

# 2019 NOAA/AOML/HRD Hurricane Field Program - IFEX

## MATURE STAGE EXPERIMENT *Flight Pattern Descriptions*

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**Experiment/Module:** Environment Interaction (TC in Shear) Experiment

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**Requirements:** Categories 2–5

### **Mature Stage Science Objective(s) Addressed:**

- 1) Collect observations targeted at better understanding the response of mature hurricanes to their changing environment, including changes in vertical wind shear, moisture and underlying oceanic conditions [*IFEX Goals 1, 3*]

### **P-3 Pattern 1:**

**What to Target:** Sample the *core region* of a TC for which the distance of the center from significant land mass and significant SST gradients exceeds  $\sim 3x$  the radius of maximum wind.

**When to Target:** Sample before a significant increase in environmental vertical wind shear. The P-3 should be coordinated with G-IV Pattern 1.

**Pattern:** Rotated Figure-4. Alternate patterns: Butterfly; Fig-4; Alpha

**Flight altitude:** 12 kft preferable for best dropsonde coverage

**Leg length or radii:** 105 n mi (195 km)

**Estimated in-pattern flight duration:**  $\sim 5$  h

**Expendable distribution:** Modify standard by including an RMW dropsonde, moving the mid-point dropsonde to half the radius of innermost G-IV circumnavigation (or 30 n mi) and removing turn-point dropsondes. Modification ensures eyewall thermodynamic coverage and 30 n mi (55 km) radial sampling of thermodynamic fields immediately outside the eyewall. Modification also leverages availability of G-IV dropsondes (20 dropsondes total).

**Instrumentation Notes:** Use TDR defaults. Use straight flight legs as safety permits. Inbound-outbound passes should be uninterrupted.

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

**What to Target:** Sample the *core region* of a TC for which the distance of the center from significant land mass and significant SST gradients exceeds  $\sim 3x$  the radius of maximum wind.

**When to Target:** Sample as the large-scale, deep-layer shear increases and downshear convective asymmetry is evident; when the TC core exhibits large vertical tilt (an intensifying TC may have reduced its rate of intensification or begun to weaken); and when the TC core has realigned (a weakening or steady state TC may have begun to intensify).

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**Pattern:** Figure-4, fly 45 deg downwind, then uninterrupted small-scale Rotated Figure-4. Orient initial pass along shear vector if possible. Purpose of small-scale Rotated Figure-4 is high-temporal-resolution sampling of eyewall and near-eyewall thermodynamic structure. Alternate (small-scale) patterns: Butterfly for coarser azimuthal sampling; P-3 Circumnavigation

**Flight altitude:** 12 kft preferable for best dropsonde coverage

**Leg length or radii:** 105 n mi (195 km) for initial Figure-4; small-scale Rotated Figure-4 should extend just beyond the primary region of organized convection outside the eyewall (~15–30 n mi or ~30–60 km beyond *mean* radius of maximum wind).

**Estimated in-pattern flight duration:** ~ 4 h 45 min for Figure-4 + Rotated Figure-4 [45 n mi (85 km) legs]

**Expendable distribution:** For initial Figure-4, modify standard by removing mid-point dropsondes (if G-IV present, remove IP and turn-point dropsondes). For small-scale Rotated Figure-4, modify standard by launching 4 equally-spaced dropsondes from the *mean* radius of maximum wind to the turn point of each leg (42 dropsondes total, 38 if G-IV present). Given limited resources, may target only quadrant *downwind* of organized convection (22 dropsondes total, 18 if G-IV present).

**Instrumentation Notes:** Use TDR defaults. Use straight flight legs as safety permits. Inbound-outbound passes should be uninterrupted.

#### G-IV Pattern 1:

**What to Target:** Sample the *environment* of a TC for which the distance of the center from significant land mass and significant SST gradients exceeds ~ 3x the radius of maximum wind.

**When to Target:** Sample before a significant increase in environmental vertical wind shear; during the period of maximum vortex tilt. Coordinate G-IV takeoff with the corresponding P-3 mission such that the innermost G-IV circumnavigation coincides with the P-3 sampling.

**Pattern:** G-IV Circumnavigation (Hexagon). Should be storm centered. Alternate patterns: G-IV Circumnavigation (Octagon) for more sondes; G-IV Star if TDR coverage is not crucial

**Flight altitude:** 41–45 kft

**Leg length or radii:** 150 n mi, 90 n mi, and 60 n mi (275 km, 165 km, 110 km)

**Estimated in-pattern flight duration:** ~ 4 h 25 min

**Expendable distribution:** Standard (18 dropsondes total).

**Instrumentation Notes:** Use TDR defaults. Use straight flight legs as safety permits.