

**EARLY STAGE EXPERIMENT**  
*Flight Pattern Descriptions*

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**Experiment/Module:** Surface Wind Speed and Significant Wave Height Validation Module

**Investigator(s):** Heather Holbach and Ivan PopStefanija (ProSensing Inc.)

**Requirements:** TD, TS, Category 1

**Early Stage Science Objective(s) Addressed:**

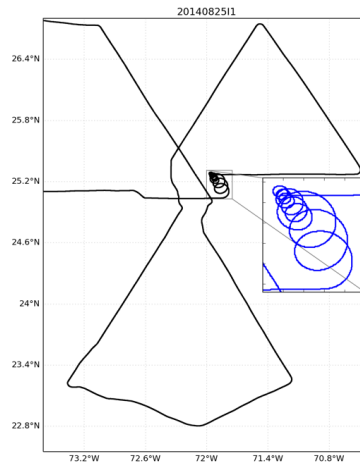
- 1) Collect datasets that can be used to improve the understanding of intensity change processes, as well as the initialization and evaluation of 3-D numerical models, particularly for TCs experiencing moderate vertical wind shear [*IFEX Goals 1, 3*].
- 2) Test new (or improved) technologies with the potential to fill gaps, both spatially and temporally, in the existing suite of airborne measurements in early stage TCs. These measurements include improved three-dimensional representation of the TC wind field, more spatially dense thermodynamic sampling of the boundary layer, and more accurate measurements of ocean surface winds [*IFEX Goal 2*].

**P-3 Pattern #1:**

**What to Target:** Regions of wind speeds  $\geq 15 \text{ m s}^{-1}$  with homogenous rain rates (or no rain) and wind direction (e.g. not in eye). Avoid regions with large wind speed or rain rate gradients.

**When to Target:** This module can be flown at any point during the flight while in the storm. If the WSRA is on the plane collecting surface wave data then the preference is to fly this module at night or when the sun is low in the sky.

**Pattern:** This module can be flown with any of the traditional in-storm flight patterns. The module consists of flying at least 3 consecutive circles at a given roll angle (Figure 1). Roll angles to be sampled are  $15^\circ$ ,  $30^\circ$ , and  $45^\circ$ . If time allows, it is preferable to fly 5 consecutive circles at  $45^\circ$ . Best to begin circles by turning upwind for station keeping.



**Figure 1:** Example flight path (black) with SFMR high-incidence angle module. The inset zoomed in portion with the blue track displays the SFMR module in more detail.

## 2020 NOAA/AOML/HRD Hurricane Field Program - IFEX

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**Flight altitude:** 7–12 kft radar

**Leg length or radii:** Any

**Estimated in-pattern flight duration:** 3 circles at 15° takes ~17 min., 3 circles at 30° takes ~7 min., and 3 (5) circles at 45° takes ~4.5 (~7) min. for a total time of ~28.5 (~31) min. If time is a concern, remove 15° circles for a total time of ~11.5 min for 3 circles each at 30° and 45° or ~14 min for 3 circles at 30° and 5 circles at 45°.

**Expendable distribution:** Release a dropsonde/AXBT combo at the beginning of the module. If no AXBTs are available, this module can still be flown while only releasing a dropsonde at the beginning of the module.

**Instrumentation Notes:** Use standard SFMR set-up. Important to maintain as constant of a roll angle, pitch angle, altitude, and rain rate as possible. Ideal to fly this module while the WSRA is also operating and gathering surface wave data. However, any data collected is useful as long as there is a dropsonde for comparison.

#### **P-3 Pattern #2:**

**What to Target:** Regions with significant wave heights of 8 ft and greater.

**When to Target:** Begin data collection when approaching significant wave heights of 8 ft on first inbound pass and continue data collection when significant wave heights are  $\geq 8$  ft.

**Pattern:** This module can be flown with any of the standard in-storm flight patterns. This pattern consists of extending standard flight legs, when necessary, to obtain WSRA significant wave height measurements in all regions with significant wave heights  $\geq 8$  ft. PIs will advise LPS prior to and during flight on the extent of waves with significant wave heights  $\geq 8$  ft.

**Flight altitude:** 8–12 kft radar

**Leg length or radii:** Out to radius of significant wave heights  $\geq 8$  ft.

**Estimated in-pattern flight duration:** Data collection will occur during the entire flight. Extension of legs could add 30-60 min to a flight.

**Expendable distribution:** No expendables required.

**Instrumentation Notes:** Use standard WSRA set-up. Important to maintain 8-12 kft radar altitude for WSRA data collection.