2019 NOAA/AOML/HRD Hurricane Field Program - IFEX

MATURE STAGE EXPERIMENT
Flight Pattern Descriptions

Experiment/Module: Secondary Eyewall Formation Module

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Requirements: Categories 2–5

Mature Stage Science Objective(s) Addressed:

1) Collect observations targeted at better understanding internal processes contributing to mature hurricane structure and intensity change [*IFEX Goals, 1 3*]
2) 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 (Pre-SEF):

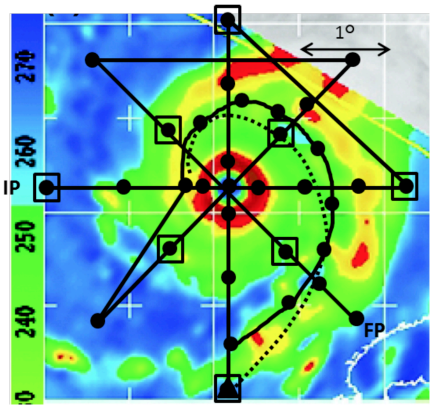

Figure 1. Proposed flight pattern for pre-SEF with the P-3 that includes an initial Figure-4, and a track paralleling the primary rainband.

What to Target: Mature hurricane that has pronounced rainband activity, and possibly a secondary eyewall forming. We are targeting the inside edge of primary rainband and the overall primary rainband.

When to Target: Proposed flight pattern (Fig. 1) should take place when microwave satellite imagery indicates the presence of asymmetric rainbands occurring in the storm environment.

Pattern: Fly a combination of a Rotated Figure-4 and a rainband spiral along the inside edge of the rainband, within ~5–10 n mi (9-20 km) of the inner edge of the rainband. Fly the spiral pattern straight and level as long as possible, i.e., keeping aircraft bank angle at a minimum, to minimize loss of radar data due to aircraft banking. Ferry time may preclude the second Figure-4.

Flight Altitude: 10–12 kft preferable

Leg length or radii: The flight leg or radii depends on the primary rainband location. Ideally, the extension of the leg should be just outside of the primary rainband as indicated by Fig. 1.

Estimated in-pattern flight duration: 5 h

Expendable distribution: For P-3, deploy dropsondes at all turn and mid-points in Figure-4, plus first center pass, at four locations in primary eyewall, and in the middle of rainband precipitation feature. Also release dropsonde at ~50 n mi (95 km) spacing along rainband spiral. If Coyote is available, deploy it following the inflow path where it will collect observations that can be used to calculate boundary layer characteristics outside, within, and inside rainband.

Instrumentation Notes: N/A

P-3 Pattern 2 (Post-SEF):

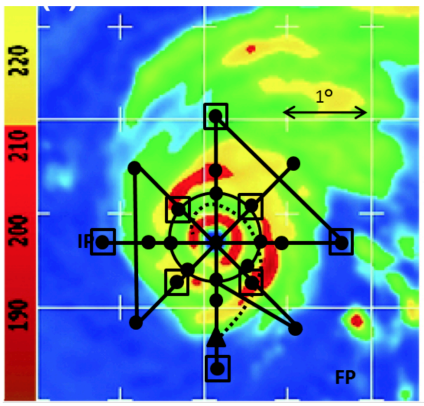

Figure 2. Proposed flight pattern for post-SEF with the P-3 that includes an initial Rotated Figure-4 and a follow-on circumnavigation of the moat region.

What to Target: Mature hurricanes that are expected to have a secondary eyewall already formed or are undergoing an ERC. We are targeting the concentric rings and the moat region.

When to Target: These concentric rings can be easily detected based on radar or microwave satellite imagery. For storms that are already undergoing these ERCs and repeated ERCs are forecast, sampling patterns as indicated in Fig. 2 are proposed.

Pattern: Fly a combination of a Rotated Figure-4 and a circumnavigation in the moat region, within ~5–10 n mi of the inner edge of the outer eyewall (see Fig. 2). Fly the circumnavigation straight and level as long as possible, i.e., keeping aircraft bank angle at a minimum, to minimize loss of radar data due to aircraft banking. Ferry time may preclude the second Figure-4.

Flight Altitude: 10–12 kft preferable

Leg length or radii: The flight leg or radii depends on the primary rainband location. Ideally, the extension of the leg should be just outside of the primary rainband as indicated by Fig. MA-3 and the circumnavigation is inside the moat region.

Estimated in-pattern flight duration: 5 h

Expendable distribution: Deploy dropsondes at all turn and mid-points in Rotated Figure-4 survey pattern, plus first center pass, at four locations in primary eyewall. Also release dropsonde at ~50 n mi spacing along circumnavigation in moat region. If Coyote is available, deploy it following the inflow path where it will collect observations that can be used to calculate boundary layer characteristics outside, within, and inside outer eyewall.

Instrumentation Notes: Preferably fly DWL for the circumnavigation, maintaining straight legs as best as possible while executing circumnavigation

G-IV Pattern 1 (SEF):

What to target: Sample the environment of a TC right outside of the primary rainband

When to target: Proposed flight pattern should take place when microwave satellite imagery indicates the presence of asymmetric rainbands occurring in the storm environment when there is a high chance the storm may undergo SEF. In the case that the ERC is already occurring, these concentric rings can be easily detected based on radar or microwave satellite imagery. Fly the circumnavigation patterns outside of the outer rainband.

Pattern: G-IV Circumnavigation; fly pattern such that the innermost circumnavigation (octagon or hexagon) is as close to outer edge of rainband as is safely allowed. Standard circumnavigation (octagon or hexagon) would work as long as the inner radius is close to outer edge of the rainband.

Flight altitude: 41–45 kft preferable

Leg length or radii: The flight leg or radii depends on the primary rainband location. The innermost radius should be as close to the outer edge of the rainband as is safely allowed.

Expendable distribution: Deploy dropsondes at all turn points. The octagons are all turn points could also be staggered rather than aligned to achieve better azimuthal sonde coverage.

Instrumentation Notes: N/A