GENESIS STAGE EXPERIMENT
Flight Pattern Description

Experiment/Module: Favorable Air Mass (FAM) Experiment

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Requirements: Pre-genesis disturbances (pre-tropical cyclones; pre-TCs), including NHC-designated "Invests"

Genesis Stage Science Objective(s) Addressed:
The overarching objective is to investigate the physical processes that determine if a pre-genesis disturbance will mature into a TC, including the organization of convection and the development of a closed low-level circulation.

1) To investigate the favorability in both dynamics (e.g., vertical wind shear) and thermodynamics (e.g., moisture) for tropical cyclogenesis in the environment near a pre-TC, especially the downstream environment [*APHEX Goal 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 tropical disturbances that are in the pre-genesis or genesis stage. These measurements include improved three-dimensional representation of the tropical disturbance/TC 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: The environment near a pre-TC or "invest" (such as an African easterly wave), especially ahead of the pre-TC's trajectory. In most cases, this will be the environment to the west and north of a pre-TC.

When to Target: Every 12 h. Could be every 6 h if it is determined that the environment is evolving rapidly and aircraft/crew availability allows it.

Pattern: Standard Lawnmower (refer to Appendix A)

Flight altitude: 20-25 kft

Leg length or radii: 600–1000 n mi (1110–1850 km) x 150 n mi (280 km) with the longer leg oriented approximately perpendicular to the trajectory of the pre-TC. The length of the longer leg should be set based on an analysis of the environment to be measured.

Estimated in-pattern flight duration: 3–6 h depending on the number of lawnmower legs and the length of the ferry

Expendable distribution: dropsondes every ~150 n mi (280 km)

Instrumentation Notes: Use straight flight legs as safety permits. See attached figure below for more information.

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G-IV Pattern #1:

What to Target: The environment near a pre-TC or "invest" (such as an African easterly wave), especially ahead of the pre-TC's trajectory. In most cases, this will be the environment to the west and north of a pre-TC.

When to Target: Every 12 h

Pattern: Standard Lawnmower (refer to Appendix A)

Flight altitude: 40–45 kft

Leg length or radii: 600–1000 n mi (1110–1850 km) x 150 n mi (280 km) with the longer leg oriented approximately perpendicular to the trajectory of the pre-TC. The length of the longer leg should be set based on an analysis of the environment to be measured.

Estimated in-pattern flight duration: 3–6 h depending on the number of lawnmower legs and the length of the ferry.

Expendable distribution: dropsondes every ~150 n mi (280 km).

Instrumentation Notes: Use straight flight legs as safety permits. See attached figure for more information.

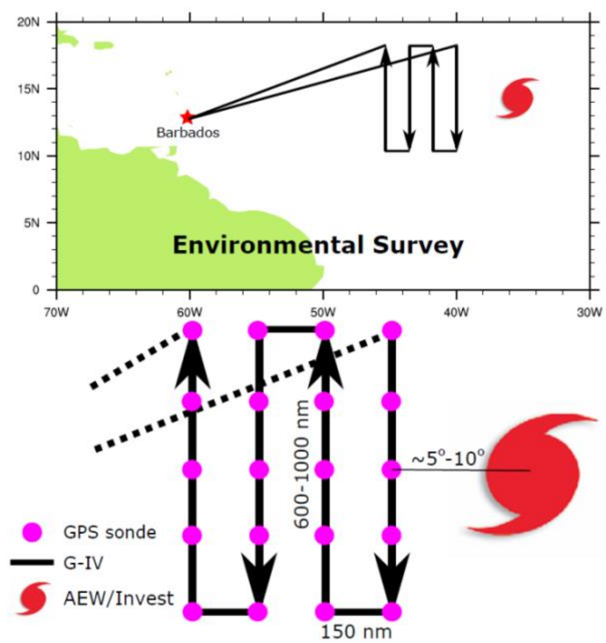


***Figure 1**. The environmental survey pattern is characterized by lawnmower legs in the region ahead of a pre-TC (typically to the west or northwest). The top panel shows a zoomed out view, while the bottom panel shows a close-up view with the distribution of expendables.*

Link to ONR's Moisture and Aerosol Gradients / Physics of Inversion Evolution (MAGPIE)

Note: This module would serve as the flight plan for the entire mission and would therefore replace the entire FAM flight pattern.

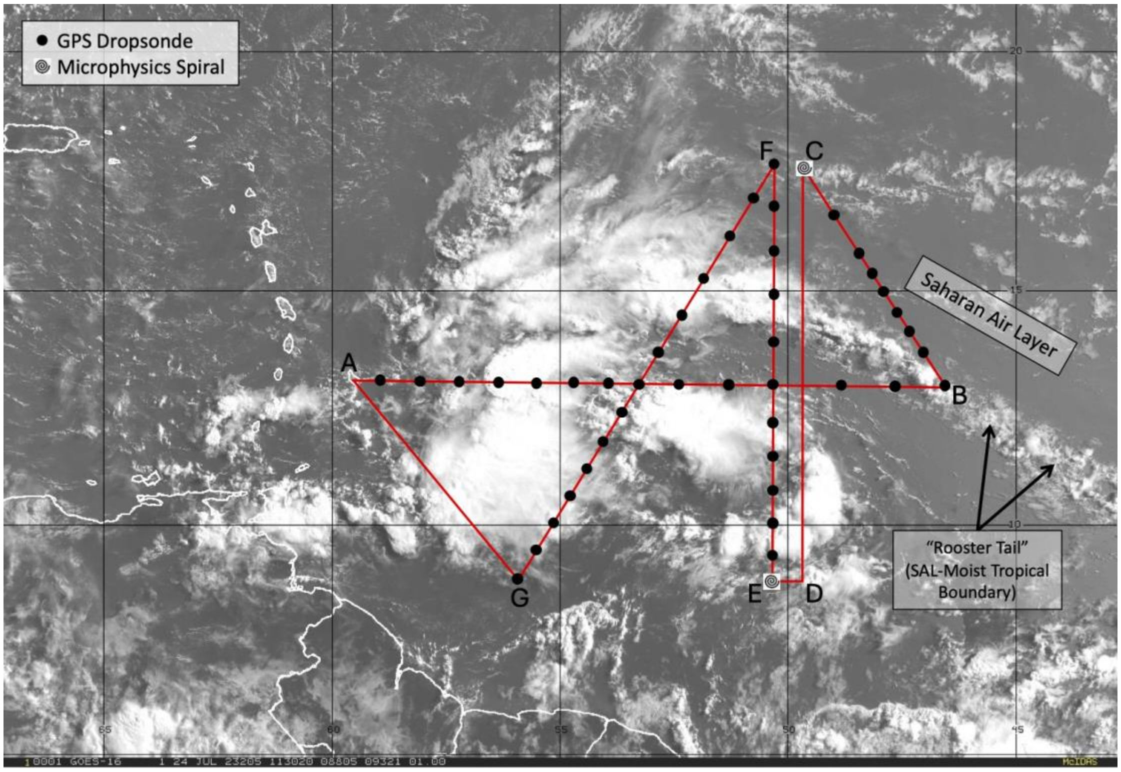
MAGPIE P-3 Pattern #1: Large Scale

What to Target: African easterly waves (AEWs) and dry air and aerosols to the north and east of the AEW. The flight plan below (MAGPIE Fig. 1a) shows an AEW in the presence of the SAL's dust aerosols (light gray shading on satellite image). These flights seek to perform cross sections of the AEW, then profile in the dry air to the northeast of the AEW, then fly north-south transects across the the dry air and SAL outbreak, and finally cross perpendicular to the moisture gradient (MAGPIE Fig. 1a, colored contours).

When to Target: When the AEW event is located near or west of ~50ºW and in range of Barbados

Pattern: Non-standard flight pattern that will target the environments of an AEW of interest and the Saharan Air Layer (SAL) that will typically be located NW, N and NE of the AEW (MAGPIE Fig. 1a).

- A-B: Cross through the axis of the AEW at maximum altitude (≥25 kft and as low as 10-12 kft if there are aircraft icing concerns). Dropsondes released every 0.5-1 degrees.
- B-C: Transit at maximum altitude to sample the SAL-moist tropical boundary and the SAL mid-level easterly jet and to collect TDR and cloud microphysics measurements.
- C: microphysics spiral down to near boundary layer (~500-1,500 ft safety permitting), sampling temperature, moisture, aerosols.
- C-D: Options include low-level (~1,500 ft, safety permitting) extended leg, 25 kft for high level dropsondes, and porpoising between ~1,500 and 10 kft along the leg for aerosol and atmospheric measurements.
- E: microphysics spiral up to ~23-25 kft for upper level sampling temperature, moisture, aerosols.
- E-F: South-to-North transect at maximum altitude (≥25 kft and as low as 10 kft if there are aircraft icing concerns). Dropsondes released every 0.5-1 degrees.
- F-G: Cross moisture gradient between the SAL and AEW at maximum altitude (~≥25 kft and as low as 10 kft if there are aircraft icing concerns). Dropsondes released every 0.5-1 degrees.
- G-A: Cross SW to W side of the AEW at maximum altitude (~≥25 kft and as low as 10 kft if there are aircraft icing concerns).



MAGPIE Figure 1a. *The MAGPIE Large-Scale Module. The flight track is shown by the yellow dashed line and colored contours show total precipitable water (TPW). Dropsonde locations are shown by blue X's.*

Flight altitude: 500 ft to 25+ kft pressure altitude (see pattern description and MAGPIE Fig. 1a above).

Leg length or radii: Leg lengths will be non-standard and will vary depending on the targets of interest (AEW and the SAL).

Estimated in-pattern flight duration: ~6.0-8.0 h

Expendable distribution: Dropsonde spacing of ~0.5-1.0 degrees (see pattern description and MAGPIE Fig. 1a above).

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.

MAGPIE P-3 Pattern #2: Convective-Scale

What to Target: Areas of convection, airmass boundaries (e.g., AEW and SAL) and regions of dust can be targeted in the Main Development Region of the North Atlantic, easter of the Lesser Antilles. This module targets the evolution of convection, the evolution of airmass boundaries, and soundings in airmasses characterized by dust associated with the SAL.

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When to Target: Environments of interest that align with MAGPIE's goals, generally near or west of ~50^{o}W and in range of Barbados.

Patterns:

- *Option 1*: For convection and repeated observations by the P-3's W-band radar and TDR, a **double racetrack pattern** is flown along the axis of convection, with leg lengths of ~40 n mi (75 km) on a side (MAGPIE Fig. 1b). This pattern provides 3 transects along the area of convection with the W-band radar and 5 with the TDR; the pattern can be repeated as needed to continue observations of the target convective area. In this configuration, the P-3 transits with the convective line and at least 3 dropsondes are needed (one for either side of the connection, and a third on the second convection pass). The width of the racetrack pattern should be determined by the LPS (pattern MAGPIE Fig. 1c takes ~1 hour to complete). This can be repeated as necessary, with an optional intermediary transect with dropsondes (e.g., see MAGPIE Fig. 1a).
- *Option 2*: For airmass boundary changes where convection is to be observed at least twice during the mission, the double racetrack pattern reverts to a transect with dropsondes aligned cross low-level trade wind flow, convection centered. These can be as much as ~30-60 minutes per side, or 150-300 n mi (~280-555 km; MAGPIE Fig. 1c). A minimum of 3 dropsondes are to be released in the cross-gradient direction at the LPS's discretion.
- *Option 3*: For added dust/convection in situ measurements, microphysics spiral descent from 23-35 kft down to ~500-1,500 ft in the upstream (east) side of the maximum moisture gradient (e.g., dusty side, or in absence of dust more convectively active side). At the discretion of the LPS, a cross gradient straight and level leg can also be flown after the completion of the microphysics spiral at the approximate center height of the SAL (~10 kft), and/or at 200 m above cloud base (~2.5 kft) and/or at ~500-1,500 ft, safety permitting. Total time, up to 1.5-2 hours.
- *Option 4*: Following takeoff, proceed to 20 n mi (35 km) offshore of Barbados in the upwind (east) direction. Then perform a low-level (500 ft) cross-wind transect for 5 minutes. Loop back upstream (east) of Ragged Point at and perform a microphysics box spiral to 18 kft, 2 minutes per side, ~500-600 ft/min climb rate. Pause P-3 descent and fly straight and level at cloud level (~2 kft) for one (1) circuit, allowing for minor deviations to penetrate the center of clouds, safety permitting.

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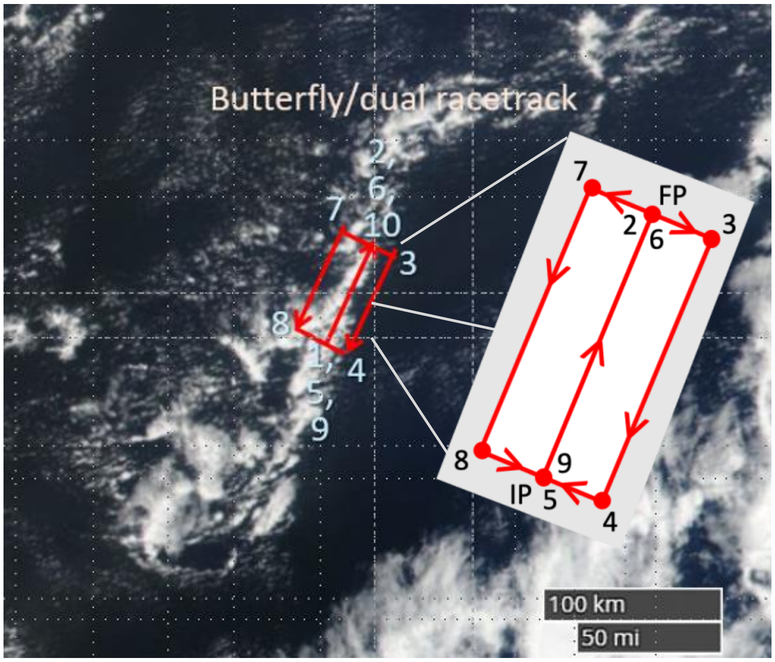
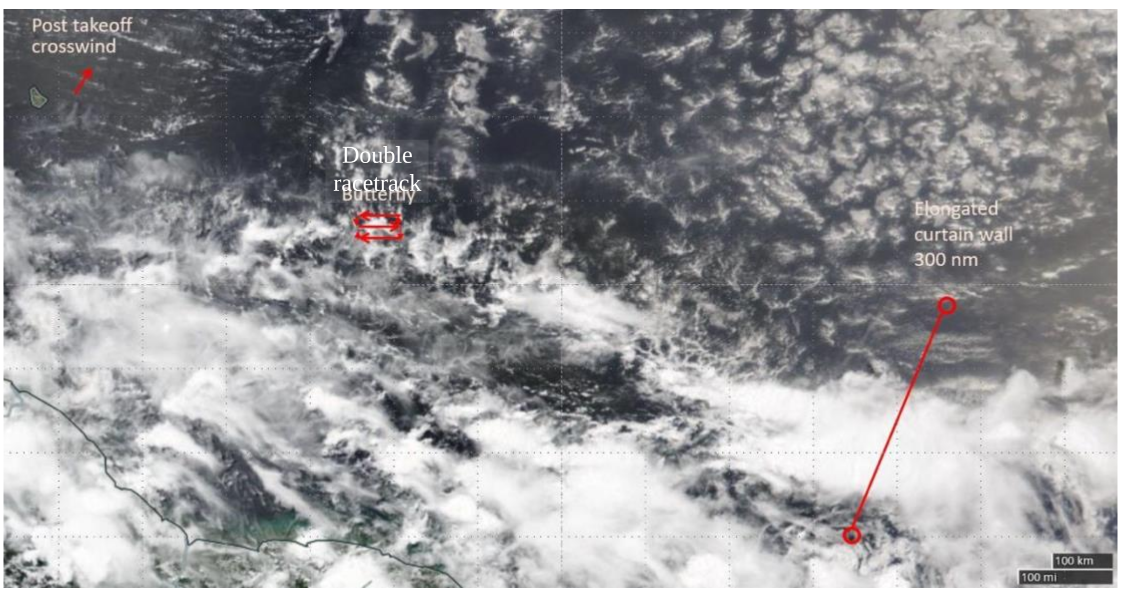


***MAGPIE Figure 1b**. P-3 dual racetrack pattern.*



***MAGPIE Figure 1c**. Example length scales for a (left) post takeoff crosswind transect, (middle) double racetrack, and (right) dropsonde transect across a moisture boundary (i.e., curtain wall.*

Flight altitude: 18 kft (Pattern Options 1-3), 500 ft -18 kft (Pattern Option 4).

Leg length or radii: Leg lengths will be non-standard and will vary depending on the targets of interest (AEW-SAL boundaries, clouds, etc.).

Estimated in-pattern flight duration: ~2.0-8.0 h

Expendable distribution: Dropsondes (see pattern Options 1-4 above).

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.

MAGPIE P-3 Pattern #3: Island Wake - Long

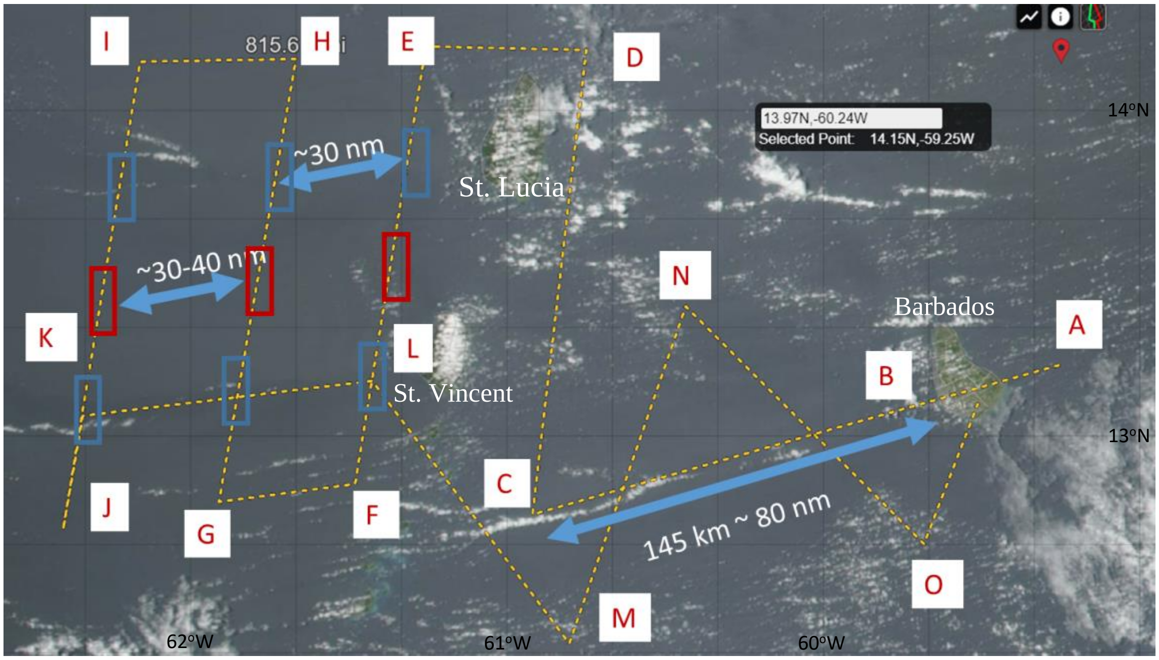
What to Target: Measure cross and along-wake (island downwind (leeward) area) profiles of winds, temperature, and moisture upstream and downstream from Barbados and taller islands during various times of the day to capture different MABL thermodynamic regimes throughout MABL. The length of the minor axis of these wakes are approximately the width of the island. The length of the major axis varies, but can extend 100s of km downstream. Wakes are apparent on visible and infrared satellites as regions of clear skies, with the exception of possible thin cloud streamers oriented parallel to the winds.

When to Target: This module can be tacked on to the beginning and or end of a mission or flown as a stand-along mission. There are several preferred times for this module that include: 1) Alignment with SAR satellite overpasses (near sunrise & sunset); 2) mid-day to capture the daytime marine atmospheric boundary layer (MABL) and 3) overnight to capture nocturnal MABL.

Pattern: Non-standard flight pattern that will target the environment on the lee (west) side of the Windward Islands. Lee side target areas include Barbados to capture the atmospheric wake resulting from flat topography and St. Vincent & St. Lucia to capture atmospheric wakes on the lee side of islands with steeper terrain. MAGPIE Fig. 2a shows the Island Wake-Long P-3 pattern. Details of waypoints A-O are as follows:

1) A-B: begin at a waypoint ~15 n mi (28 km) offshore NE of Ragged Point Lighthouse (13.28 N 59.24 W); dropsonde, then fly toward Ragged Point Lighthouse (13.16 N 59.43 W). Deploy a dropsonde in downwind (leeward) area west of Barbados as soon as the P-3 emerges over water and it is safe to deploy (e.g., 12+ n mi (22+ km) offshore).
2) B-C: Travel along wake dropping frequent dropsondes (may not be obvious from satellite where wake is; follow thin cloud streamer if present; visual clues include where the ocean surface is very choppy as wake is turbulent; otherwise, just transit 80 nm downstream from island). C serves as the starting point for the upstream leg from C-D, 10 kft.
3) C-D: 10 kft. Drop a few sondes to sample the upstream environment profile.
4) D: Endpoint of the upwind (windward) leg east of St. Lucia (12+ n mi (22+ km) offshore, safety permitting).

5) E-F-G-H-I-J (details below): Lawnmower pattern at 10 kft, dropping as many sondes as possible within the wakes (blue boxes) in addition to 1 dropsonde between islands (red boxes)
6) E: Sample the downwind (leeward) area west of St. Lucia (12+ n mi (22+ km) offshore, safety permitting). Beginning of first downstream leg from E-F (10 kft). Located ~10 n mi north of St. Lucia latitude, to ensure leg begins outside of the wake area.
7) F: Endpoint of the downwind (leeward) area west of St. Vincent & the Grenadines. Located ~10 n mi (19 km) south of St. Vincent latitude, to ensure leg ends outside of the wake area.
8) G-H: 2nd downwind (leeward) leg (30 n mi downstream from previous E-F transect, safety permitting). 10 kft with option to porpoise between G-H (between 1000 ft – 10 kft).
9) I-J: 3rd downwind (leeward) leg (30-40 n mi downstream from previous G-H transect).
10) K: within wake, beginning of upstream, along wake transect to L, flying at 1000 ft to sample near-surface environment following wake.
11) L: end of near surface along wake transect. End 12 n mi (22 km) offshore of St. Vincent, safety permitting.
12) M-N-O: low level saw tooth pattern to sample the downwind (leeward) area west of Barbados. Drop sondes frequently (at discretion of LPS).



MAGPIE Figure 2a. Island Wake Module – Long *sample P-3 flight pattern. Waypoints A-O are described in the Pattern section above. Blue boxes indicate sections of cross-wake transits within the wake, where multiple dropsondes can be launched. Red boxes indicate between islands where at least 1 dropsonde is preferred. This sample pattern shows the general target regions of interest- exact waypoint positions will be determined on a case-by-case basis.*

Flight altitude: Flight-level varies throughout the pattern.

- A-B: 10 kft
- B-C: 10 kft (500-1000 ft - 10 kt porpoising could be requested at the discretion of the LPS)
- C-D: 10 kft
- D-E: 10 kft
- E-F: 10 kft (500-1000 ft - 10 kt porpoising could be requested at the discretion of the LPS)
- F-G: 10kft
- G-H: 10 kft (500-1000 ft - 10 kt porpoising could be requested at the discretion of the LPS)
- H-I: 10kft
- I-J: 10 kft (500-1000 ft - 10 kt porpoising could be requested at the discretion of the LPS)
- J-K: 10 kft to 500-1500 ft (as close to surface as is safe)
- K-L: 500-1500 ft (as close to surface as is safe)
- M-N-O: 10 kft (500-1000 ft - 10 kt porpoising could be requested at the discretion of the LPS)

Leg length or radii: Leg lengths will be non-standard and will vary depending on the targets of interest (e.g., windward and leeward regions around some of the Windward Islands).

Estimated in-pattern flight duration: ~3.0 - 6.0 h

Expendable distribution: Dropsondes at all waypoints A-O and possible intermediate points (see Pattern description and MAGPIE Fig. 2a above).

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. SFMR and flight-level data will also be collected for analysis during this mission.

MAGPIE P-3 Pattern #3: Island Wake - Short

What to Target: Measure cross and along-wake profiles of winds, temperature, and moisture upwind (windward) and downwind (leeward) areas around Barbados during various times of the day to capture different MABL thermodynamic regimes throughout the MABL. The length of the minor axis of these wakes are approximately the width of the island. The length of the major axis varies, but can extend 100s of km downstream. Wakes are apparent on visible and infrared satellites as regions of clear skies, with the exception of possible thin cloud streamers oriented parallel to the winds.

When to Target: This module can be tacked on to the beginning and or end of a mission. There are several preferred times for this module that include: 1) Alignment with SAR satellite overpasses (near sunrise & sunset); 2) mid-day to capture the daytime MABL and 3) overnight to capture nocturnal MABL.

Pattern: Non-standard flight pattern that will target the environment on the downwind (leeward) side of the Windward Islands. These target areas include Barbados to capture the atmospheric wake resulting from flat topography and St. Vincent & St. Lucia to capture atmospheric wakes on the lee side of islands with steeper terrain. MAGPIE Fig. 2b shows the **Island Wake-Short** P-3 pattern. Details of waypoints A-D are as follows:

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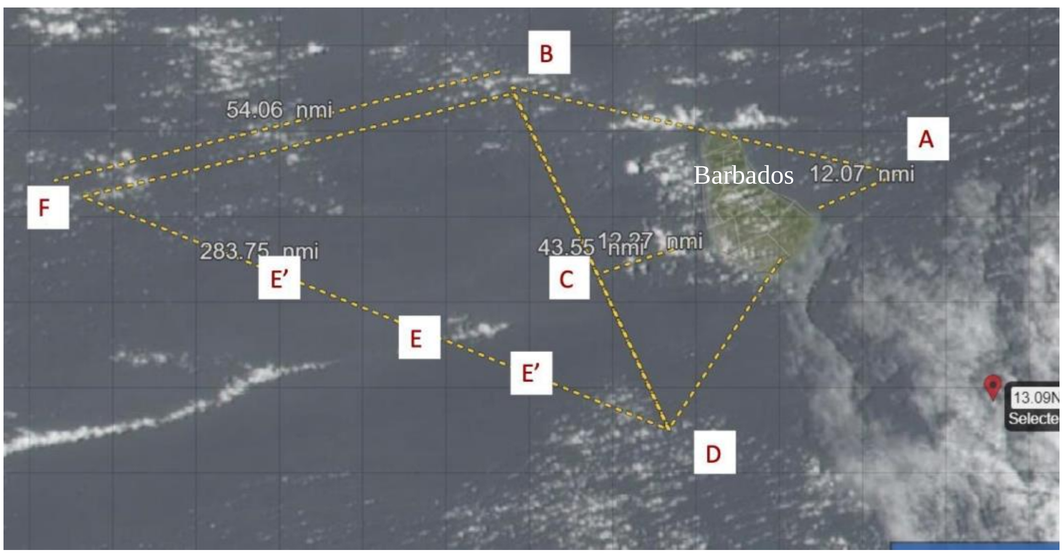
1) A-B: begin at a waypoint ~15 n mi (~28 km) offshore NE of Ragged Point Lighthouse (13.28 N 59.24 W). For the transit to waypoint B, the flight pattern can cross the Barbados coastline or maintain a 12 n mi (22 km) standoff from the coast. The science target is to cross the cross-wake axis as close to the island as possible. The cross-island wake region will be determined by the ground-based LPS and communicated to the onboard LPS in real-time.
2) B-C-D: Sample outside island wake environment (B & D) and inside the island wake environment (C).
3) D-E-F: Sample outside the island wake area (D & F) and inside the island wake area ~40 n mi (~75 km) downwind (leeward) of Barbados. If an obvious downwind (leeward) cloud streamer is present (e.g., the MAGPIE Fig. 2b cloud line that extends from C to E and southwest of E, deploy dropsondes before (and/or after) reaching streamer (i.e., the two waypoints labeled E') and over/near the cloud streamer (E) to try to capture convergent cross-wake circulation. Cloud streamers can be identified using NASA MTS with visible or shortwave infrared imagery overlaid and communicated to the onboard LPS via xchat.
4) Return F-B-D, sampling focused along B-D



MAGPIE Figure 2b. Island Wake Module – Short *sample P-3 flight pattern. Waypoints A-F are described in the Pattern section above. Dropsonde deployments at waypoints A-B-C-D-E-F. Optional intermediate dropsondes at the two waypoints labeled E' if cloud streamers are present. This sample pattern shows the general target regions of interest-exact waypoint and dropsonde locations will be determined on a case-by-case basis.*

Flight altitude:
- A-B: 10 kft
- B-D-F: 10 kft
- F-B-D: 500-1,500 ft (lower preferred, safety permitting), (500-1000 ft - 10 kt porpoising could be requested at the discretion of the LPS between B-D)

Leg length or radii: Leg lengths will be non-standard and will vary depending on the targets of interest (e.g., local trade wind flow and cloud streamer locations).

Estimated in-pattern flight duration: ~1.0 h

Expendable distribution: Dropsondes at waypoints A-F and possible intermediate points (see Pattern description and MAGPIE Fig. 2b above).

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.

MAGPIE P-3 Pattern #3: Island Wake – Very Short

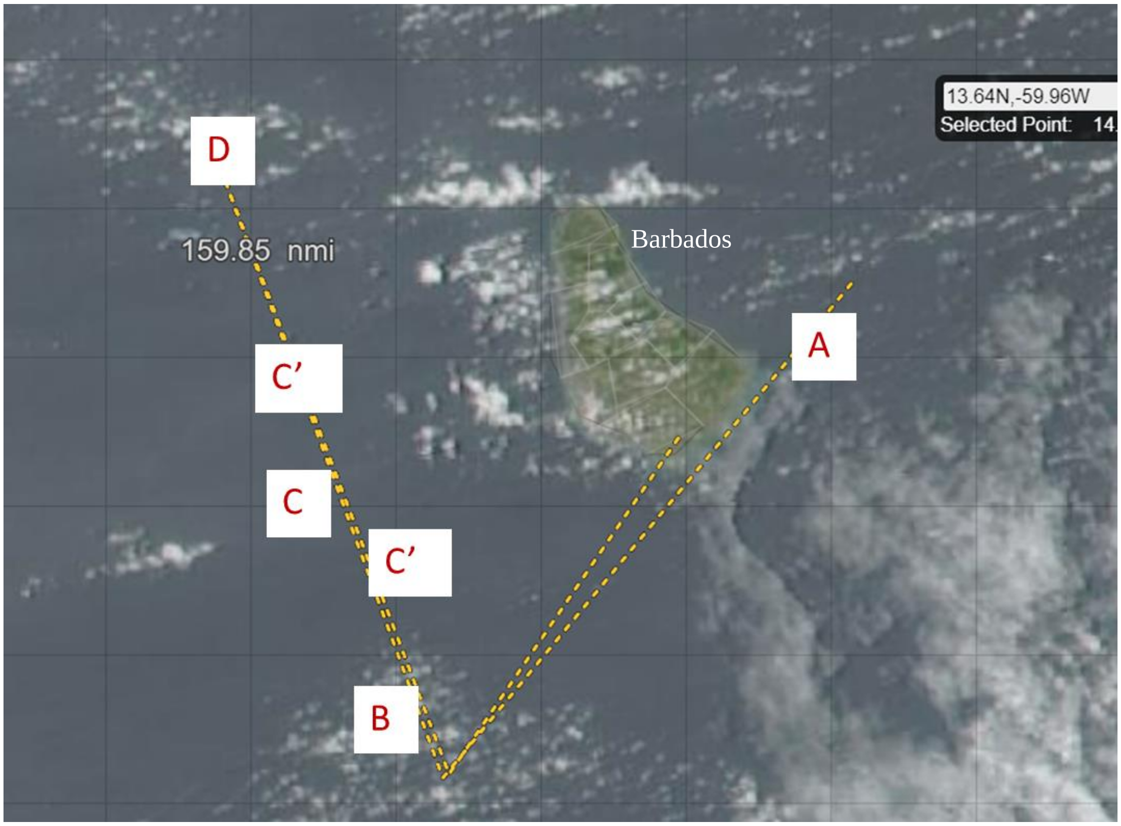
What to Target: Measure cross and along-wake profiles of winds, temperature, and moisture upwind (windward) and downwind (leeward) of Barbados during various times of the day (at the beginning/end of mission) to capture different MABL thermodynamic regimes throughout MABL. The length of the minor axis of these wakes are approximately the width of the island. The length of the major axis varies, but can extend 100s of km downstream. Wakes are apparent on visible and infrared satellites as regions of clear skies, with the exception of possible thin cloud streamers oriented parallel to the winds.

When to Target: This module can be tacked on to the beginning and or end of a mission. There are several preferred times for this module that include: 1) Alignment with SAR satellite overpasses (near sunrise & sunset); 2) mid-day to capture the daytime MABL and 3) overnight to capture nocturnal MABL.

Pattern: Non-standard flight pattern that will target the environment on the upwind (windward) and downwind (leeward) side of the Windward Islands. These target areas include Barbados to capture the atmospheric wake resulting from flat topography. MAGPIE Fig. 5 shows the **Island Wake-Short** P-3 pattern. Details of waypoints A-D are as follows:

1) A-B: begin at a waypoint ~15 n mi (~28 km) offshore NE of Ragged Point Lighthouse (13.28 N 59.24 W). For the transit to waypoint B, the flight pattern can cross the Barbados coastline or maintain a 12 n mi (22 km) standoff from the coast.
2) B-C-D, 10kft: The science target is to cross the cross-wake axis as close to the island as possible (i.e., as close to the 12 n mi (22 km) standoff distance from land as possible) during the transit from A-B. The cross-island wake region will be determined by the ground-based LPS and communicated to the onboard LPS in real-time. If an obvious downwind (leeward) cloud streamer is present (e.g., the MAGPIE Fig. 2c cloud line that extends from southwest to over and northeast of C, deploy dropsondes before (and/or after) reaching streamer (i.e., the two waypoints labeled C') and over/near the cloud streamer (C) to try to capture convergent cross-wake circulation. Cloud streamers can be identified using NASA MTS with visible or shortwave infrared imagery overlaid and communicated to the onboard LPS via xchat.
3) D: Descend to 500-1,500 ft at D as safety permits, prepare for near-surface D-C-B cross-wake leg (D-C-B).

4) D-C-B: This leg repeats the B-C-D leg that was previously flown at 500-1500'. Waypoint B along this NW-SE leg is the final point for the mission.



MAGPIE Figure 2c. Island Wake Module – Vert Short *sample P-3 flight pattern. Waypoints A-D are described in the Pattern section above. Dropsonde deployments at waypoints A-B-C-D. Optional intermediate dropsondes at the two waypoints labeled C' if cloud streamers are present. This sample pattern shows the general target regions of interest- exact waypoint and dropsonde locations will be determined on a case-by-case basis.*

Flight altitude: 10 kft except 500-1,500 ft during circumnavigation of waypoint D

Leg length or radii: Leg lengths will be non-standard and will vary depending on the targets of interest (AEW-SAL boundaries, clouds, etc.).

Estimated in-pattern flight duration: ~45 min to 1.0 h

Expendable distribution: Dropsondes at waypoints A-D and possible intermediate points (see Pattern description and MAGPIE Fig. 2c above).

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.

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Link to Organized Convection and Earthcare Studies over the Tropical Atlantic (ORCESTRA) field campaign:

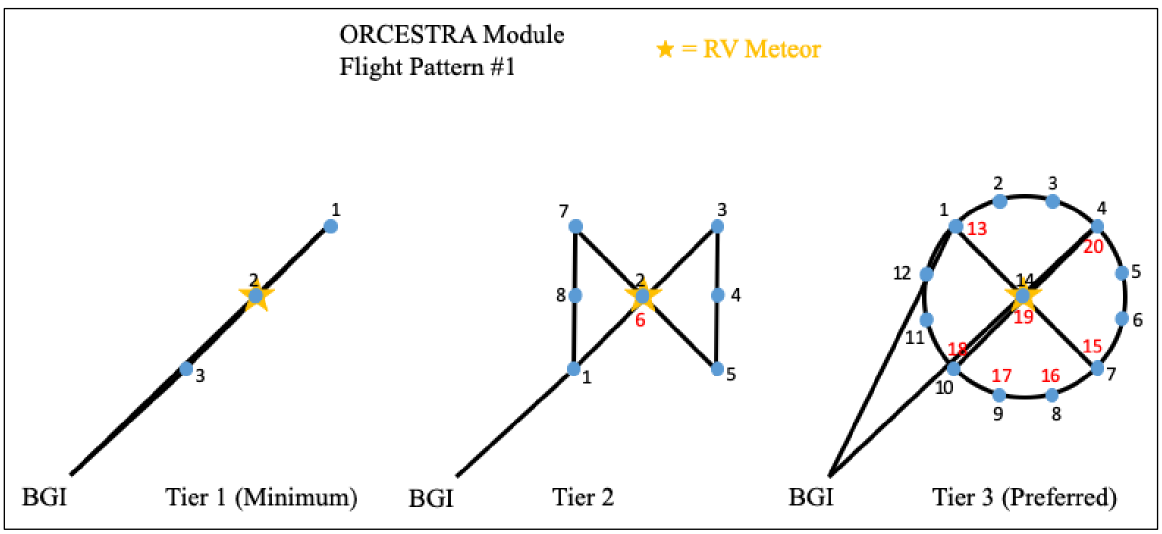
ORCESTRA "Deep Convection" Module (ORCESTRA P-3 or G-IV Pattern #1):

What to Target: Deep convection associated with tropical disturbance within ~68 n mi (~125 km) of RV Meteor position.

When to Target: When location of RV Meteor is within flight range of Barbados (expected September 12-23, 2024).

Pattern: Non-standard straight radial leg (Tier 1), Figure-4 (Tier 2), or Figure-4 + Circumnavigation (Tier 3) flight patterns that will be collocated with the RV Meteor and target environments of an AEW of interest and/or the Saharan Air Layer (SAL).

- **Tier 1 (minimum):** Straight-leg overpass of RV Meteor (ORCESTRA Fig. 1a, left)
- **Tier 2 (better)**: Figure-4 pattern centered on RV Meteor (ORCESTRA Fig. 1a, middle)
- **Tier 3 (preferred)**: Hybrid Figure-4/Circumnavigation pattern centered on the RV Meteor (ORCESTRA Fig. 1a, right)



ORCESTRA Figure 1a*. Tier 1 (Minimum), Tier 2, and Tier 3 (Preferred) versions of Flight Pattern #1. This applies to either the P-3 or G-IV. We are agnostic about the direction of circumnavigation or orientation of the Figure-4. Dropsondes at red waypoints are optional.*

Flight altitude: ~25 kft or as high as possible, or as low as 10-12 kft if aircraft icing is a concern kft (P-3); 41-45 kft (G-IV)

Leg length or radii: Leg lengths will be non-standard and will vary depending on the targets of interest (e.g., AEWs and the SAL). Preferred circumnavigation radius is 68 n mi (125 km).
Estimated in-pattern flight duration: ~2.0-6.0 h

Expendable distribution:

- **Tier 1**: Overpass of RV Meteor with a dropsondes at/near the ship location and 68 n mi (125 km) from the ship location (minimum 3 dropsondes total). See ORCESTRA Fig. 1a (left).
- **Tier 2**: 8 dropsondes total: at each corner of the Figure-4 pattern, halfway point of longer side legs, and one dropsonde each of the two passes over the RV Meteor. Deploy a dropsonde on the second pass over/near the RV Meteor (point 6) is optional. See ORCESTRA Fig. 1a (middle)
- **Tier 3**: 12 dropsondes around the circumnavigation and one dropsonde on the first pass over/near the RV Meteor (13 total; drop on points 1-12, 14). If available, additional dropsondes on second pass through the points (add drops on points 13, 15-18, 19, 20). The minimum is 8 dropsondes around the circumnavigation and one dropsonde over/near the RV Meteor (points 1, 4, 7, 10, 14, and halfway between 2 and 3, halfway between 5 and 6, halfway between 8 and 9, halfway between 11 and 12). See ORCESTRA Fig. 1a (right)

Instrumentation Notes: Use TDR defaults. Use straight flight legs for straight radial and Figure-4 patterns 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.

ORCESTRA "Precipitable Water" Module (ORCESTRA P-3 or G-IV Pattern #2):

What to Target: Northern edge of ITCZ, defined by 50 mm total precipitable water (TPW) contour, as defined by passive microwave satellite imagery and/or model forecasts.

When to Target: During ferry to tropical disturbance of interest for genesis stage experiments or to RV Meteor location for P-3 Pattern #1. Ideally in coordination with ORCESTRA/PERCUSION HALO G550 flight from Barbados. See Fig. 1b.

Pattern: Follow 50 mm TPW contour as long as possible during ferry.

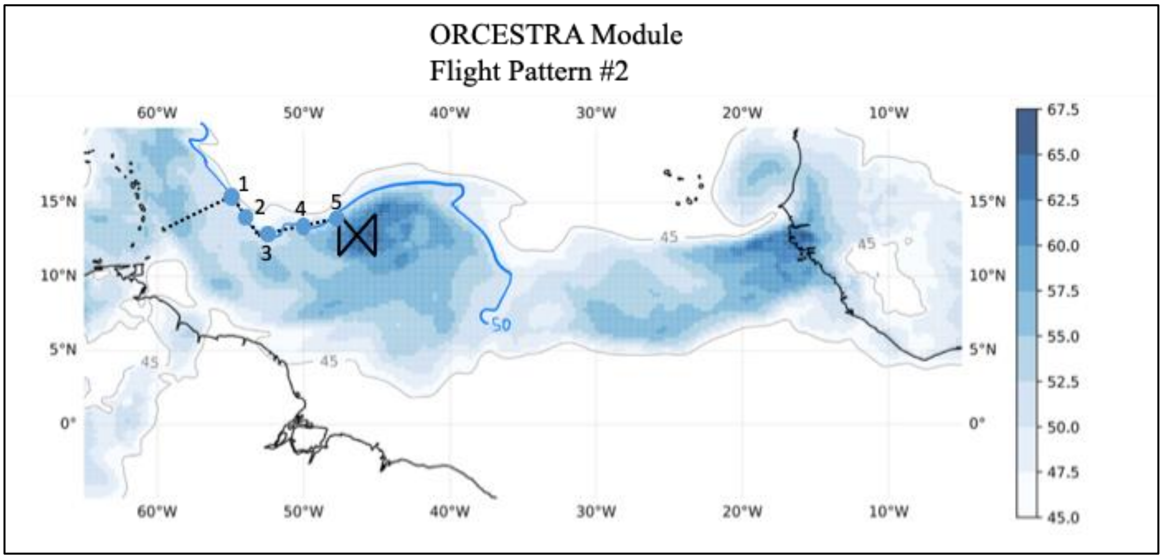
Flight altitude: ~25 kft or as high as possible (P-3); 41-45 kft (G-IV)

Leg length or radii: Leg lengths will be non-standard and will vary depending on the 50 mm contour of TPW.

Estimated in-pattern flight duration: ~1.0-3.0 h

Expendable distribution: Evenly spaced along the 50 mm TPW contour; preferably every 70 n mi (130 km) but will vary depending on leg length.

Instrumentation Notes: Use TDR defaults. All GPS dropsonde data should be transmitted to the Global Telecommunication System (GTS) in real-time to ensure availability for assimilation into forecast models.



***ORCESTRA Figure 1b**. Flight Pattern #2. Color shading shows precipitable water from ERA-5 on August 15, 2021, as an example. The objective of this flight pattern is to fly along the 50 mm TPW contour (indicated by the bright blue line) along the way to the disturbance of interest. Here a Figure-4 pattern is shown over the disturbance of interest as an example; it doesn't have to be that pattern. The ORCESTRA module component is the black dashed line with dropsondes indicated at points 1-5.*