MATURE STAGE EXPERIMENT
Flight Pattern Description

Experiment/Module: Eye-Eyewall Mixing

Investigator(s): Sim Aberson, Joe Cione, Jun Zhang

Requirements: Categories 4–5

Mature Stage Science Objective(s) Addressed:
1) Collect observations targeted at better understanding internal processes contributing to mature hurricane structure and intensity change [APHEX 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 mature hurricanes. These measurements include improved three-dimensional representation of the hurricane wind field, more spatially dense thermodynamic sampling of the boundary layer, and more accurate measurements of ocean surface winds [APHEX Goal 2]

P-3 Pattern #1:

What to Target: This module requires a category-4 or category-5 TC with a clearly defined, visible eye and closed eyewall.

When to Target: The module can be included within any missions during aircraft passage through the eye.

Pattern: The purpose of this pattern is to gather Doppler radar data in the eye and eyewall at an approximately constant sampling rate in the search for low-level small-scale features. It is a break-away pattern that is compatible with any standard pattern with an eye passage (all P-3 patterns except the Square spiral or Lawnmower). The eye must be large enough for the P-3 to safely perform circles within the eye. The P-3 will penetrate the eyewall at the standard-pattern altitude. Once inside the eye, the P-3 will perform at least three clockwise or counter-clockwise (no preference) orbits of the eye at an approximately constant bank with the flight-level circulation center within the orbits; distance from the eyewall need not be constant, and the only constraint is that the eyewall be within a distance to be sampled by Doppler radar. The size of all the orbits will be the same, and should allow for the completion of each orbit approximately every 6 min, 7.5 min, or 10 min (circle diameter about 7-13 n mi depending on ground speed) at crew discretion so that each circle fits within one model data assimilation cycle for easy data analysis. The flight level of the orbits can be adjusted for safety considerations at the pilot's discretion. If a center fix is required, this pattern can be done either before or after the center fix. It is highly desirable, though not required, that an sUAS be conducting an Eyewall/Radius of Maximum Winds Module while this pattern is being executed.

Flight altitude: The flight altitude will largely be the same as the standard pattern altitude, but can be adjusted for safety reasons.
Leg length or radii: The P-3 will circumnavigate the eye at least three times with consistent orbit size allowing for completion of each circle every 6, 7.5, or 10 min.

Estimated in-pattern flight duration: Depending upon the size of the eye, this pattern should take between 0.25 and 0.5 h.

Expendable distribution: No expendables required.

P-3 Pattern #2:

What to Target: Any category-4 or category-5 hurricane with a well-defined eyewall.

When to Target: During any transit across what is believed to be the strongest region of the eyewall.

Pattern: The pattern will not deviate from the regular eyewall penetration during any mission. Flight altitude: A regular altitude for the main purpose of the flight.

Leg length or radii: N/A

Estimated in-pattern flight duration: This module does not add any time to the mission.

Expendable distribution: Dropwindsondes will be dropped as quickly as possible across the wind- speed maximum of the eyewall. The dropwindsondes should be spaced as close together as possible. The goal is to have the second-outermost dropwindsonde to be coincident with the flight-level radius of maximum wind speed, and the second-innermost dropwindsonde to be coincident with the surface radius of maximum wind speed.

Instrumentation Notes: The goal is to have as many dropwindsondes as possible in the air at the same time to investigate the structure of an individual miso- or meso-scale vortex.