| **MISSION PLAN** | | | |
| --- | --- | --- | --- |
| **FLIGHT ID** | 20240630I1 | **STORM** | AL02/Beryl |
| **MISSION ID** | 0202A | **TAIL NUMBER** | NOAA-43 |
| **TASKING** | EMC/NHC | **PLANNED PATTERN** | Figure-4 |
| **MISSION SUMMARY** | | | |
| **TAKEOFF [UTC]** | 0900 | **LANDING [UTC]** | 1643 |
| **TAKEOFF LOCATION** | TISX | **LANDING LOCATION** | TISX |
| **FLIGHT TIME** | Fractional hr, Takeoff to Landing Time | **BLOCK TIME** | Get from onboard LPS or Flight Director |
| **TOTAL REAL-TIME RADAR ANALYSES**  **(Transmitted)** | 2 (2) | **TOTAL DROPSONDES Deployed (Transmitted)** | 35 (35) |
| **OCEAN EXPENDABLES (Type)** | 6 ONR AXBTs  (5 good) | **sUAS (Type)** | N/A |
| **APHEX EXPERIMENTS / MODULES** | Exact name of the Experiment in the HFP Plan; identify relevant experiments / module even if not a research tasking | | |
| **HRD CREW MANIFEST** | | | |
| **LPS ONBOARD** | J. Zhang | **LPS GROUND** | J. Dunion/X. Zhang/M. Montgomery |
| **TDR ONBOARD** | J. Zhang | **TDR GROUND** | M. Fischer |
| **ASPEN ONBOARD** | K. Sellwood | **ASPEN GROUND** | n/a |
| **NESDIS SCIENTISTS** | n/a | | |
| **GUESTS (Affiliation)** | n/a | | |
| **AOC CREW MANIFEST** | | | |
| **PILOTS** | Doremus/Wood/Taraboletti | | |
| **NAVIGATOR** | Schaefer/Meier | | |
| **FLIGHT ENGINEERS** | Tyson/Wysinger/Ripp | | |
| **FLIGHT DIRECTOR** | Kalen, Q. | | |
| **DATA TECHNICIAN** | Richards,T. | | |
| **AVAPS** | Patel | | |

| **PRE-FLIGHT** | |
| --- | --- |
| **Flight Plan** | *[Insert image of ONR/TCRI detailed pattern image, if available]*    *[If you want, briefly describe the pattern in words]*  Attached is the proposed Figure-4 pattern for Sunday morning’s NHC-EMC tasked NOAA-43 TDR mission into Tropical Storm Beryl - 0500L / 0900z takeoff from St. Croix and recovering in St. Croix. Timing of the pattern is to be on-station for EMC data collection for the 1200z assimilation window between 0900z and 1500z.  Pattern: Fly Figure-4 pattern with 105 NM legs (120 NM for the WP 1-center leg)  Altitude:   * 10 kft preferred - 8 kft if AF deconfliction is required (pressure altitude)   Potential add-on Modules: (time permitting)   * Genesis Stage >> FAM Experiment: Dual Racetrack pattern |
| **Expendable Distribution** | *[Describe planned dropsonde, ocean buoy, sUAS deployment locations; e.g., “Dropsondes/AXBT combo drops at endpoints, midpoints, and center”*  Expendables:   * Load 35 dropsondes   + Release at endpoints, midpoints, centers, RMWs (if requested by NHC) >> charged to NWS   + Release extra sondes along legs WP 1-Center (2) & Center-WP-4 (2) >> charged to ONR   + Additional drops may be requested at the discretion of the onboard HRD LPS >> charged to ONR     - extra drops during the inbound/outbound to/from the storm are likely   + All dropsondes transmitted to the GTS * 6 AXBTs - see notes below   + All AXBTs transmitted to the AOC ground server if possible |
| **Preflight Weather Briefing** | *Beryl continues to strengthen rapidly this evening. Cold convective*  *cloud tops between -70 to -80 C are now wrapping fully around the*  *center after earlier being confined to its southern semicircle.*  *After the prior advisory, a late arriving SSMIS microwave pass*  *revealed a small closed eyewall now exists. The latest subjective*  *and objective intensity estimates range between 65 to 80 kt and*  *based on the continued improved structure on satellite imagery, the*  *intensity is set at 75 kt, towards the upper end of those estimates.*  *As earlier mentioned, both the NOAA and Air Force Reserve Hurricane*  *Hunters will investigate Beryl tomorrow morning, which will provide*  *our first in-situ data to assess the hurricane.*  *Beryl has maintained a just north of due west fast motion this*  *evening, estimated at 280/17 kt. An extensive mid-level ridge*  *remains positioned poleward of the hurricane, and Beryl should*  *maintain a westward to west-northwestward motion at a similar speed*  *over the next couple of days. This track will take the hurricane*  *over the Windward Islands overnight on Sunday into Monday. A subtle*  *weakness in this ridging in the 24-48 hour period should help the*  *hurricane gain a bit of latitude before the ridge builds back in*  *over the southeastern U.S. by the middle of next week, likely*  *resulting in a turn back more westward by the end of the forecast*  *period. The NHC forecast track is just a touch left and slower*  *compared to the prior advisory, but remains very close to a blend of*  *the consensus aids HCCA and TVCN.*  *Unfortunately Beryl has all the ingredients favorable for continued*  *rapid intensification in the short-term. The light to moderate*  *easterly shear that had been affecting the system is subsiding,*  *while the hurricane remains embedded in a large area of deep-layer*  *moisture and over 28-29 C sea-surface temperatures. The small and*  *well-organized inner core likely means the hurricane should take*  *full advantage of these pristine conditions, and both the GFS and*  *ECMWF versions of SHIPS-RII show rapid intensification indices 7 to*  *10 times above climatology. Thus, the latest NHC intensity forecast*  *will explicitly show rapid intensification over the next day, making*  *Beryl a very dangerous Category 3 hurricane before it moves across*  *the Windward islands by tomorrow night. Once Beryl enters the*  *Caribbean, there could be a marked increase in westerly vertical*  *wind shear as a strong easterly low-level jet, common for this time*  *of year in the eastern Caribbean Sea, will keep Beryl moving quickly*  *westward against lighter upper-level upper-level easterlies*  *partially eroded by a deep-layer trough off the Eastern Seaboard.*  *Thus some weakening is forecast after 48 hours as Beryl moves*  *further into the Caribbean. The NHC intensity forecast remains close*  *to the reliable consensus aids and now shows a peak intensity of 110*  *kt in 36 hours, though a few of the regional-hurricane models do*  *peak Beryl stronger than shown here.*    *[Briefly describe the relevant environmental drivers.]*  *[Copy in GIF of recent (~6 hr) satellite loops (https://www.star.nesdis.noaa.gov/GOES/index.php)]* |
| **Instrument Notes** | *TDR working, all instruments worked* |

| **IN-FLIGHT** | |
| --- | --- |
| **Time [UTC]** | **Event** |
| 0900 | Take-off from STX |
| 0900 | Beryl's structure is quickly evolving this morning as it undergoes  rapid intensification. Recent GOES 1-minute satellite imagery  shows the development of an eye, with cooling cloud tops in the  eyewall and a warming eye. The initial wind speed is set to 85 kt.  Now that the core has solidified based on a recent AMSR2 microwave  pass, continued rapid intensification looks likely over the next 24  hours. |
| 0930 | The hurricane is moving slightly north of due west, estimated at  280/18 kt.  Beryl is over SSTs near 29C and within shear less than  10 kt. |
| 0932 | ONR sonde targeted at 63 W is delayed as we are close to islands.  Will drop the 1st sonde at 61W |
| 0951 | Sonde #1 ONR ferry |
| 1002 | Sonde #2 ONR ferry |
| 1013 |  |
| 1030 | Convective burst, as seen on infrared and visible satellite imagery, has been cyclonically orbiting the eyewall. Recently, this burst has caused the eye to become obscured on satellite imagery. |
| 1039 | Sonde #3 ONR |
| 1128 | Sonde #4 With BT combo, IP |
| 1040 |  |
|  |  |
| 1055 | TC diurnal cycle imagery shows a TC diurnal pulse at R~300 km. The convective band to the NW and N (diurnal pulse could be a target for the dual race track at the end of the pattern. |
| 1109 | Lightning strikes occurred within the eyewall as shown on satellite imagery. |
| 1109 | Depressurized by BT purposes |
| 1111 | CIMSS vertical wind shear shows light shear this morning. SHIPS 06z VWS: 7kt @25 deg. |
| ~1115 | AF fix: extrapolated surface pressure 973 mb, peak inbound NW quadrant |
| 1128 | IP: Sonde #4 BT combo SST 28.49C based on .dat file |
| 1036 | Sonde #5 ONR |
| 111z | AF VDM: FL 700 mb, 969 mb, MAX FL wind 108 kt, SFMR 94 kt, |
| 1142 | Sonde #6 |
| 1150 | Sonde #7 ONR |
| 1200 | Sonde #8 RMW N |
| 1201 | Visible satellite imagery of lightning strikes occurring in the center of the eyewall. |
| 1202 | Sonde #9 Center BT combo SST 29.11C  969mb 13kt 110 deg |
| 1204 | Sonde #10 RMW S |
| 1206 |  |
| 1213 | NOAA fix: extrapolated surface pressure 965.7 mb, peak inbound N quadrant. |
| 1216 | Sonde #11 MP S |
| 1228 | Sonde #12 BT combo EP S SST 28.91 C |
| 1238 | AF fix: extrapolated surface pressure 964.2 mb, peak outbound center. |
| 1245 | Sonde #13 combo downwind leg (SE side) SST 28.46 C |
| 1259 | Infrared imagery of Hurricane Beryl with a pronounced eyewall. |
| 1259 | Turn E-W IP |
| 1259 | Sonde #14 combo E-W IP SST N/A BT failed |
| 1314 | Sonde #15 MP E |
| 1323 | Sonde #16 RMW E |
| 1325 | Sonde #17 Center |
| 1325 | Hunting storm center for NHC |
| 1330 | Sonde #18 RMW W |
| 1327 | Vortex data Message: 1324, 10.57N, 054.35W |
| 1334 | Sonde #19 ONR extra |
| 1322 | Max FL 110 kt 073/10 NM |
| 1340 | Sonde #20 MP W - NWS |
| 1347 | Sonde #21 ONR extra |
| 1354 | Sonde #22 EP W Combo |
| 1355 |  |
| 1400 | Heading toward the IP of the box pattern |
| 1404 | Sonde #23 IP of the box NE |
| 1410 | Sonde #24 MP of NE-SW leg short leg |
| 1413 | Sonde#25 EP of NE-SW leg |
| 1417 | Sonde #26 MP1 of SW-NE leg |
| 1422 | Sonde #27 MP2 of SW-NE leg |
| 1426 | Sonde #28 EP of SW-NE leg |
| 1431 | Sonde #29 MP of NW-SE leg |
| 1434 | Sonde #30 EP of NW-SE leg |
| 1438 | Sonde #31 MP1 of NE-SW leg |
| 1443 | Sonde #32 MP2 of NE-SW leg |
| 1453 | Sonde #33 ONR ferry back 1 |
| 1526 | Sonde #34 ONR ferry back 2 |
| 1602 | Sonde #35 ONR ferry back 3 - last drop |
| 1415 | Wind Radii Estimates based on Advanced Dvorak Technique (34-64kt) |
| 1424 | Racetrack pattern for MAGPIE |
| 1441 |  |
| 1510 |  |
| 1600 | Based on the data collected by both P3 and AF flights, the minimum pressure has fallen significantly to 964 mb and the maximum wind speed is now up to 105 kt.  Satellite images show that Beryl has a  classic major hurricane pattern with a clear and circular eye and  symmetric convective pattern surrounding it. |

| **POST-FLIGHT** | |
| --- | --- |
| **Mission Summary** | AOML/HRD was supporting operationally tasked NOAA NHC/EMC P-3 Tail Doppler Radar missions into Hurricane Beryl. Hurricane Beryl is now a Category 3 hurricane. The APHEX-HRD and ONR (MAGPIE) science teams (See final mission track) participated in the mission. 6 BTs and 35 dropsondes dropped and 34 transmitted. 5 BTs were successful. Two-pass radar analyses through the hurricane were sent to the operational center, then a FAM dual racetrack to observe the SAL and rain drop size from w-band. The mission successfully addressed the operational TDR needs. The maximum wind was observed at the FL 110 kts. Two center fixes were reported. |
| **Actual Standard Pattern Flown** | *Figure-4 and FAM Experiment (Dual racetrak pattern)* |
| **APHEX Experiments / Modules Flown** | *FAM P-3 dual racetrack pattern/Diurnal cyclone box pattern* |
| **Plain Language Summary** | AOML/HRD was supporting operationally tasked NOAA NHC/EMC P-3 Tail Doppler Radar missions into Hurricane Beryl. The mission was very successful. Airforce and NOAA reconnaissance contributed to the upgrade to Category 3 of Hurricane Beryl. TDR data were provided to the modeling center and National Hurricane Center. NOAA and ONR collected data in Beryl’ environment to study the lowest part of the atmosphere near the ocean and collected data from a special onboard radar that measures small water droplets in the atmosphere. |
| **Instrument Notes** | *All instruments worked well* |
| **Final Mission Track** |  |