| **MISSION PLAN** | | | |
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| **FLIGHT ID** | 20220902I1 | **STORM** | AL91 |
| **MISSION ID** | 04FFA | **TAIL NUMBER** | NOAA43 |
| **TASKING** | EMC | **PLANNED PATTERN** | Butterfly |
| **MISSION SUMMARY** | | | |
| **TAKEOFF [UTC]** | 1958 | **LANDING [UTC]** | 0253 |
| **TAKEOFF LOCATION** | Barbados | **LANDING LOCATION** | Barbados |
| **FLIGHT TIME** | 6.9 | **BLOCK TIME** | 7.2 |
| **TOTAL REAL-TIME RADAR ANALYSES**  **(Transmitted)** | 5 (5) | **TOTAL DROPSONDES (Good/Transmitted)** | 15 (15 / 15) |
| **OCEAN EXPENDABLES (Type)** | 8 AXBT (ONR) (8 good) | **sUAS (Type)** | None |
| **APHEX EXPERIMENTS / MODULES** | Genesis Stage Experiment: PREFORM; Early Stage Experiment: AIPEX (VAM) | | |
| **HRD CREW MANIFEST** | | | |
| **LPS ONBOARD** | Marks | **LPS GROUND** | Hazelton |
| **TDR ONBOARD** | Reasor | **TDR GROUND** | Gamache |
| **ASPEN ONBOARD** | Aberson | **ASPEN GROUND** | None |
| **NESDIS SCIENTISTS** | Chang, Sapp | | |
| **GUESTS (Affiliation)** | None | | |
| **AOC CREW MANIFEST** | | | |
| **PILOTS** | Doremus, Copare, Wood | | |
| **NAVIGATOR** | Utama | | |
| **FLIGHT ENGINEERS** | Darby, Pittman | | |
| **FLIGHT DIRECTOR** | Kalen, Holmes | | |
| **DATA TECHNICIAN** | Richards | | |
| **AVAPS** | Warnecke | | |

| **PRE-FLIGHT** | |
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| **Flight Plan** | Pattern: Fly butterfly pattern with 105 nmi legs  Altitude: 10 kft (pressure altitude)  On-station time for EMC data collection for the 0000Z assimilation window is between 2100Z and 0300Z.  AXBTs deployed from inside the cabin.  We plan to add on a vortex alignment module (VAM), part of AIPEX, at the end of the second (east-west) leg. |
| **Expendable Distribution** | Up to 33 sondes planned (all dropsondes transmitted to the GTS); 8 ONR/NRL AXBTs (all AXBTs transmitted to the AOC ground server if possible)  Release sondes at endpoints, midpoints, centers; possible supplemental rapid RMW drops across RMW/eyewall inbound and outbound. |
| **Preflight Weather Briefing** | Storm is not as strong, so we planned to forego the RMW drop sequence unless something changes. We are planning to follow the mission as briefed up to point 4. At that point we are planning to do a VAM module between center and PT 4 at the end of 2nd leg through the storm (West to east leg). That should give us 3 TDR looks at the vortex tilt in about 1.5 h. After the VAM module we plan to head to point 5 and complete our last full pass through the system and then to Barbados.  NHC currently gives the disturbance a 50% chance to develop in the next 48 hrs and 70% in the next 5 days. |

| **IN-FLIGHT** | |
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| **Time [UTC]** | **Event** |
| 1947 | Start taxi |
| 1958 | Takeoff from Barbados |
| 2036 | Begin descent to 10 kft |
| 2044 | Combo drop #1, AXBT #1 released and measured an SST of 28.92C |
| 2059 | Air Force flight has observed something close to a closed circulation |
| 2102 | Drop #2 mid point, 17.5 N, 58.2 W |
| 2114 | Drop #3 holding BT till we can put it out safely |
| 2118 | Drop #4 midpoint, AXBT #2 released and measured an SST of 28.82C |
| 2124 | We are planning to line up our west-east pass from pt 3-4 on the AF fix. However, air space restrictions will limit our leg from 3-center to 80 nm, not 105 nmi |
| 2133 | Some new convection bubbling as we approach sunset |
|  |  |
| 2139 | Combo Drop #5, AXBT #3 released and measured an SST of 28.83C near 19.86N, 59.55W  Sonde #5 drier than others, still 60-70% RH down to 4 kft |
| 2155 | First set of synoptic plots |
| 2210 | Combo drop #6, AXBT #4 released and measured an SST of 29.19C. Drop data looks moist.  ​​ |
| 2214 | Some SW->NE tilt |
| 2219 | Drop #7 midpoint, 17.9193N, 59.7913W |
| 2228 | Drop #8 at center fix 10 kft, near 17.8728N, 59.2439W |
| 2240 | Frank notes a crescent band-like feature forming |
| 2240 | Drop #9 midpoint near 17.8324N, 58.3513W in massive stratiform area |
| 2307 | Drop #10 endpoint |
| 2310 | Large tilt between 2 km center and 6 km center. Subjective interpretation differs a bit from objective tilt estimate in the first analysis as shown above |
| 2321 | Tracking 270 degrees back through for VAM leg #2 |
| 2325 | CB blowing up over the center |
| 0008 | Higher reflectivities along the flight track from ~3- 7km. Maybe it is attenuation in a high rain-rate region? TDR shows an impressive bright band in the stratiform region too.          Large 2–8 km tilt. Wind max at 2 km well displaced from circulation center. |
| 0024 | Heading outbound to finish the VAM |
| 0041 | Revised PT 4 is 18.25 N, 57.65 W |
| 0049 | AXBT #5 |
| 0052 | EP Pt 4, turn to track 300 degrees to Pt 5 |
| 0114 | Turn to track 210 degrees |
| 0114 | Combo drop #11, AXBT #6 released and measured an SST of 28.66C near 19.4199N, 58.7124W |
| 0125 | Drop #12 mid point drop, 18.7944N, 59.1906W |
| 0136 | Microwave Imagery from ~0036Z suggest most of the deep convection is still east of the LLC |
| 0137 | Combo drop #13, AXBT #7 released and measured an SST of 28.85C |
| 0146 | Drop #14 mid point, 18.0640N, 59.5124W |
| 0155 | 015515 UTC combo drop #15 at EP, AXBT #8 released near  17.0058N, 60.1357W  Science Complete |
|  | Final swath and composite analysis show the apparent large tilt (> 100 km) between the low-level (1–3 km) and mid-level (5–7 km) centers. The mid-level circulation is very broad and predominantly within the stratiform region. Deep convection is located nearer the LLC along the western edge of the MLC. Indications of potential upward growth of the low-level vortex with a more compact circulation now up to 4–5 km altitude. The low-level vortex may have an ~30–50 km tilt (as a separate entity from the broad MLC previously discussed). |
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|  | Final 850 hPa and WL150 synoptic maps |

| **POST-FLIGHT** | |
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| **Mission Summary** | We flew a butterfly pattern with a vortex alignment module in AL91. The storm was developing concentrated convection near the center, and appeared to be attempting to align and generate a more defined circulation. This made it a perfect case for the Vortex Alignment Module (VAM).  This is the first time the VAM was successfully flown. The additional legs captured the evolution of both the precipitation and vortex structure near the low- and mid-level centers.  The timing of the module was ideal as an intense convective burst began just prior to the start of the module and continued throughout the module.  Based on the data from this flight and an earlier Air Force flight, the decision was made to upgrade the system to AL06 (TS Earl), which “officially” makes this a genesis mission. |
| **Actual Standard Pattern Flown** | Butterfly with inbound and outbound legs for the VAM. |
| **APHEX Experiments / Modules Flown** | Data collection supports the *Genesis Stage Experiment: PREFORM*, as well as the *Early Stage Experiment: AIPEX*, specifically the *Vortex Alignment Module* within *AIPEX.* |
| **Plain Language Summary** | * We flew another mission into AL91 to help study the processes that were allowing it to attempt to form into a tropical cyclone. The storm became better organized throughout the day today, and based on Air Force Reserve and our observations NHC upgraded AL91 to Tropical Storm Earl. |
| **Instrument Notes** | No issues |
| **Final Mission Track** |  |