EARLY STAGE EXPERIMENT
Flight Pattern Description

Experiment/Module: Impact of Targeted Observations on Forecasts (ITOFS) Experiment

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Requirements: No requirements: flown at any stage of the TC lifecycle

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 [*APHEX Goals 1, 3*].

G-IV Pattern #1

What to Target: Sample the near and peripheral environments of the TC or pre-genesis invest. If the P-3 is not flying a concurrent in-storm mission, the G-IV could also overfly or circumnavigate as closely as possible, the TC core or pre-genesis invest. Sampling strategies will be determined using real-time targeting guidance derived from the ECMWF, GEFS, NRL, HAFS models, as well as COAMPS-TC adjoint sensitivity.

When to Target: Sample when model-targeting guidance indicates viable targets (Fig. 1) that could positively impact forecasts of TC (or pre-genesis invest) track, intensity and/or structure. Any strength TC (or pre-genesis invest); no land restrictions; no specific take-off time requirements; missions can be once every 12 or 24 h. It is desirable to coordinate potential G-IV flight targets with NHC. A high-priority scenario would include flying a series of G-IV ITOFS (or ITOFS-East) missions for a TC or pre-genesis invest that has a reasonable chance of being later tasked by NHC to fly operational Synoptic Surveillance missions. In this scenario, a combination of ITOFS (or ITOFS-East) and Synoptic Surveillance missions could provide an extended period with continuity in observations where data is being regularly assimilated into forecast models for several days.

Pattern: Variable from storm to storm, dictated by regions that are identified using model targeting techniques. The over-storm or near-storm portion of the pattern could incorporate the following patterns: Figure-4, Rotated Figure-4, Butterfly, Lawnmower, G-IV Circumnavigation, G-IV Star pattern, or G-IV Star with Circumnavigation. In order to maintain consistency with NOAA NHC operational Synoptic Surveillance missions, an outer circumnavigation at R=180 n mi (335 km) should be flown. If time and conditions permit, a second inner circumnavigation is also desirable. This inner radius should be the smaller of the following two radii:

1. 90 n mi (165 km), the standard inner radius used by NHC
2. NHC's analyzed R34 winds multiplied by 1.5 (addresses storms with small R34 winds). For reference, an observed value of R34 for a small Atlantic hurricane is 50 n mi (90 km), equating to a G-IV inner circumnavigation radius of ~75 n mi (~140 km).

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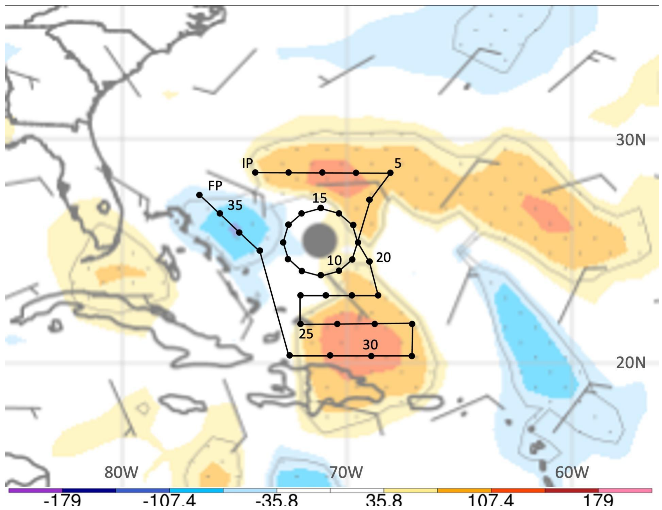

Figure 1. G-IV Synoptic Flow pattern for a mission flown in a TC on 29 Aug 0000 UTC designed to impact the forecast for 31 Aug 0000 UTC. The plot shows hypothetical reductions in ECMWF position variance due to assimilating GPS dropsonde data at each horizontal location. Warmer and cooler colors denote areas where GPS dropsonde data could most effectively reduce variance amongst the ensemble members. A circumnavigation with a radius of 90 n mi (165 km) is indicated in the pattern and GPS dropsonde locations (solid circles) are overlaid.

Flight altitude: 40–45 kft or as high as possible to provide better vertical sampling by dropsondes that are deployed.

Leg length or radii: Standard leg lengths for over-storm patterns. For near-storm patterns, inner points and optional inner circumnavigation, radii should be as close to the edge of the inner core convection as possible. This distance will be dictated by safety considerations, will typically range from ~60–90 n mi (110-165 km), and will require coordination between the HRD LPS and G-IV Flight Director. A radius of 180 n mi (335 km) is desirable for the outer circumnavigation.

Estimated in-pattern flight duration: ~2.5–7.5 h

Expendable distribution: Standard in the pre-invest/TC inner core. For the near and far environments, ~1.5–2 degree spacing in quiescent regions and oversampling (~1–2 degree spacing) in model-indicated target areas.

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.

Flight altitude: 40–45 kft or as high as possible to provide better vertical sampling by dropsondes that are deployed.

Leg length or radii: For near-storm G-IV circumnavigation, radii should be as close to the edge of the inner-core convection as possible. This distance will be dictated by safety considerations, typically range from ~60–90 n mi (110-165 km) and will require coordination between the HRD LPS and G-IV Flight Director.

Estimated in-pattern flight duration: ~2–4 h

Expendable distribution: 8 azimuthally equidistant GPS dropsondes for circumnavigation, and ~1.5–2 degree spacing in common environment region between TCs (unless otherwise indicated by G-IV Pattern 1). If one of the P-3s is flying a concurrent in-storm pattern, release dropsondes at all end points and include at least 1 center dropsonde; GPS dropsondes at the midpoints/RMW can be added on a case-by-case basis.

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.