TROPICS satellite. The full satellite swath width is ~2000 km, but the highest priority is coverage of nadir and the area within +/- 750 km of nadir. The P-3 leg should ideally begin ~10-15 min before and continue for ~10-15 min after the satellite passes "overhead". This will equate to a P-3 leg length of ~90-135 n mi (165-250 km). P-3 ferries to and from the storm can also be used to target satellite underflights in the far environment.

**Flight altitude:** 8-12 kft (5 kft is minimum altitude for dropsonde launches) in the TC inner core and near environment and 20+ kft in the TC far environment.

**Leg length or radii:** N/A

**Estimated in-pattern flight duration:** ~20-30 min for single-leg module

**Expendable distribution:** During the TROPICS underflight, GPS dropsonde spacing should generally be 10 n mi (20 km), which will require ~10-14 dropsondes. Dropsonde frequency can be adjusted based on LPS discretion, and the minimum number of dropsondes for pattern execution is 2.

**Instrumentation Notes:** Use TDR defaults. Use straight flight legs as safety permits. All GPS dropsonde data should be transmitted to the Global Telecommunication System (GTS) in real-time to

ensure availability for assimilation into forecast models. Use P-3 equipped with the Compact rotational Raman Lidar (CRL) if possible.

**G-IV Pattern #1**

**What to Target:** Coordinated underflights of TROPICS satellites in the TC inner core (R ≤ 150 km), near environment (R = 150-300 km), and far environment (R > 300 km) in a variety of conditions, including precipitation, cloud cover, and dry air intrusions.

**When to Target:** G-IV take-off times and flight patterns will be adjusted (when possible) to coordinate temporal and spatial overlap with overpasses by TROPICS satellites. GPS dropsonde and G-IV tail-Doppler radar (TDR) sampling should be timed to be ≤ 30 min and ≤ 400 n mi (750 km) from collocated satellite nadir temperature, and moisture, and precipitation retrievals and will depend on the area of operation (determined on a case-by-case basis). NASA's MTS aircraft software should be used to coordinate the underflight with TROPICS orbits.

**Pattern:** This can be a standalone mission or a breakaway pattern that involves a straight-line leg that underflies the TROPICS satellite. The full satellite swath width is ~2000 km, but the highest priority is coverage of nadir and the area within +/- 750 km of nadir. The G-IV leg should ideally begin ~10-15 min before and continue for ~10-15 min after the satellite passes "overhead". This will equate to a G-IV leg length of ~140-210 n mi (~260-390 km). G-IV ferries to and from the storm can also be used to target satellite underflights in the far environment.

**Flight altitude:** 40–45 kft or as high as possible to provide better vertical sampling by dropsondes that are deployed.

**Leg length or radii:** N/A

**Estimated in-pattern flight duration:** ~20-30 min for single-leg module, 7-8 h for standalone mission

**Expendable distribution:** During the TROPICS underflight, GPS dropsonde spacing should generally be ~10 n mi (20 km), which will require ~14-21 dropsondes. Dropsonde frequency can be adjusted based on LPS discretion.

**Instrumentation Notes:** Use TDR defaults (though not a requirement for this experiment). Use straight flight legs as safety permits. All GPS dropsonde data should be transmitted to the Global Telecommunication System (GTS) in real time to ensure availability for assimilation into forecast models.