

**NOAA / AOML / Hurricane Research Division  
Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H1**

<b>MISSION PLAN</b>			
<b>FLIGHT ID</b>	20210821H1	<b>STORM</b>	AL08 / HENRI
<b>MISSION ID</b>	0908A	<b>TAIL NUMBER</b>	NOAA42
<b>TASKING</b>	EMC	<b>PLANNED PATTERN</b>	Butterfly
<b>MISSION SUMMARY</b>			
<b>TAKEOFF [UTC]</b>	0757	<b>LANDING [UTC]</b>	1540
<b>TAKEOFF LOCATION</b>	Lakeland	<b>LANDING LOCATION</b>	Lakeland
<b>FLIGHT TIME</b>	7.7	<b>BLOCK TIME</b>	8.0
<b>TOTAL REAL-TIME RADAR ANALYSES (Transmitted)</b>	3 (3)	<b>TOTAL DROPSONDES (Good/Transmitted)</b>	19 (19/19)
<b>OCEAN EXPENDABLES (Type)</b>	6 (AXBT, 4 good, 1 partial, 1 bad)	<b>sUAS (Type)</b>	None
<b>APHEX EXPERIMENTS / MODULES</b>	Early Stage Experiment: AIPEX; Gravity Wave Module		
<b>HRD CREW MANIFEST</b>			
<b>LPS ONBOARD</b>	Aberson	<b>LPS GROUND</b>	Holbach
<b>TDR ONBOARD</b>	Aberson	<b>TDR GROUND</b>	Fischer/Reasor
<b>ASPEN ONBOARD</b>	None	<b>ASPEN GROUND</b>	J. Zhang/Dunion
<b>NESDIS SCIENTISTS</b>	Chang		
<b>GUESTS (Affiliation)</b>	None		
<b>AOC CREW MANIFEST</b>			
<b>PILOTS</b>	Rossi, Shaw, Keith		
<b>NAVIGATOR</b>	Utama		
<b>FLIGHT ENGINEERS</b>	Sanchez, Stokes		
<b>FLIGHT DIRECTOR</b>	Lundry		
<b>DATA TECHNICIAN</b>	T. Richards		
<b>AVAPS</b>	S. Paul		

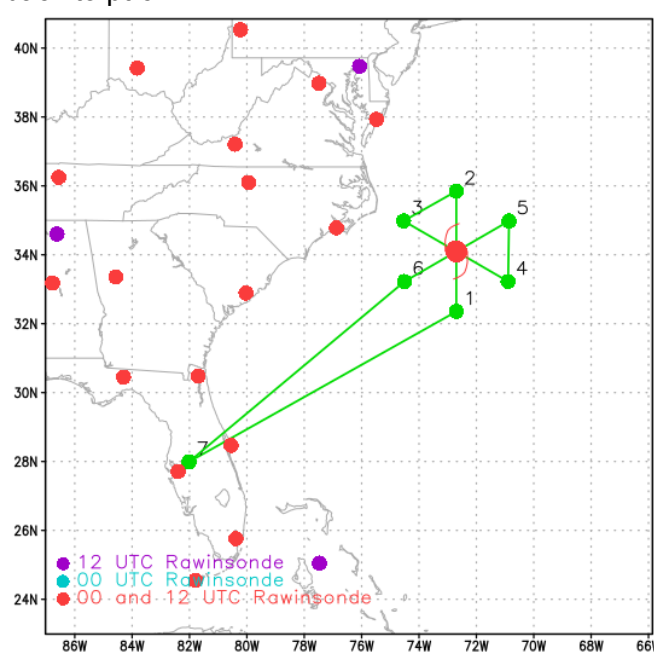
NOAA / AOML / Hurricane Research Division  
 Hurricane Field Program  
 Advancing the Prediction of Hurricanes Experiment (APHEX)

FLIGHT LOG - 20210821H1

**PRE-FLIGHT**

**Flight Plan**

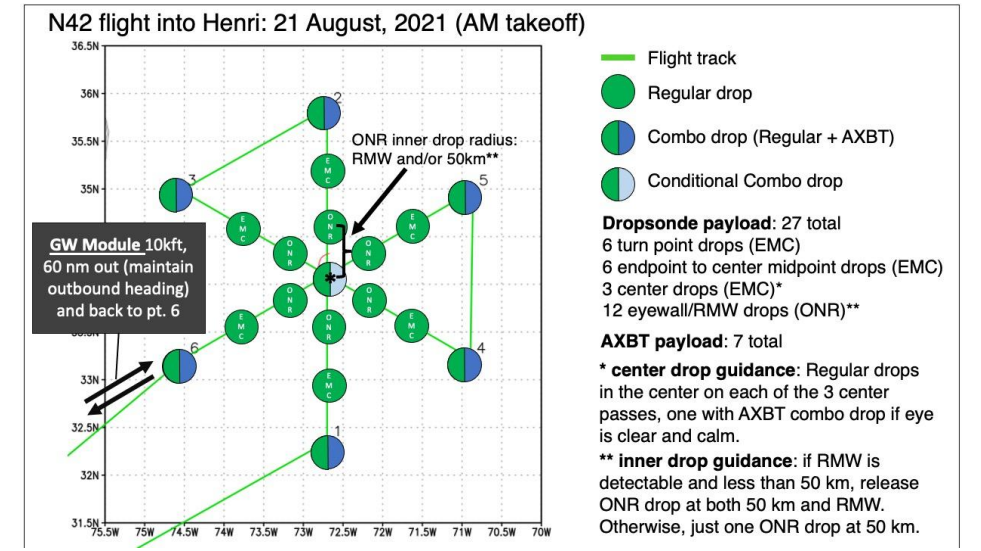
Butterfly pattern to collect data from 1200 UTC HWRP model cycle. Gravity wave module after pt 6 is planned heading outbound 60 n mi then back to pt 6.



Map showing the flight path (green lines) and rawinsonde locations (colored dots) over the Eastern United States. The flight path consists of 7 numbered points forming a butterfly pattern. Rawinsonde locations are marked with colored dots: purple for 12 UTC, cyan for 00 UTC, and red for 00 and 12 UTC. The map includes latitude (24N to 40N) and longitude (86W to 66W) coordinates.

**Expendable Distribution**

N42 flight into Henri: 21 August, 2021 (AM takeoff)



Map showing the flight track (green line) and drop locations (colored circles) for the N42 flight into Henri on August 21, 2021. The flight track starts at point 1, moves to point 2, then to point 3, then to point 4, then to point 5, then to point 6, and finally back to point 1. Drop locations are marked with colored circles: green for Regular drop, blue for Combo drop (Regular + AXBT), and grey for Conditional Combo drop. The map includes latitude (31.5N to 36.5N) and longitude (75.5W to 70W) coordinates.

**Legend:**

- Flight track
- Regular drop
- Combo drop (Regular + AXBT)
- Conditional Combo drop

**Dropsonde payload: 27 total**  
 6 turn point drops (EMC)  
 6 endpoint to center midpoint drops (EMC)  
 3 center drops (EMC)\*  
 12 eyewall/RMW drops (ONR)\*\*

**AXBT payload: 7 total**

\* **center drop guidance:** Regular drops in the center on each of the 3 center passes, one with AXBT combo drop if eye is clear and calm.

\*\* **inner drop guidance:** if RMW is detectable and less than 50 km, release ONR drop at both 50 km and RMW. Otherwise, just one ONR drop at 50 km.

**GW Module 10kft, 60 nm out (maintain outbound heading) and back to pt. 6**

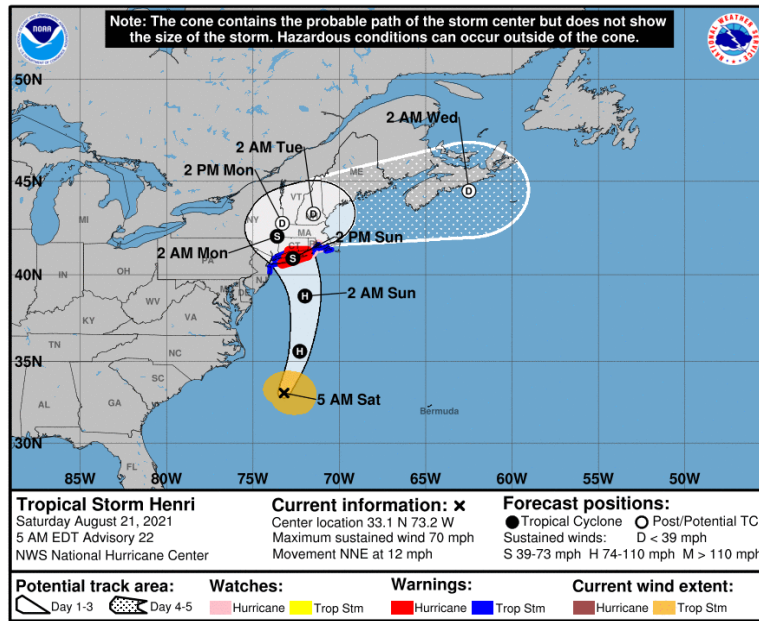
ONR inner drop radius: RMW and/or 50km\*\*

**NOAA / AOML / Hurricane Research Division  
Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H1**

**Preflight  
Weather  
Briefing**

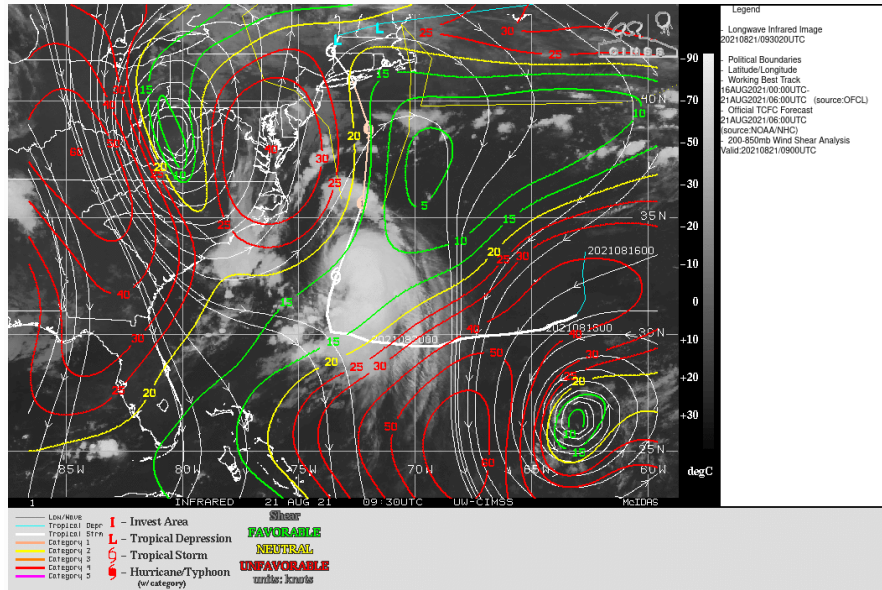
As of 09Z, Henri is a 60 kt tropical storm moving north-northeastward (015) at 10 kt with mslp 996 mb. Henri has been battling shear for a while now, but appears to have begun wrapping convection around to the northeastern and eastern portions of the circulation suggesting that the shear is decreasing. It is expected to continue moving north-northeastward today at a faster forward speed and with the decrease in shear become a hurricane.



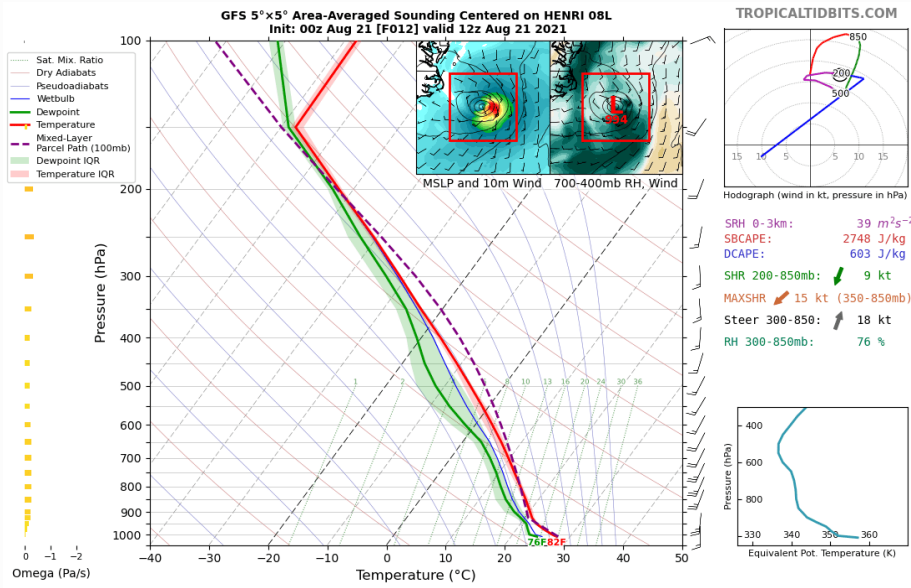
UW-CIMSS shear analysis shows Henri in a region of 10-15 kts of shear.

**NOAA / AOML / Hurricane Research Division  
Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H1**



00Z GFS area-averaged sounding (courtesy tropicaltidbits.com) forecasts ~15 kts shear at 1200 UTC



Microwave imagery indicates that a partial eyewall may be forming.



**NOAA / AOML / Hurricane Research Division  
Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

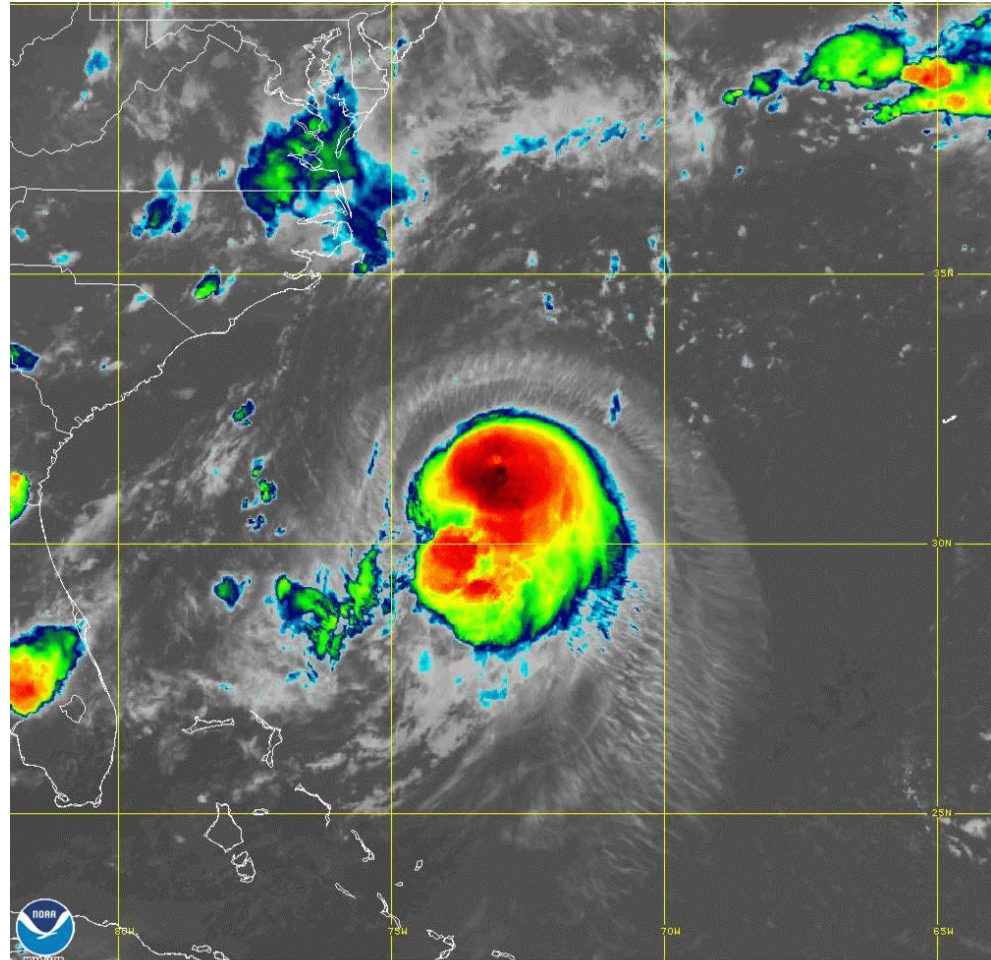
**FLIGHT LOG - 20210821H1**

	<p>AL08 HENRI at 2021-08-21 06:00:00, NRL-Monterey GCOM-W1 AMSR2 89H at 2021-08-21 06:58:37 GOES-16 ABI Infrared at 2021-08-21 07:00:20</p>
<b>Instrument Notes</b>	None

IN-FLIGHT	
Time [UTC]	Event
0757	Takeoff
0900	GOES IR shows healthy convective activity

**NOAA / AOML / Hurricane Research Division  
Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H1**



21 Aug 2021 00:40Z NOAA/NESDIS/STAR GOES-East Band 13 TS Henri

0931	Small deviation around weather on way to IP
0941	Beginning descent to IP
0943	Sim noted the presence of an eye on the MMR roughness mode about 80 n mi out and further east of forecasted center.
0953	Drop #1 (IP, combo drop, EMC sonde, ONR BT)
0956	Deviating around convection and back to 010 to the center
0959	Drop #2 (IP-center midpoint, EMC sonde)
1001	Light hunting of center

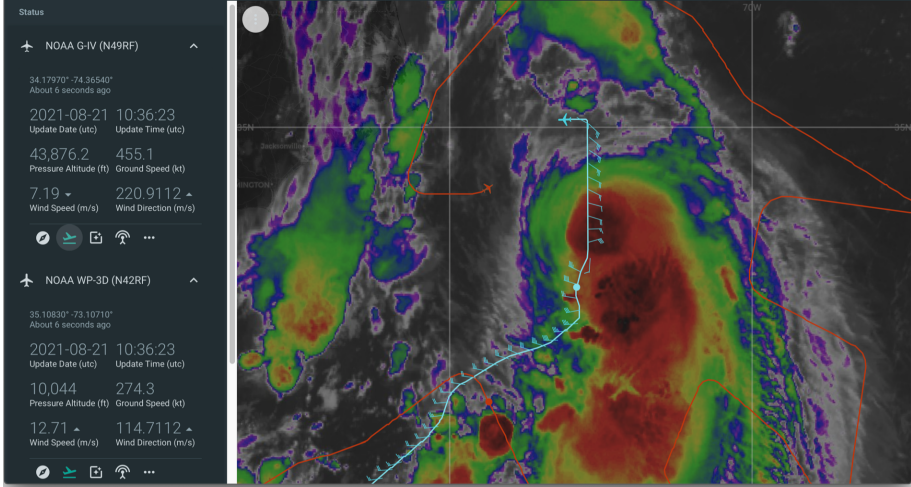
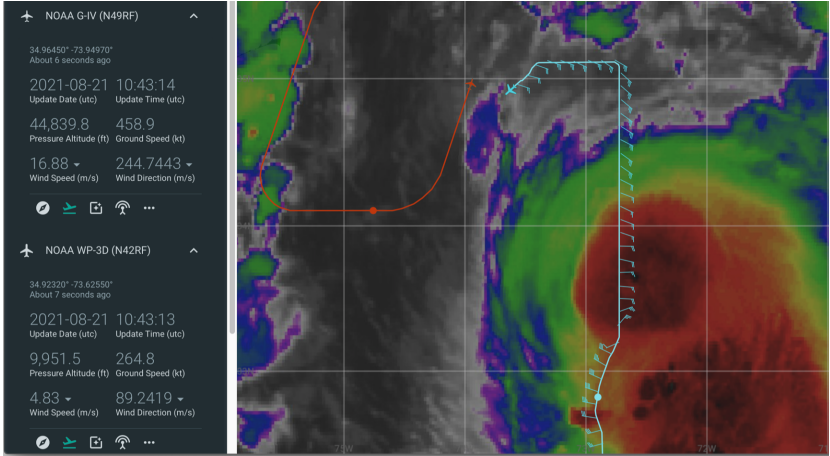
**NOAA / AOML / Hurricane Research Division  
Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H1**

1004	Sim noted that the north eyewall is much stronger than the south on radar
1006	Drop #3 (center, EMC sonde): 995.8 mb 230/31 kt
100637	Center fix: 33.26N 72.72W extrap 992mb
1011	Sim noted that it is pretty clear on the north side
1013	Drop #4 (center-pt 2 50 n mi, ONR sonde)
1019	Drop #5 (center-pt 2 midpoint, EMC sonde)
1031	Drop #6 (pt 2, combo drop, EMC sonde, ONR BT)
1031	<p>First TDR analysis shows that the center is tilted to the southeast at low levels and to the west at upper levels</p> <p>210821H1 (HENRI) 093430 to 103154 UTC Vorticity (<math>10^{-4} \text{ s}^{-1}</math>) at 2.0 km SHIPS Shear (SHDC): 11.2 kt @ 158 deg X: w&gt;6 m/s Mean Center Fix: 33.27, -72.69</p> <p>210821H1 (HENRI) 093430 to 103154 UTC Vorticity (<math>10^{-4} \text{ s}^{-1}</math>) at 5.0 km SHIPS Shear (SHDC): 11.2 kt @ 158 deg X: w&gt;6 m/s Mean Center Fix: 33.27, -72.69</p>
1036	MTS screenshot of first leg

**NOAA / AOML / Hurricane Research Division  
Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H1**

	
1043	<p>Descending to 8 kft as AF is entering the storm. Passing very close to the G-IV.</p> 
1056	Drop #7 (pt 3, combo drop, EMC sonde, ONR BT)
1108	Drop #8 (pt 3-center midpoint, EMC sonde)
1114	Drop #9 (pt 3-center 50 n mi, ONR sonde)
1122	<p>CPA to center. Hook-like feature was present on radar that would have required a sharp turn after it to get into center. Decision was made not to make that turn to keep straight and level for radar. With the small size of the center this prevented them from getting into the core, passing to its south.</p>



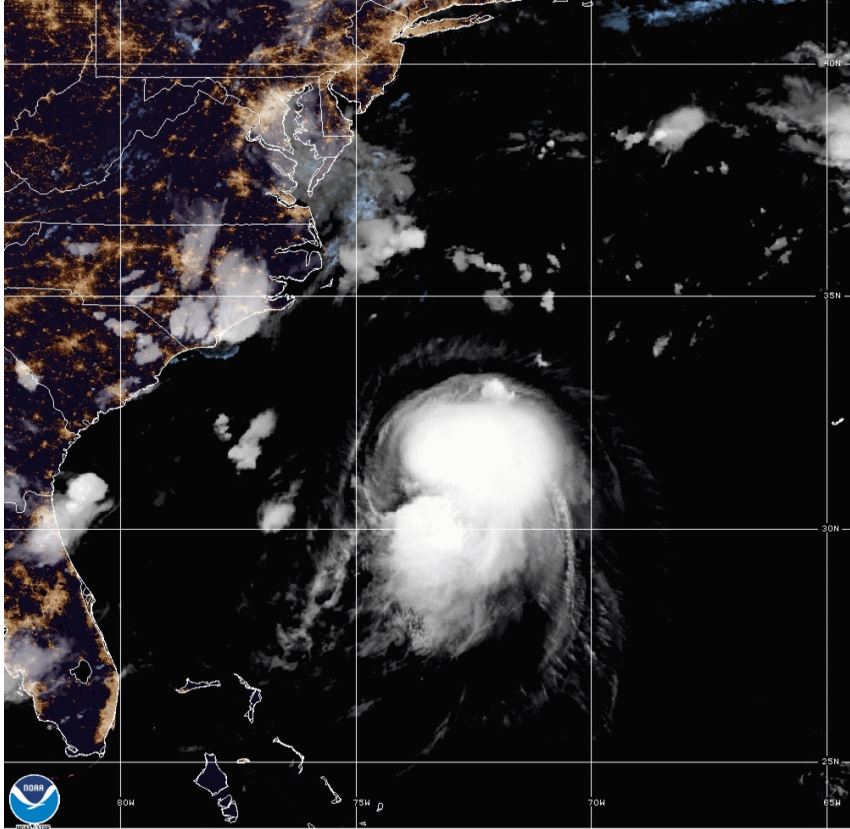
**NOAA / AOML / Hurricane Research Division  
Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H1**

1131	Drop #10 (center-pt 4 50 n mi, ONR sonde)
1137	Drop #11 (center-pt 4 midpoint, EMC sonde)
1147	Drop #12 (pt 4, combo drop, EMC sonde, ONR BT): BT had spotty data
1148	<p>Second TDR analysis shows strong outer wind field on SE side with broad area of 64+ kt winds at 0.5 km</p> <div style="display: flex; justify-content: space-around;"> <div data-bbox="446 1249 917 1711"> <p style="text-align: center;">210821H1 (HENRI) 093430 to 114818 UTC Wind Speed (kt) at 0.5 km</p> </div> <div data-bbox="933 1249 1404 1711"> <p style="text-align: center;">210821H1 (HENRI) 093430 to 114818 UTC Wind Speed (kt) at 3.0 km (~flight level)</p> </div> </div>
1149	Adjusting downwind leg slightly to get strong band to the east
1150	Sim noted an angry looking ocean below them. Lots of white caps and some foam

NOAA / AOML / Hurricane Research Division  
Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)

FLIGHT LOG - 20210821H1

1200	<p>1200 UTC NHC advisory has Henri as a 60 kt TS with 993 mb central pressure</p> <p>GOES-16 Geocolor</p>  <p>21 Aug 2021 03:40Z NOAA/NESDIS/STAR GOES-East GEOCOLOR</p>
1201	MTS screenshot of leg 2 and adjustment to downwind leg



**NOAA / AOML / Hurricane Research Division  
Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H1**

1208	Sim noted that the strongest winds may be all the way out in the outer band to their east on this downwind leg. Wind field is very broad (and stronger) on the southeast and east side of the storm as seen in TDR analysis above.
1218	Drop #13 (pt 5, combo drop, EMC sonde, ONR BT): first BT did not launch, so backup was released.
1230	Drop #14 (pt 5-center midpoint, EMC sonde)
1234	Drop #15 (pt 5-center 50 n mi, ONR sonde)
1243	Turning to 180 degree heading for light hunting, lowest wind speed 5 kt, then turn back to 225 heading
1244	Drop #16 (center, combo drop, EMC sonde, ONR BT): no data from BT; center estimate 33.73N 72.28W extrap 992mb; center drop had 993.4mb with 280/21 kt wind
1251	Drop #17 (center-pt 6 50 n mi, ONR sonde)
1254	Sim noted that they were now in the clear, but lots of scatterers above them.
1258	Drop #18 (center-pt 6 midpoint, EMC sonde)
1313	Drop #19 (pt 6, EMC sonde): attempted to launch BT again that didn't launch earlier, but no luck. Beginning gravity wave module

**NOAA / AOML / Hurricane Research Division  
Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H1**

1322	<p>Final TDR composite analysis shows a fairly well aligned lower circulation between 2 and 5 km. Convective center is quite small ~10 n mi. Strongest winds are in eastern half of the storm.</p> <div style="display: flex; justify-content: space-around;"> <div data-bbox="446 510 917 968"> <p>210821H1 (HENRI) 093430 to 132200 UTC Reflectivity (dBZ) at 2.0 km</p> <p>North-South distance (km)</p> <p>East-West distance (km)</p> <p>Mean Center Fix: 33.52, -72.48</p> </div> <div data-bbox="933 510 1421 968"> <p>210821H1 (HENRI) 093430 to 132200 UTC WS (kt) at 2.0 km; Streamlines at 2.0, 5.0 km</p> <p>2-km MaxV<sub>r</sub> (RMW): 18 m/s (22 km)</p> <p>SHIPS Shear (SHDC): 8.3 kt @ 199 deg</p> <p>X: w &gt; 6 m/s</p> <p>North-South distance (km)</p> <p>East-West distance (km)</p> <p>Mean Center Fix: 33.52, -72.48</p> </div> </div>
1332	Turning back inbound for Gravity Wave Module
1350	Heading back LAL
1352	<p>MTS screenshot showing final leg and gravity wave module</p>

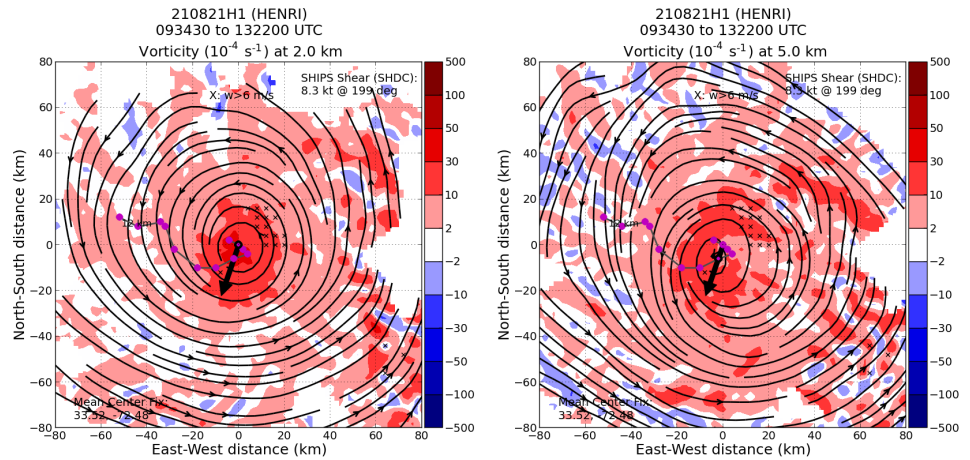
<b>POST-FLIGHT</b>	
<b>Mission</b>	The mission was successful at transmitting 3 TDR analyses to EMC for

**NOAA / AOML / Hurricane Research Division  
Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

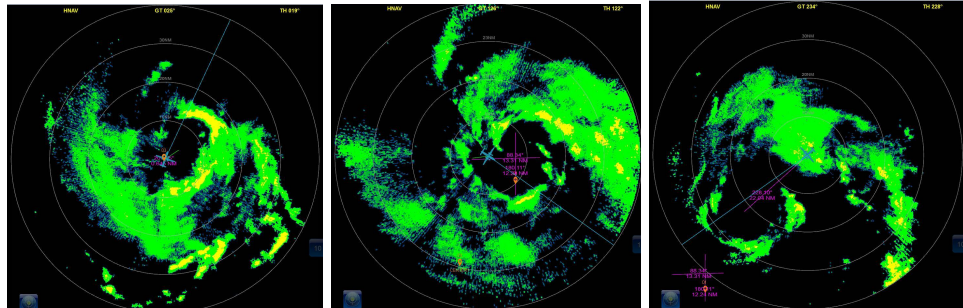
**FLIGHT LOG - 20210821H1**

**Summary**

assimilation into the 12Z HWRP model cycle. Over the course of the flight, Henri's low level circulation became slightly more stacked although the upper levels appeared to increase their tilt to the west. The westward tilt of the vortex at upper levels was unexpected given the analyzed shear directions from SHIPS and CIMSS. It is possible that there is some mid-level shear not identified by those entities that could be causing the westward tilt.



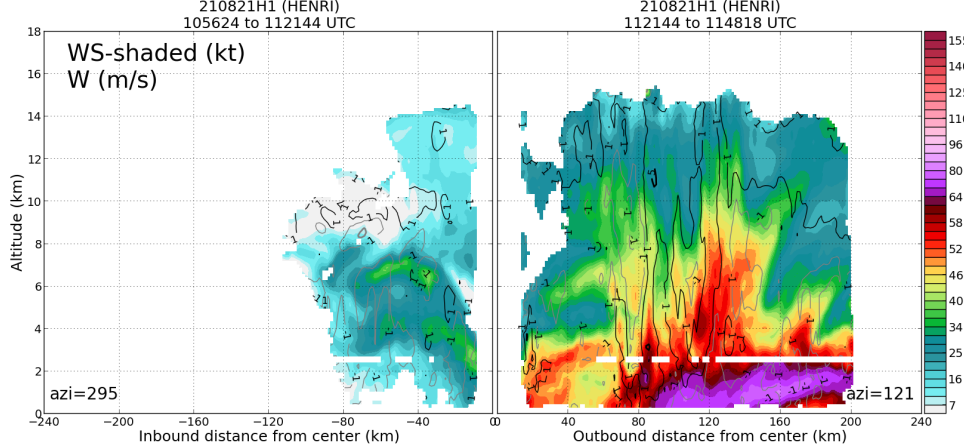
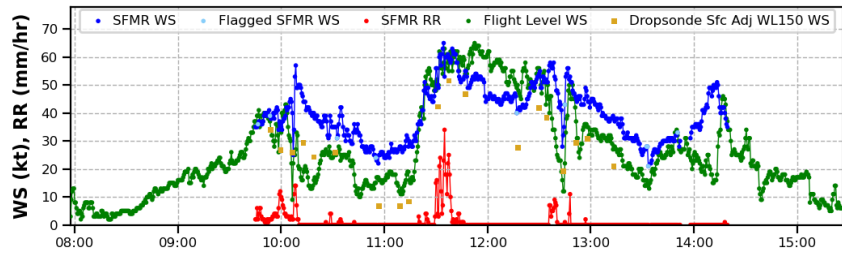
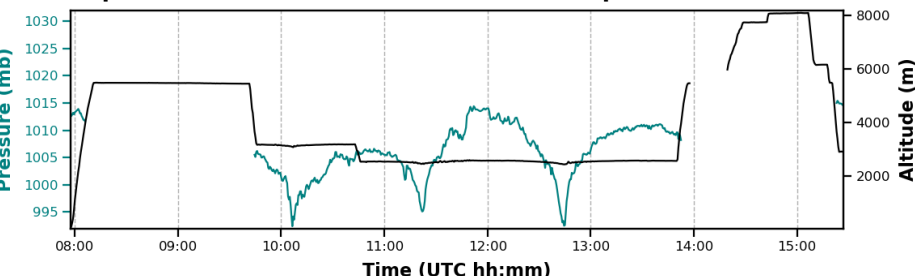
The convective structure remained fairly healthy throughout the flight with the strongest convection near the center persisting and wrapping cyclonically around as the flight progressed.



MSLP has dropped throughout the flight to 991 mb with a motion to the northeast. TDR winds at 0.5km showed a large area of 64+ kt winds; however dropsondes and SFMR did not indicate that hurricane force winds were mixing all the way down to the surface.

**NOAA / AOML / Hurricane Research Division  
Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H1**

	<div style="text-align: center;"> <p>210821H1 (HENRI) 105624 to 112144 UTC</p>  </div> <div style="text-align: center;"> <p><b>Wind Speed and Rain Rate (NOAA 20210821H1)</b></p>  </div> <div style="text-align: center;"> <p><b>Extrapolated Surface Pressure (mb) and Geopotential Altitude (m)</b></p>  </div> <p>NHC upgraded Henri to a hurricane at 1500 UTC based on Air Force observed 82 kt flight level wind at 1320 UTC. 1500 UTC NHC discussion notes "The NOAA tail Doppler radar data indicate that the storm is becoming more vertically aligned and that a more symmetric eyewall appears to be forming."</p> <p>19 sondes (14 NWS/EMC, 5 ONR); 6 AXBT (all ONR)</p>
<p><b>Actual Standard Pattern Flown</b></p>	<p>Butterfly. First pass at 10 kft. Second and third passes plus Gravity Wave Module at 8 kft.</p>

**NOAA / AOML / Hurricane Research Division  
Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H1**

<b>APHEX Experiments / Modules Flown</b>	<i>Early Stage Experiment: AIPEX and Gravity Wave Module; mission flown in collaboration with ONR TCRI</i>
<b>Plain Language Summary</b>	<ul style="list-style-type: none"> <li>● Henri has become more organized vertically overnight.</li> <li>● The strongest winds in Henri are on the southeast side with a fairly broad wind field on the eastern half of the storm.</li> <li>● Storms around the center were trying to organize into an eyewall throughout the flight.</li> </ul>
<b>Instrument Notes</b>	AXBTs launched externally; SFMR S/N 001 still appears to be ~5-10 kt higher than sondes
<b>Final Mission Track</b>	<p style="text-align: center;"><b>Flight track + Flight-level Winds: HENRI (NOAA 20210821H1)</b></p>