| **MISSION PLAN** | | | |
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| **FLIGHT ID** | 20241107H1 | **STORM** | AL18/Rafael |
| **MISSION ID** | 1818A | **TAIL NUMBER** | NOAA-42 |
| **TASKING** | HRD | **PLANNED PATTERN** | Rotated-4 |
| **MISSION SUMMARY** | | | |
| **TAKEOFF [UTC]** | 0829 | **LANDING [UTC]** | 1529 |
| **TAKEOFF LOCATION** | KLAL | **LANDING LOCATION** | KLAL |
| **FLIGHT TIME** | 7 hr | **BLOCK TIME** | 7.3 hr |
| **TOTAL REAL-TIME RADAR ANALYSES**  **(Transmitted)** | 4 (4) | **TOTAL DROPSONDES Deployed (Tx to GTS)** | 23 (23) |
| **OCEAN EXPENDABLES deployed (good)** | 2 wave drifters (2) | **sUAS (Type)** | 40 Streamsondes |
| **APHEX EXPERIMENTS / MODULES** | RICO-SUAVE, CHAOS, NESDIS Ocean Winds | | |
| **HRD CREW MANIFEST** | | | |
| **LPS ONBOARD** | Marks | **LPS GROUND** | Looney/Dunion |
| **TDR ONBOARD** | Marks | **TDR GROUND** | Reasor |
| **ASPEN ONBOARD** | N/A | **ASPEN GROUND** | Kaplan |
| **NESDIS SCIENTISTS** | N/A | | |
| **GUESTS (Affiliation)GUESTS (Affiliation)** | Kaisti (Skyfora), Reiner, Baringer (NOAA/AOML), Stienbarger (NOAA/GOMO),  Deloach (Embry-Riddle) | | |
| **AOC CREW MANIFEST** | | | |
| **PILOTSPILOTS** | Copare, Wood, Reeves | | |
| **NAVIGATORNAVIGATOR** | Dunford, Saunders | | |
| **FLIGHT ENGINEERS** | Stokes, Perichet | | |
| **FLIGHT DIRECTOR** | Kalen | | |
| **DATA TECHNICIAN** | RIchards | | |
| **AVAPS** | Brannigan | | |

| **PRE-FLIGHT** | |
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| **Flight Plan** | Pattern: Fly Rotated Fig-4 pattern with 105 NM legs   * Any drop points over land can be omitted or repositioned at the discretion of the onboard LPS   Altitude:   * 10 kft preferred - 8 kft if AF deconfliction and minimum altitude overland rules are required (pressure altitude) |
| **Expendable Distribution** | Expendables:   * Load 40 Skyfora Streamsondes * Load 2 A-Sized Wave Drifters (ASWDs) - see notes below * Load 30 dropsondes - see notes below   + All dropsondes transmitted to the GTS in real time |
| **Preflight Weather Briefing** | Rafael is on the southwest side of a low- to mid-level ridge over the western Atlantic and Florida. This ridge is forecast to build westward in response to  a developing deep-layer trough over the southwestern United States.  This evolution should cause the cyclone to continue moving westward across the Gulf of Mexico. The initial motion is 315/11. The global models suggest that the current shear should decrease in about 24 h, then increase again later in the forecast period.  Forecast for 07/1200Z: 24.4N 84.9W 85 KT  Previous P-3 mission: |
| **Instrument Notes** | *all instruments are nominal* |

| **IN-FLIGHT** | |
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| **Time [UTC]** | **Event** |
| 0829 | Take-off from KLAL |
| 0836 | TDR up |
| 0839 | *SD-1057 @ 25.9205N, 85.81547W headed S at 3.5 kts*  *Wave Drift 1: 24.930N, 83.818W*  *Wave Drift 2: 24.754N, 85.062W*  *Wave Drift 3: 24.074N, 88.935W*  *Wave Drift 4: 24.301N, 89.338W* |
| 0851 | Targeting SD-1057 at IP. ETA 30 min |
| 0900 | added drop for SD, about 30 n mi N of IP (charge to GOMO) |
|  |  |
| 0911 | SD-1057 (5 min ago): 25.8835 N, 85.82362 W. headed S at ~4 kts. Wind 19 kts, gusting 22 kts, pressure: 1009.4 hPa, sig wave 1.9 m, SST 26.5C  N42 descending to 8000 ft altitude, 10 min out |
| 0921 | Flyover of SD-1057, dropsonde 1, CH1, splash ~500 m from saildrone |
| 0927 | IP, start leg 1 |
| 0928 | Drop 2, CH2, IP1, streamsonde combo (successful streamsonde) |
| 0940 | Drop 3, CH3, MP |
| 0945 | Orbiting to prep the 20 streamsondes for rapid fire. This took a long time and needs to be improved. It took two folks 15 min to get everything set and we needed to be out of any turbulence. Definitely a data point for future streamsonde swarm launches |
| 1000 | Back on track to center |
| 1009 | Drop 4, CH5, RMW, 20 streamsondes within 1 min, starting at 100850, dropsonde after streamsondes  IR sonde would not sync, so just a regular sonde |
| 1013 | Drop 5, CH4, Center drop, intermittent lightning in N and E eyewall, however, GLM shows more lightening in the E eye wall    Center Drop @1013z: 24.26N 84.63W Sfc. pres. 971 mb, 10m wind 150/14kt. |
| 1026 | Drop 6, CH6, MP, streamsonde combo, entering major rainband |
| 1029 | Getting some chop in outer rain band |
| 1032 | Cutting leg short due to Cuba ADIZ; from flight “plenty of scatterers from here on until we get to the west side again.” |
| 1036 | Drop 7, CH7, EP1, streamsonde combo |
| 1039 | TDR job #1 started |
| 1056 | TDR analysis #1 ended  Alt (km) Lat (deg) Lon (deg W)  0.5 99.99 99.99  2.0 24.22 84.68  3.0 24.29 84.64  6.0 24.38 84.54  2-6-km Vortex Tilt: 22.8 km at 38 deg  TDR shows “Far more substantial tilt than last night, I believe”, “tilted to the NE” |
| 1106 | PT3, end downwind leg, turn TK 225 |
| 1108 | Drop 8, CH8, IP2, Combo drop 8 + streamsonde |
| 1110 | Flight back pressurized and doing the combos by dropping sonde then taking the sleeve out and dropping the stream sonde; takes 45-60 s to do the swap |
| 1116 | In large stratiform rain area, not many bumps |
| 1119 | Drop 9, CH1, MP, combo |
| 1123 | Based on W88D, 20 n mi from strongest convection in NE eye wall, 5 min out, a bit of chop in major rainband outside eye wall |
| 1131 | Entering eye, good bumps in eye wall, Lev noticed peak FL winds of ~90 kts (48 m/s), not hunting the eye; next TDR will show NE eye wall |
| 1134 | Drop 10, CH2, Center combo drop with streamsonde |
| 1136 | From flight: SW side of the storm is totally ope at altitude, big anvil overhead |
| 1146 | Drop 11, CH3, MP |
| 1155 | Ended TDR leg early |
| 1159 | Drop 12, CH4, EP2 (WP4), combo drop with streamsonde |
| 1212 | From Lev: “looks like yall may be deploying the ADWSD nearish a pre-existing one (not a bad thing necessarily at all). WD1 @ 24.720N, 85.067W...sig waves at 7.6 m” WD2 @ 25.724N 85.183W could be nearish WP6.  SD-1057 has picked up its speed (and winds), moving nearly 4-6 kts...located at 25.68038 N, 85.84936W” |
| 1215 | Drop 13, CH5, IP3 (WP5) combo with streamsonde |
| 1215 | TDR Job 2 finished TDR center info from 241107H1\_1134\_xy.nc:  Alt (km) Lat (deg) Lon (deg W)  0.5 24.35 84.83  2.0 24.35 84.85  3.0 24.36 84.83  6.0 24.44 84.77  2-6-km Vortex Tilt: 12.8 km at 39 deg  From Paul Reasor: “could be data coverage issues at play here ... not sure the tilt actually reduced by 10 km…” |
| 1227 | Drop 14, CH6, MP with streamsonde |
| 1231 | Wave drifter near outbound RMW has sig wave of 8.25 m. 24.699N, 85.077W.  WD at outbound EP (25.733N, 85.205W) has sig wave of 4.2 m |
| 1232 | From Paul re: Radar:  Looking at the swaths, I do think a better sampling along the tilt vector on that second pass yielded a more robust result ... I'll have to talk to Michael about what he thinks of the first-pass estimate  Both showed a tilt to the NE, so that's consistent ... but whether there was an alignment of 10 km in 1 h...  (in 25-kt shear) |
| 1234 | From flight: “entering eye from south open to the north eyewall”; “E and N eyewall have scalloped appearance on radar, suggesting blow ups in the east eyewall that roll around to the north as they dump there precip” |
| 1238 | Drop 15, CH7, CP3, center with streamsondes |
| 1252 | Drop 16, CH8, MP, with streamsonde (34th streamsonde) |
| 1303 | Drop 17, CH1, EP3, with streamsonde; end leg at WP6, |
| 1305 | SD-1057 @ 25.60643 N, 85.85763 W; winds between 20-30 kts, gusting 30-40 kts; pressure 1008.5; Air Temp 26.4C, SST 27.1C, sig wave 4.7 m |
| 1308 | Start 3rd TDR Analysis |
| 1317 | Drop 18, CH2, saildrone overflight (looked extremely close) |
| 1325 | TDR Analysis #3 finished  TDR center info from 241107H1\_1238\_xy.nc:  Alt (km) Lat (deg) Lon (deg W)  0.5 24.38 84.95  2.0 24.40 84.97  3.0 24.42 84.97  6.0 24.45 84.89  2-6-km Vortex Tilt: 10.0 km at 53 deg  From Paul Reasor: “I'm thinking 10-12 km tilt is the true value…: |
| 1329 | From Flight: “we are going to sample this squall line 100 n mi W of the center. Could this be a diurnal pulse?” (Jason D. confirmed),” I asked them to cross it twice to get TDR and dropsonde on the w side of it” |
| 1338 | TC diurnal pulse moving out from the inner core (yellow to red ring) and is right on the diurnal clock- currently located at R~200 km (108 NM) at 1220z (~6a LT). |
| 1341 | Drop 19, CH3, IP4, combo drop with streamsonde on west side of band |
| 1355 | Drop 20, CH4, MP, combo with streamsonde |
| 1402 | Wave drifter deployed just outside RMW in eyewall |
| 1405 | Looks like headed straight into big cell in east eyewall |
| 1409 | Drop 21, CH5, CP4, center drop with streamsonde |
| 1420 | From flight: “in the bumps in major rainband E of center very heavy stratiform rain with embedded cells” |
| 1422 | Drop 22, CH6, MP with streamsonde |
| 1436 | Drop 23, CH7, EP4, combo drop with streamsonde, end pattern and science |
| 1440 | From flight: total 23 drops and 23 transmitted, deployed 40 streamsondes and 2 WDs; Will be 4 TDR analyses and 4 transmitted to NHC and EMC |
| 1502 | TDR center info from 241107H1\_1409\_xy.nc:  Alt (km) Lat (deg) Lon (deg W)  0.5 24.41 85.13  2.0 24.42 85.17  3.0 24.48 85.17  6.0 24.53 85.09  2-6-km Vortex Tilt: 14.4 km at 34 deg |

| **POST-FLIGHT** | |
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| **Mission Summary** | This mission was a successful mission into category 2 Hurricane Rafael. Increasing shear following landfall over Cuba has led to some additional weakening. The south and southwest regions around the eye were clear of convection. A rotated figure-4 pattern was flown. A swarm of 20 streamsondes was deployed in the NW RMW within 1 minute. Data was transmitted from all 20 of them. Additionally, 2 A-size wave drifters were deployed, both returning data. In total, 23 dropsondes were deployed, all transmitted. 2 of the sondes were deployed over a saildrone. 40 streamsondes in total were deployed (20 in the swarm, the rest paired with the regular sondes).  During the flight, the storm started to slow down and turn to the west. A strong diurnal pulse was noticed W of the center. The aircraft flew through it, deploying a sonde. When flying through the E eye wall, there was some bubbling convection, but flight was smooth. However, there was evidence of stronger updraft to the S of track. |
| **Actual Standard Pattern Flown** | *Rotated Figure-4* |
| **APHEX Experiments / Modules Flown** | CHAOS, NESDIS Ocean Winds, RICO SUAVE |
| **Plain Language Summary** | * Successful flight with 2 wave drifter deployments ahead of the storm; 40 streamsonde deployments, and 2 saildrone overflights * A swarm of 20 streamsondes was deployed within 1 minute * The storm and eye was open to the south and southwest of center |
| **Instrument Notes** | From Frank Marks: I asked the AVAPS operator to provide feedback on how we can do better preparing streamsondes for the swarm release. He and Kim were like one armed paper hangers unpacking them and initializing them before the swarm release. That took 15 min this time. We need to develop a procedure or a place to stack them for initialization before we hit the IP.  AVAPS operator noted that they did not notice much noise around the sonde frequencies that were closest to the streamsonde frequencies. |
| **Final Mission Track** |  |