

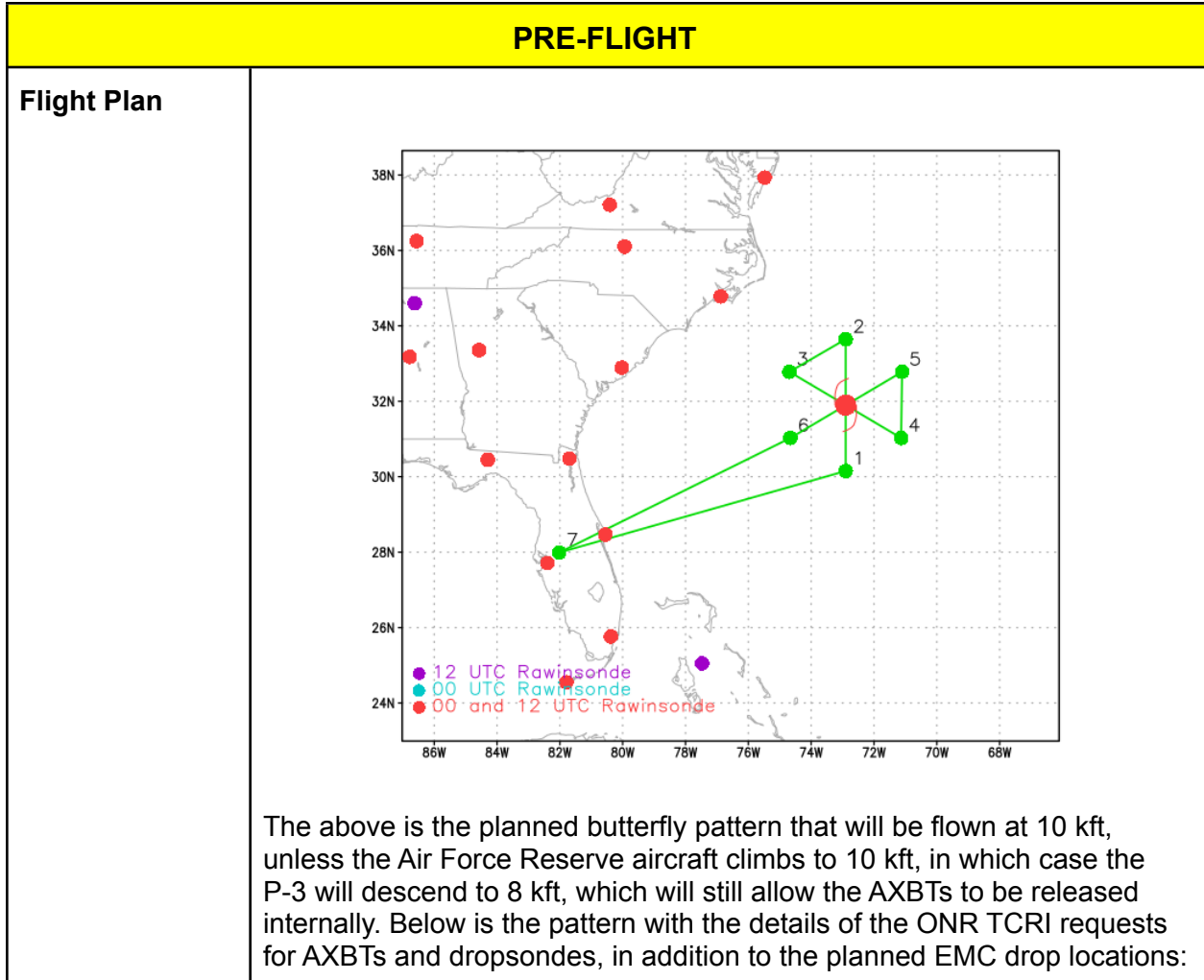
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Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG -- 20210820H1**

MISSION PLAN			
FLIGHT ID	20210820H1	STORM	AL08 / HENRI
MISSION ID	0608A	TAIL NUMBER	NOAA42
TASKING	EMC	PLANNED PATTERN	Butterfly
MISSION SUMMARY			
TAKEOFF [UTC]	2003	LANDING [UTC]	0232
TAKEOFF LOCATION	Lakeland	LANDING LOCATION	Lakeland
FLIGHT TIME	6.5	BLOCK TIME	6.8
TOTAL REAL-TIME RADAR ANALYSES (Transmitted)	3 (3)	TOTAL DROPSONDES (Good/Transmitted)	22 (20/20)
OCEAN EXPENDABLES (Type)	7 NRL AXBTs (6 good)	sUAS (Type)	None
APHEX EXPERIMENTS / MODULES	Early Stage Experiment: AIPEX; Ocean Observing Experiment: Sustained and Targeted Ocean Observations (Saildrone)		
HRD CREW MANIFEST			
LPS ONBOARD	None	LPS GROUND	Zawislak
TDR ONBOARD	None	TDR GROUND	Alvey/Gamache
ASPEN ONBOARD	None	ASPEN GROUND	Sellwood
NESDIS SCIENTISTS	None		
GUESTS (Affiliation)	None		
AOC CREW MANIFEST			
PILOTS	Mitchell, Copare, Legidakes, Doremus		
NAVIGATOR	Freeman, Hough		
FLIGHT ENGINEERS	Darby, Wysinger		
FLIGHT DIRECTOR	Carpenter		
DATA TECHNICIAN	Mascaro		
AVAPS	Underwood		

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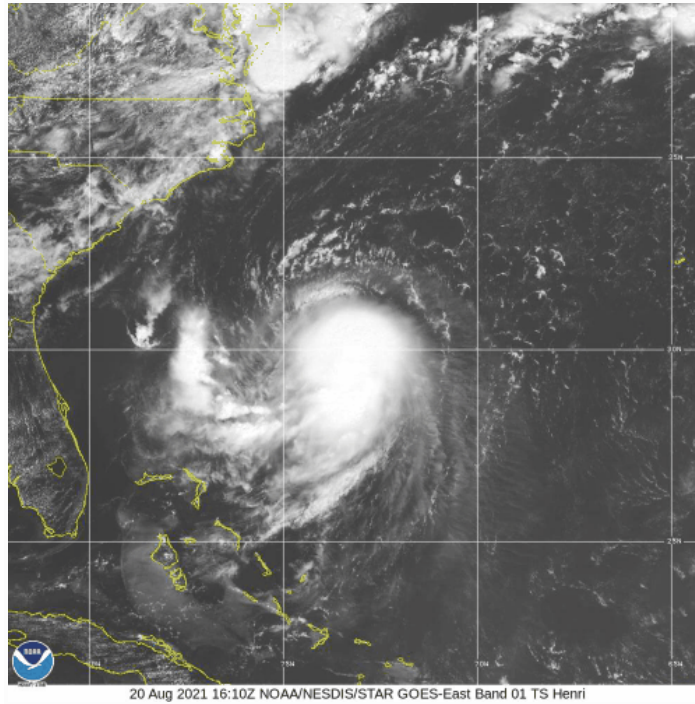
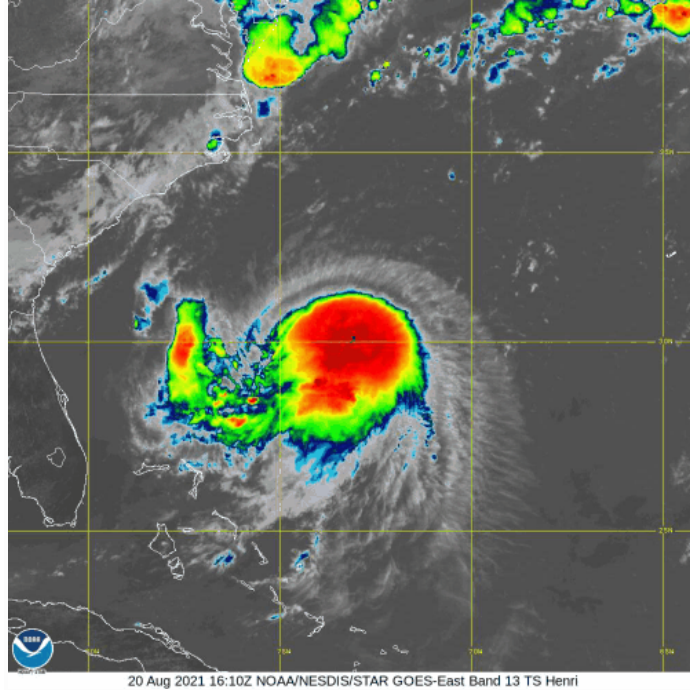
**FLIGHT LOG -- 20210820H1**

	<div style="border: 1px solid black; padding: 10px;"> <p style="text-align: center;">N42/43 flights into Henri: 20 August, 2021</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>ONR Inner drop radius: RMW or 50km</p> <p><b>GW Module 10kft, 60 nm out (maintain outbound heading) and back to pt. 6</b></p> </div> <div style="width: 45%;"> <p><b>Flight track</b></p> <ul style="list-style-type: none"> <li><span style="color: green;">●</span> Regular drop</li> <li><span style="color: blue;">●</span> Combo drop (Regular + AXBT)</li> <li><span style="color: yellow;">▲</span> Combo drop as close as possible to Sairdrone</li> <li><span style="color: green;">◐</span> Conditional Combo drop</li> </ul> <p><b>Dropsonde payload: 22</b>          6 turn point drops          6 eyewall/RMW drops          6 endpoint to center midpoint drops          3 center drops          1 drop near Sairdrone</p> <p><b>AXBT payload: 8 total AXBT planned, 1 center AXBT conditional on eye being clear/calm.</b></p> <p><b>* center drop guidance:</b> Regular drops in the center on each of the 3 center passes. On the second center pass (between turn points 3 and 4), center drop is a combo AXBT drop if eye is clear.</p> </div> </div> </div> <p>In addition to the planned pattern, ONR TCRI would like to fly, in coordination with APHEX, a Gravity Wave Module at the completion of the EMC pattern, as well as a dropsonde and AXBT combo release near the Sairdrone 1801556 located near 31.02N / 74.20W.</p>
<p><b>Expendable Distribution</b></p>	<p>EMC-planned releases will be at the endpoints (EP), midpoints (MP), and centers (CTR); ONR TCRI will supplement sondes at locations at the RMW or 50 km, which is about the “quarterpoint” (QTRPNT) of the leg, as well as one near the location of a Sairdrone near WP6. AXBTs for ONR will be released in combo with dropsondes at the endpoints, once in the center (targeting the 2nd pass), and another one with the drop coinciding with the Sairdrone.</p>

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Preflight  
Weather  
Briefing



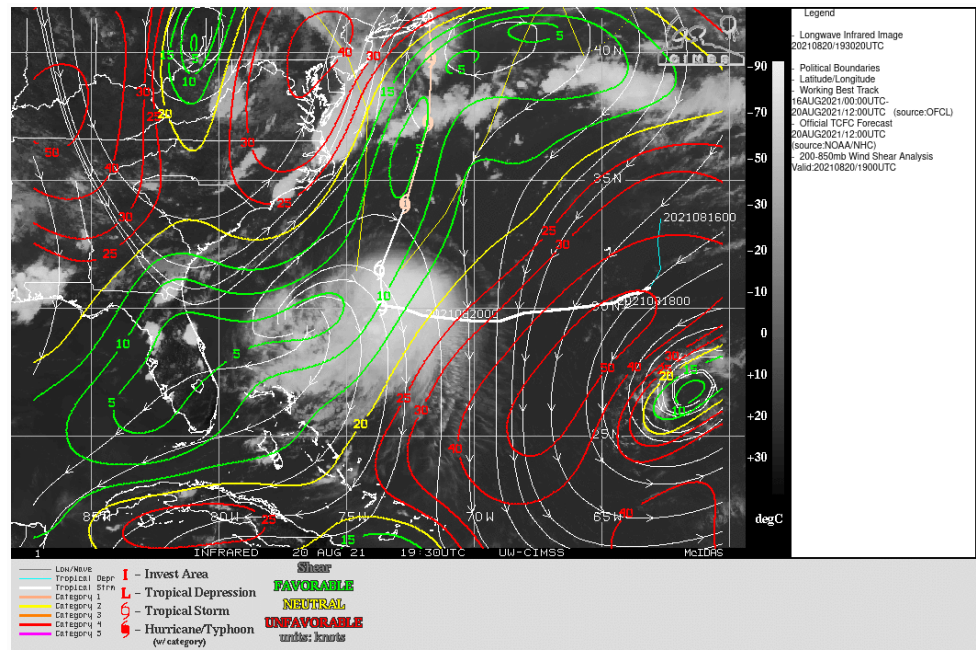
As of 2100 UTC, NHC has Tropical Storm Henri located at 31.N / 73.9W at an intensity of 994 mb, 60 kt maximum sustained winds, and moving

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north-northwest at 6 kt. The storm continues to exhibit signs of misalignment between the low-levels and midlevels as the surface circulation is somewhat displaced northward of the convective mass. Despite this misalignment, the storm has been able to remain in a steady state; although, it appears the storm may be on a strengthening trend as the last advisory increased 5 kt, with a slightly lower MSLP. This could be an indication that the storm is aligning, which also means the moderate to high deep-layer shear that it has been experiencing over the last several days may be decreasing (as has been forecast). Over the last couple of hours, the areal coverage of precipitation downshear appears to be waning, but this may simply be a product of the diurnal cycle, where later in the night, the convection may start peaking yet again.

Here is the CIMSS analysis of the deep-layer shear, showing that Henri may be moving into a lower shear environment, more favorable for intensification as it moves further north:

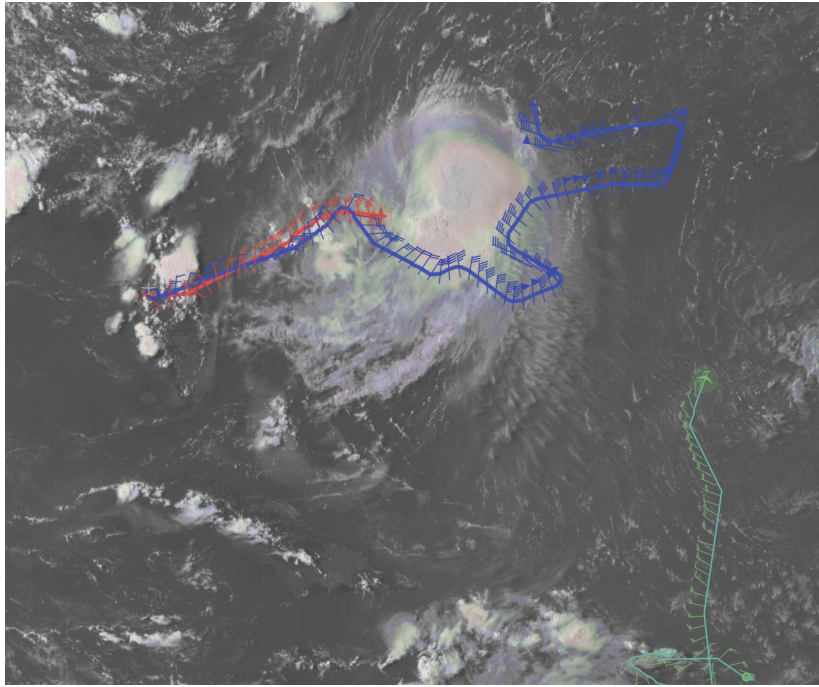


**Instrument Notes**

All instruments operating nominally, though THOR still not operational

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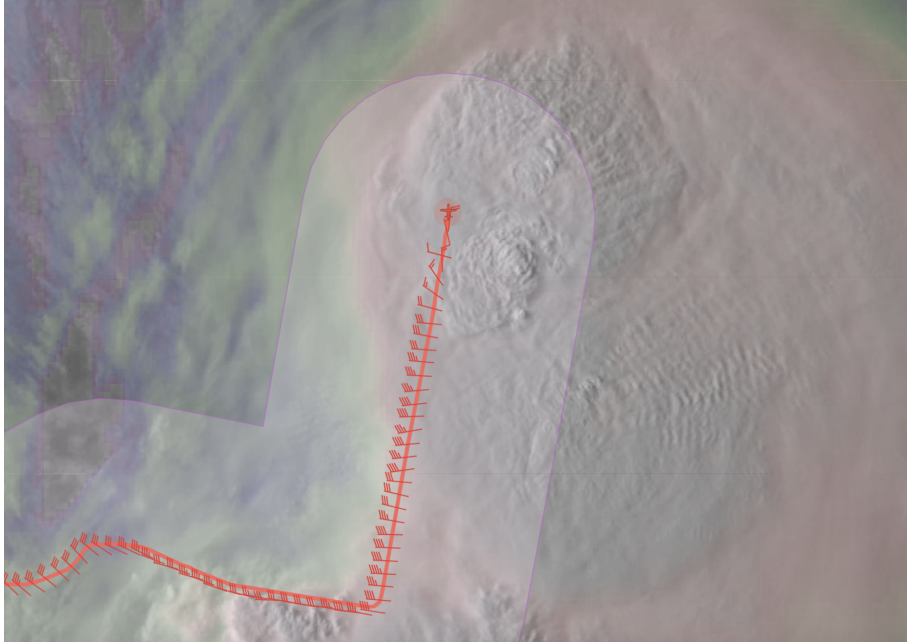
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IN-FLIGHT	
Time [UTC]	Event
2003	Takeoff from Lakeland
2119	<p>As the P-3 is approaching the S IP for the butterfly, image below shows the P-3 and G-IV flying Henri and the NASA DC-8 flight north through the SAL, soon to head west to underfly Aeolus just south of Henri on it's transit back south towards St. Croix.</p> <p>Convection continues to pulse within the precipitation shield of Henri, with the low-level/surface circulation still tucked partially underneath the anvil, but also exposed to it's north. The first pass of the P-3 will be south to north, release endpoint combo sonde/ONR AXBT, midpoint sonde, 50 km sonde ("quarterpoint") for ONR, center sonde, 50 km sonde for ONR, midpoint sonde, and final endpoint combo sonde/ONR AXBT to the north.</p> 
2127	The S Initial Point (IP) will have to be closest-point-of-approach (CPA) and shortened by about 15 miles due to the intense outerband. We'll keep the midpoint sonde where it is, even with the shortened leg. 010 azimuth inbound to keep a straighter leg.
2137	Reached the S IP; Sonde #1 (NWS 1), AXBT #1 (ONR) -- the AXBT did not



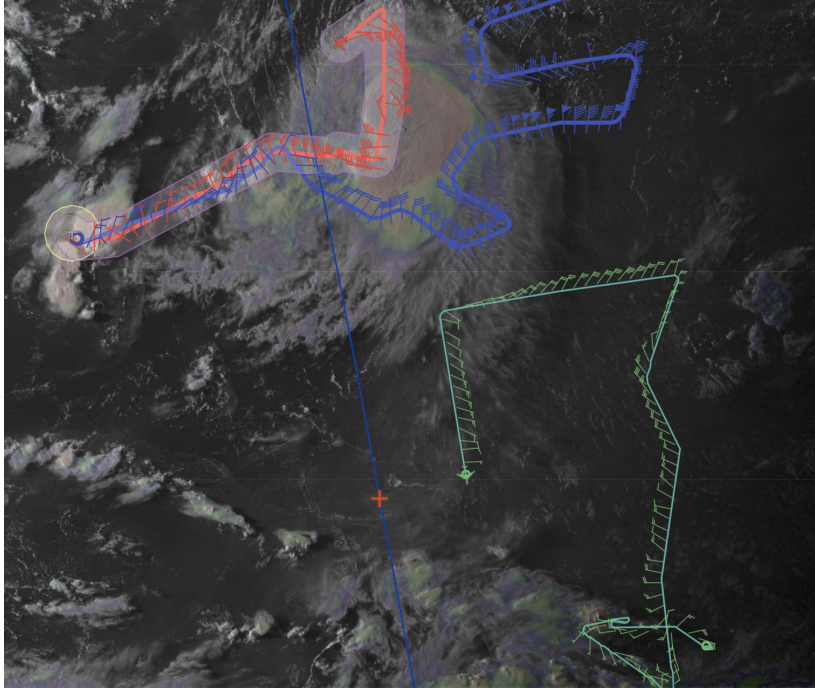
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	report data
2147	Sonde #2, inbound S, MP (NWS 2)
2153	 <p>Image from the first pass where they were able to keep the convection within TDR range and fixed a flight level center (10 kft).</p> <p>Sonde #3, Center #1, CPA (NWS 3)</p>
2209	The NHC forecast center was the target for the first pass, but because the storm is likely still very tilted, the flight level center is further south than the surface center. Therefore, the “quarterpoint” (QTRPNT) ONR 50 km drop became the center dropsonde. So there was no inbound QTRPNT drop.
2206	Sonde #4, outbound N, QTRPNT (ONR 1)
2212	Sonde #5, outbound N, MP (NWS 4)
2223	Sonde #6, outbound N, EP (NWS 5), AXBT #2 (ONR) -- BT was good 29C SST
2249	A screenshot of the DC-8 on their Aeolus underflight leg, with Aeolus passing overhead on its way to north to also pass over Henri:

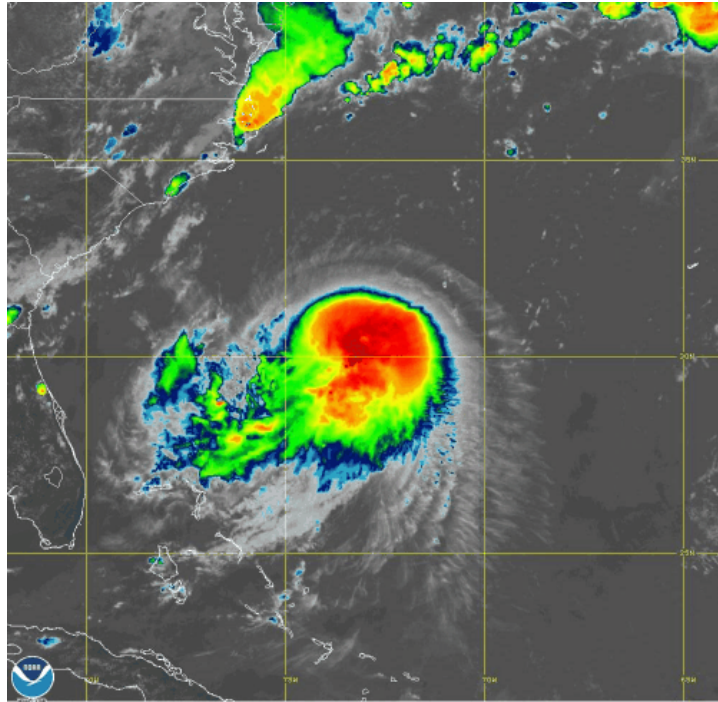
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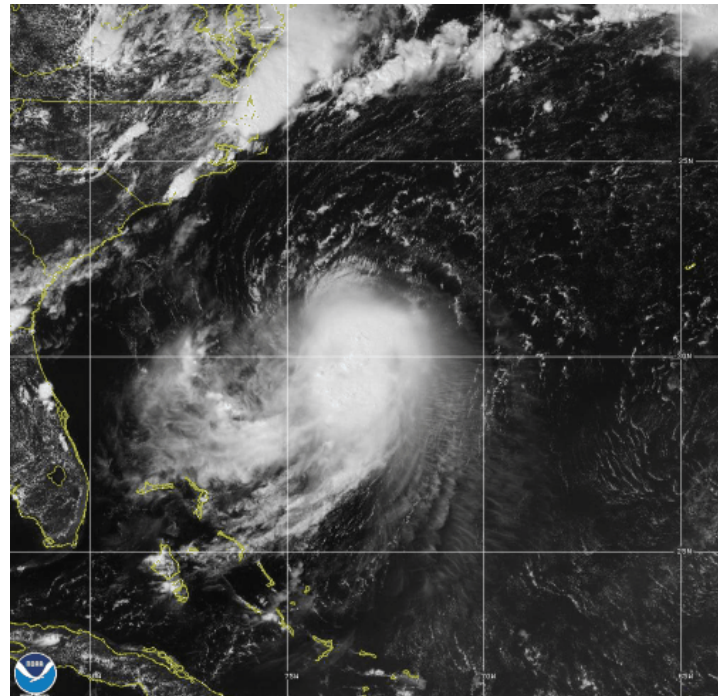
	
<p>2249</p>	<p>Sonde #7, inbound NW, IP (NWS 6), AXBT #3 (ONR)</p> <p>Now inbound to the center; same drop strategy on this pass with IP (AXBT combo), midpoint, QTRPNT (potential AXBT combo), center, QTRPNT, midpoint, endpoint (AXBT combo).</p>
<p>2302</p>	<p>A look at the most recent satellite imagery covering the first pass and now inbound for the second pass. The convection continues to grow just south of the surface center, and appears to becoming more mature and organized:</p>

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20 Aug 2021 18:30Z NOAA/NESDIS/STAR GOES-East Band 13 TS Henri



20 Aug 2021 18:50Z NOAA/NESDIS/STAR GOES-East Band 02 TS Henri

2302

Sonde #8, inbound NW, MP (NWS 7)

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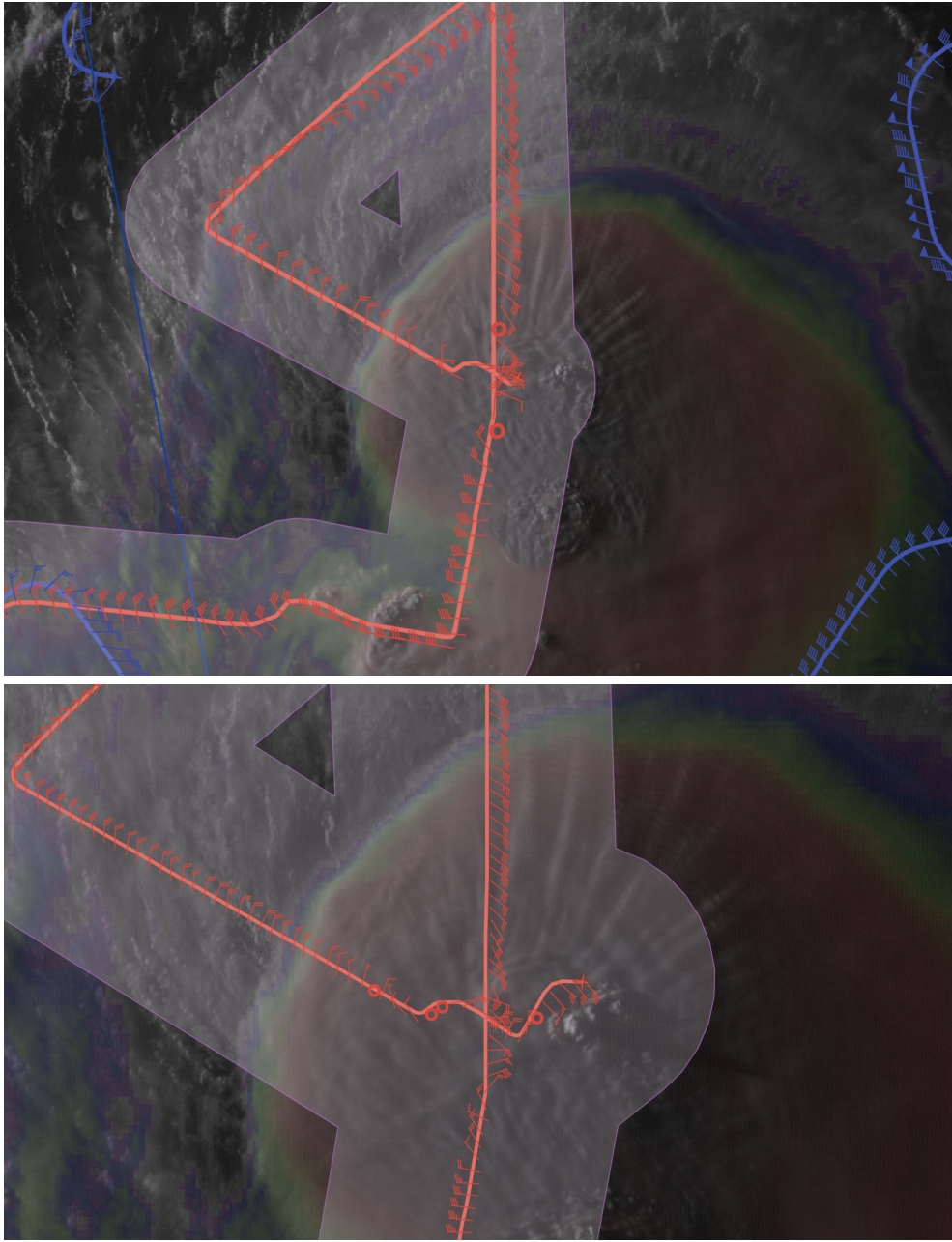
**FLIGHT LOG -- 20210820H1**

<p>2307</p>	<p>A look at the TDR analyses from the first pass that gives a sense of the displacement of the low (1 km) and midlevel (5 km) circulations At 1 km...</p> <div style="display: flex; justify-content: space-around;"> <div data-bbox="446 472 917 934"> <p style="text-align: center;">210820H1 (HENRI) 213700 to 222400 UTC Reflectivity (dBZ) at 1.0 km</p> <p style="text-align: center;">Center Fix: 30.95, -73.53</p> </div> <div data-bbox="933 472 1404 934"> <p style="text-align: center;">210820H1 (HENRI) 213700 to 222400 UTC Wind Speed (kt) at 1.0 km</p> </div> </div> <p>At 5 km...</p> <div style="display: flex; justify-content: space-around;"> <div data-bbox="446 976 917 1438"> <p style="text-align: center;">210820H1 (HENRI) 213700 to 222400 UTC Reflectivity (dBZ) at 5.0 km</p> <p style="text-align: center;">Center Fix: 30.95, -73.53</p> </div> <div data-bbox="933 976 1404 1438"> <p style="text-align: center;">210820H1 (HENRI) 213700 to 222400 UTC Wind Speed (kt) at 5.0 km</p> </div> </div>
<p>2310</p>	<p>Unable to release the QTRPNT inbound NW sonde for ONR because of the proximity of the Teal C-130.</p>
<p>2312</p>	<p>Sonde #9, Center #2, CPA (NWS 8)</p>
<p>2322</p>	<p>Convection is pretty vigorous now and avoidance maneuvers are required to not go through the convection just east of where they marked the center. Tracking 045 degrees to get around it initially, and will find a soft spot to head east, and then southeast to get back on the outbound track.</p>



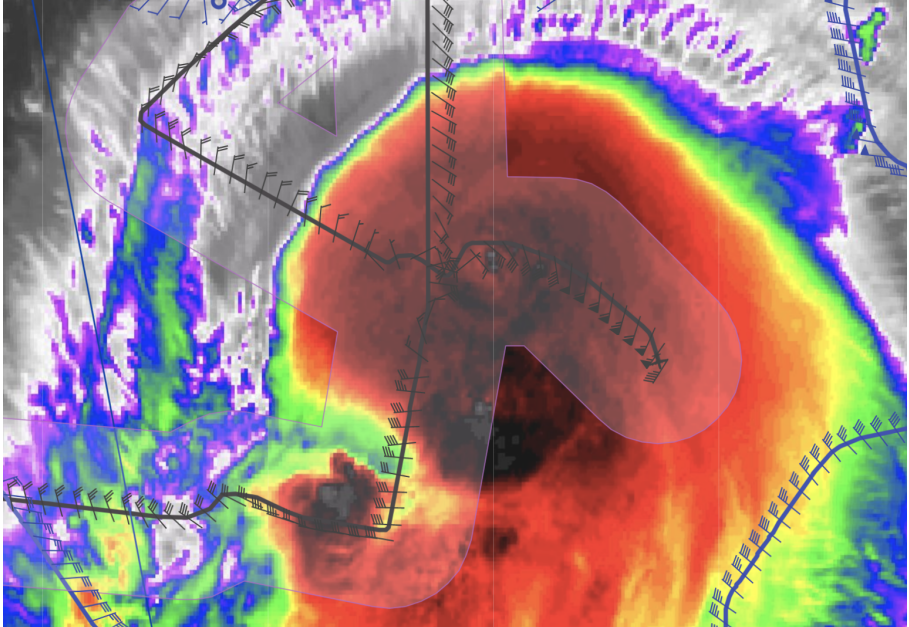
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2326 2327	Sonde #10, outbound SE, QTRPNT (ONR 2)...had late winds Sonde #11, outbound SE, QTRPNT (ONR 3)...back up for Sonde 11
2333	Sonde #12, outbound SE, MP (NWS 9)

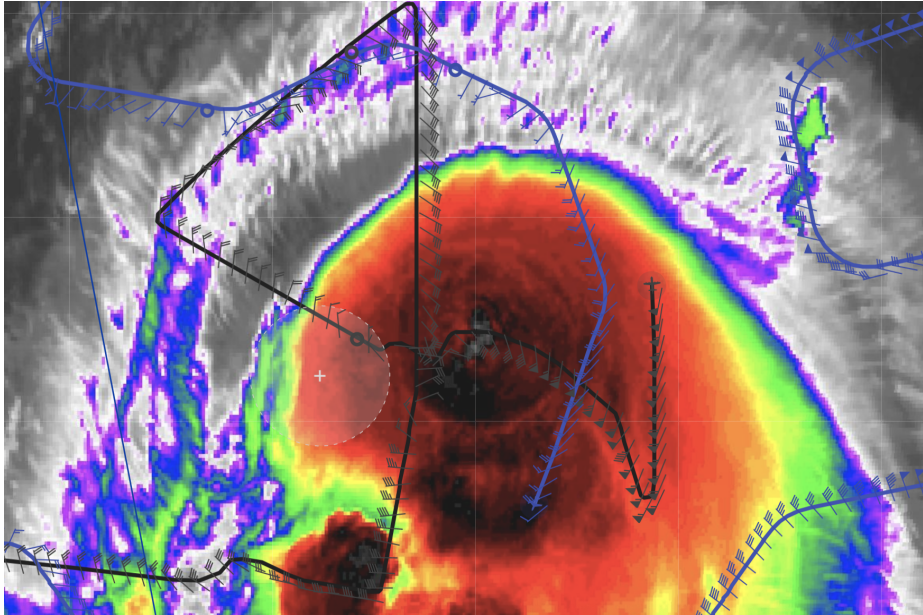
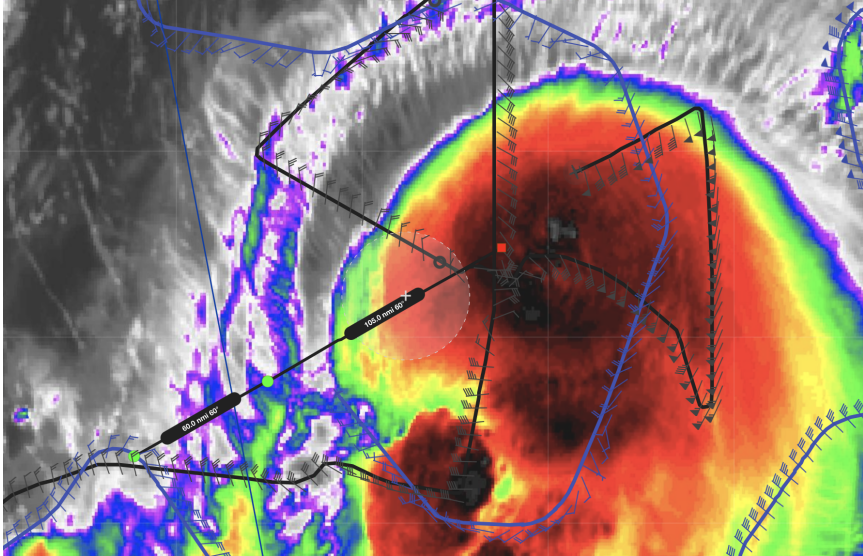
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<p>2340</p>	<p>On their outbound to the SE, they've been trying to keep the rain within range of the TDR, so after their deviation near the center, they've been working back to the original SE outbound track.</p> 
<p>2346</p>	<p>Sonde #13, outbound SE, endpoint (NWS 10), AXBT #4 (ONR) -- BT good as it had 25C SST (cold wake? That SST seems low...)</p>
<p>2356</p>	<p>Saildrone 1801556 is located near 31.02N / 74.20W...looks like the outbound leg will pass pretty close to it</p>

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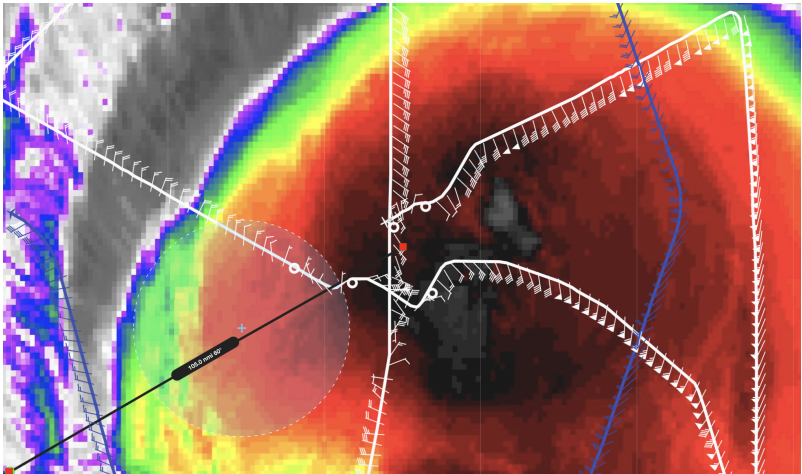
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0002	 <p>Screenshot of the G-IV now on their inner circumnavigation around the main convective center. The P-3 is now on its downwind leg to the final pass from NE to SW.</p>
0009	Sonde #14, inbound NE, IP (NWS 11), AXBT #5 (ONR) -- BT good, 28C SST
0024	



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	Still looking good and on track to pass very close to the Saildrone, indicated with the white + above. The measurement tool shows the endpoint and the potential 60 n mi gravity wave leg.
0034	 <p>Third fix of the center; on track to CPA quite close to the Saildrone</p>
0024 0025	Sonde #15, inbound NE, MP (NWS 12), no winds Sonde #16, inbound NE, MP 2, backup (NWS 13)
0031	Sonde #17, inbound NE, QTRPNT (ONR 4)
0032	Sonde #18, Center #3, CPA (NWS 14)
0045	Sonde #19, outbound SW, QTRPNT (ONR 5)
0054	Sonde #20, outbound SW, Saildrone CPA (ONR 6), AXBT #6 -- BT good, 28C SST --- sonde splash was 31.17, 74.21 -- so about 10 n mi from the Saildrone
0106	So the Saildrone was within 5 n mi of the outbound track initially, but they had to return to the point to do the sonde/AXBT release. They circled back and released the sonde and AXBT combo for ONR within 10 mi of the Saildrone.

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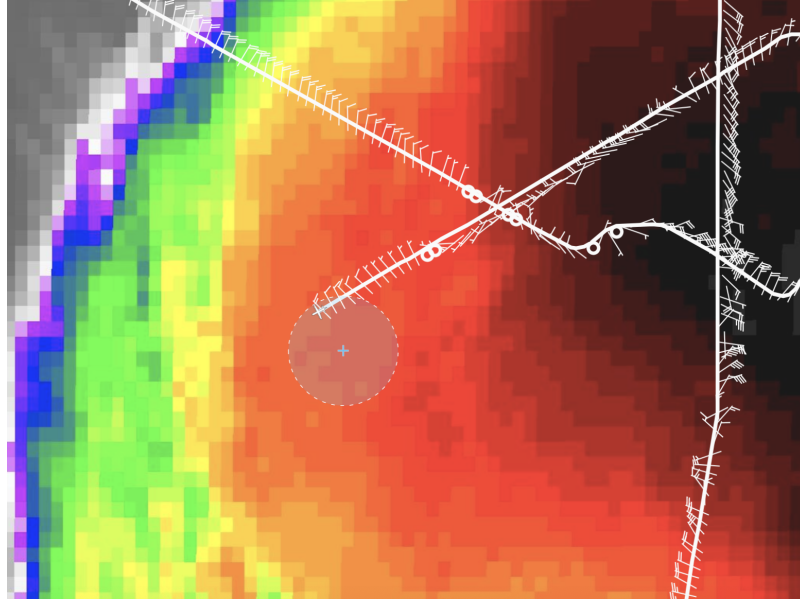
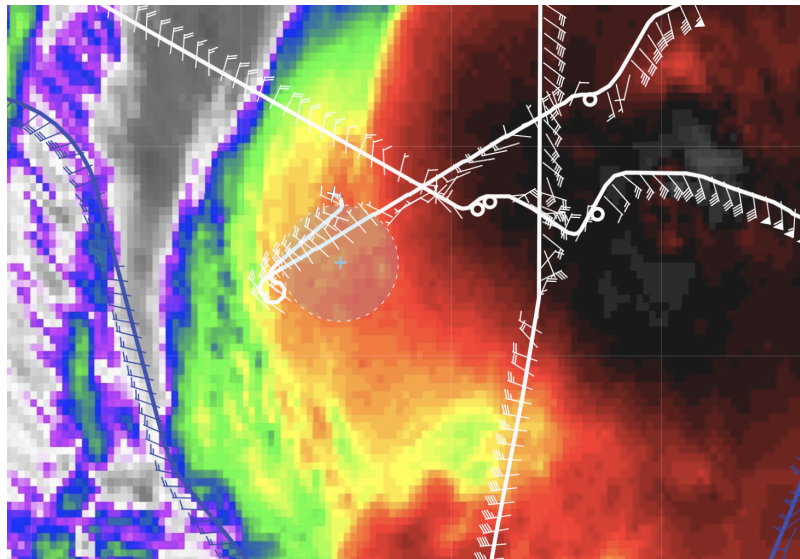


Image above: initially came within 5 n mi (range rings) of the Saildrone  
 Image below: when they turned around to CPA it again (range ring is 10 nmi)



Sonde splash was 31.17N, 74.21W -- so about 10 n mi from the Saildrone

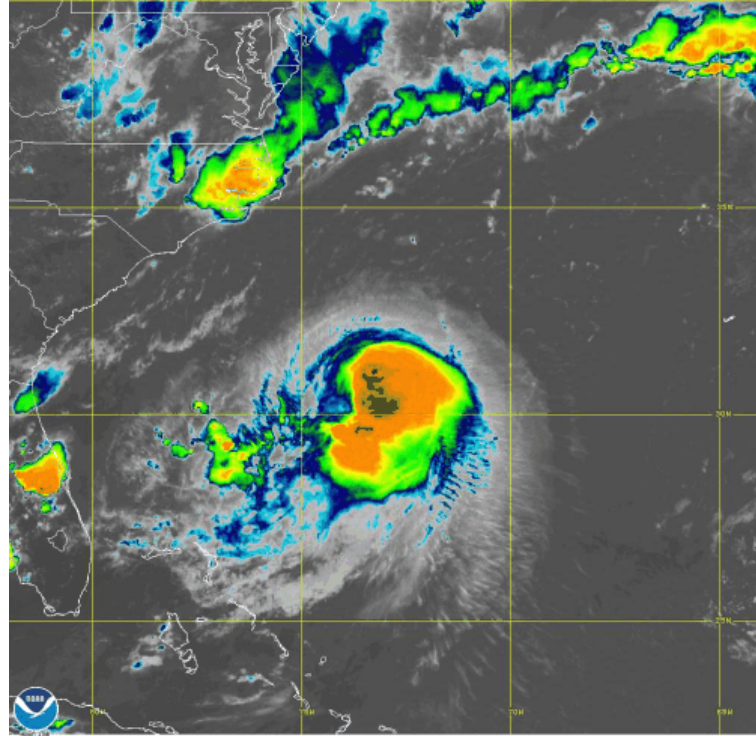
0103	Sonde #21, outbound SW, MP (NWS 15)
0115	Sonde #22, outbound SW, endpoint (NWS 16), AXBT #7 -- BT good, 29.1C SST.

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0115

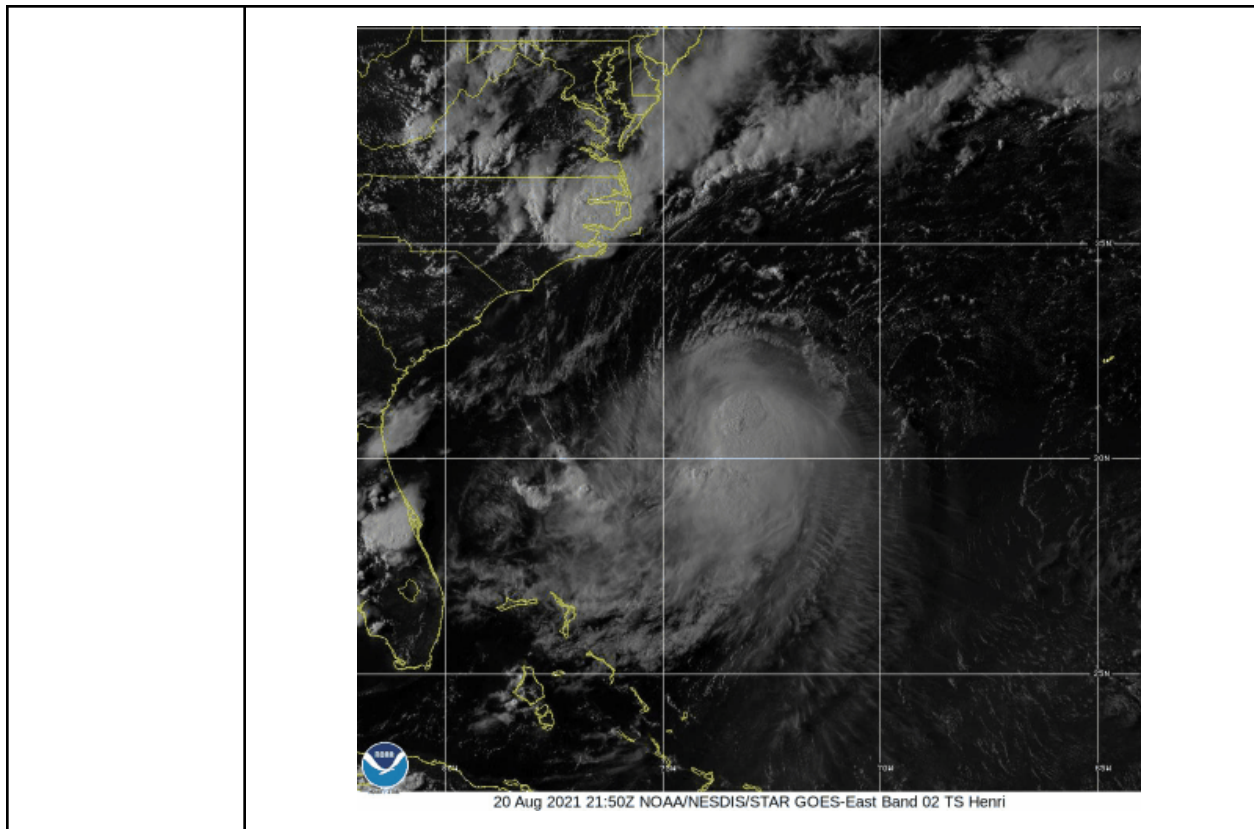
Science complete, returning to Lakeland. The final satellite loops, encompassing the mission:



20 Aug 2021 21:30Z NOAA/NESDIS/STAR GOES-East Band 13 TS Henri

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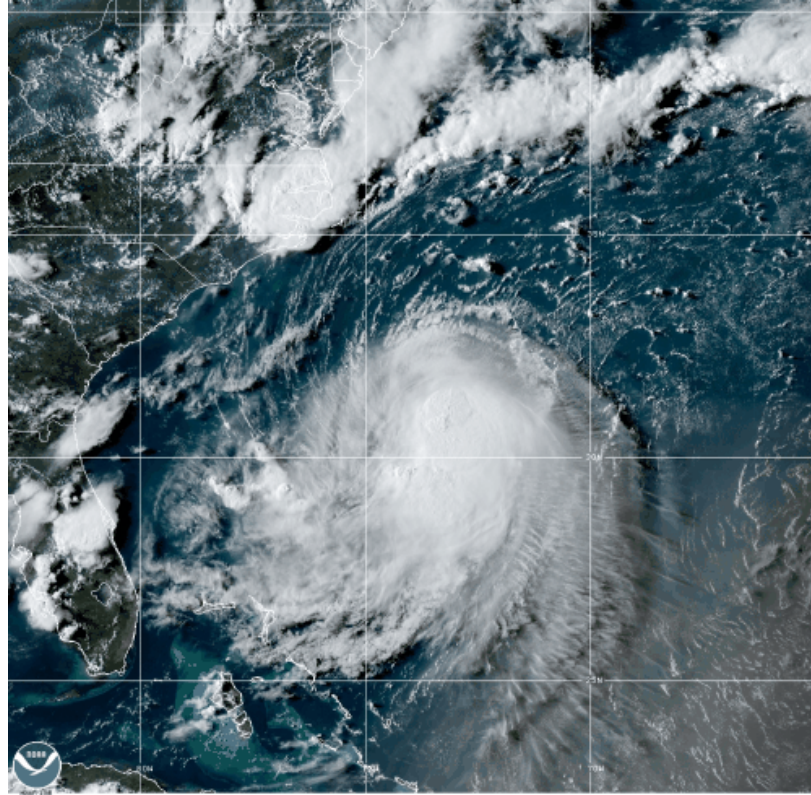
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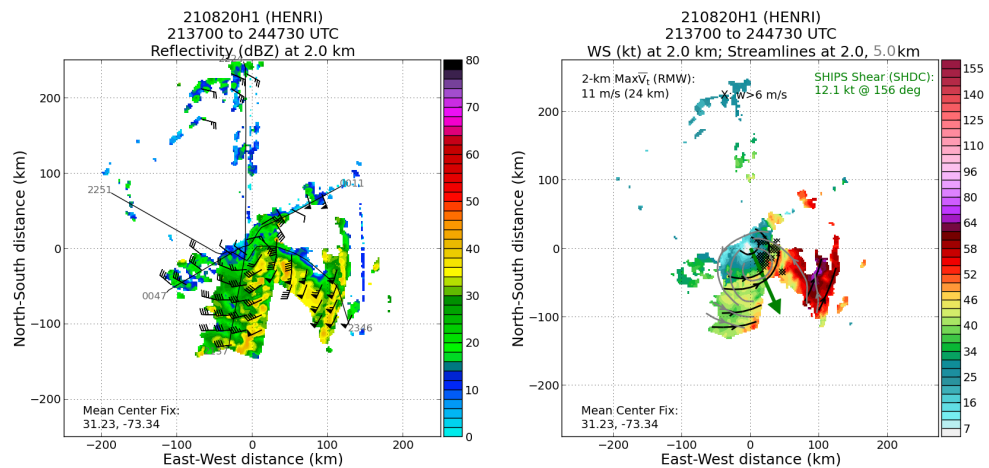
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20 Aug 2021 21:50Z NOAA/NESDIS/STAR GOES-East GEOCOLOR

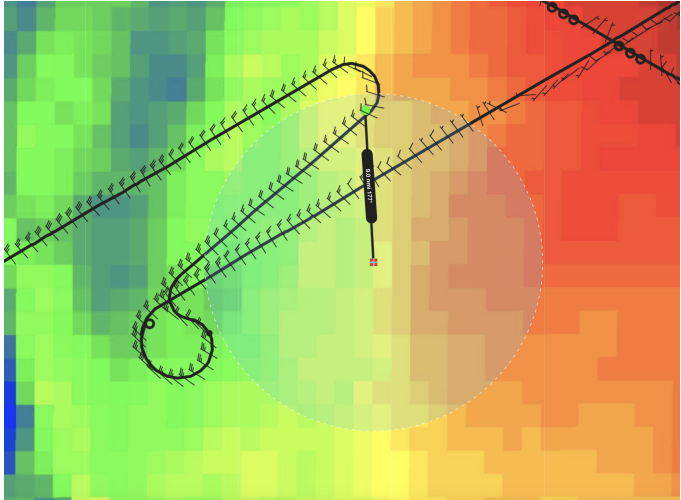
The final TDR composites showing the still tilted (to the south with height) circulation structure in Henri. But it does seem possible that there could be some alignment processes occurring, and perhaps the start of the expected intensification.





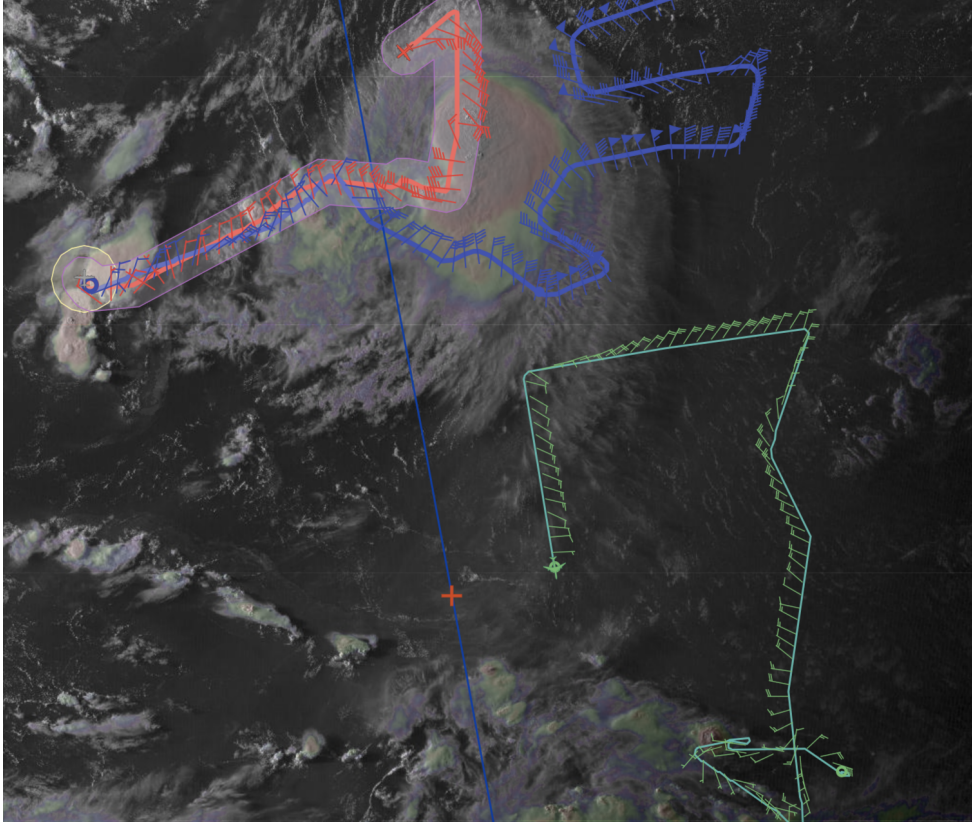
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POST-FLIGHT	
<b>Mission Summary</b>	<p>Overall, a successful butterfly pattern was flown into Henri, despite some tough navigation around the storm environment due to turbulence from the growing and maturing convection seen in the main precipitation area of the storm. The TDR analyses indicated that the storm is still tilted with height towards the south, as it has been for several days. Having said that, it's possible the storm is still trying to come into alignment, and flight level winds were nearly 70 kt on the east side. With an expectation of a reduction in shear, it's possible this flight sampled the early stages of an intensification period -- but the circulation still has to come into alignment.</p> <p>While it was decided that the gravity wave module would not be flown, the planned release by ONR of a dropsonde and AXBT near a Saildrone just southwest of the center was successful (see below). In addition, the Aeolus satellite passed over the storm, and this satellite overpass was the very same one that the NASA DC-8 (CPEX-AW mission) flew a dedicated underflight leg for further south of the storm in the Saharan Air Layer (see below).</p> <p>22 dropsondes released (20 good) -- 16 NWS, 6 ONR; 7 ONR AXBTs (6 of them good).</p> <p>Released an ONR dropsonde and AXBT within 10 n mi of the Saildrone position (to its north)</p> <p>Final screenshot for the Saildrone release of dropsonde and AXBT:</p> 

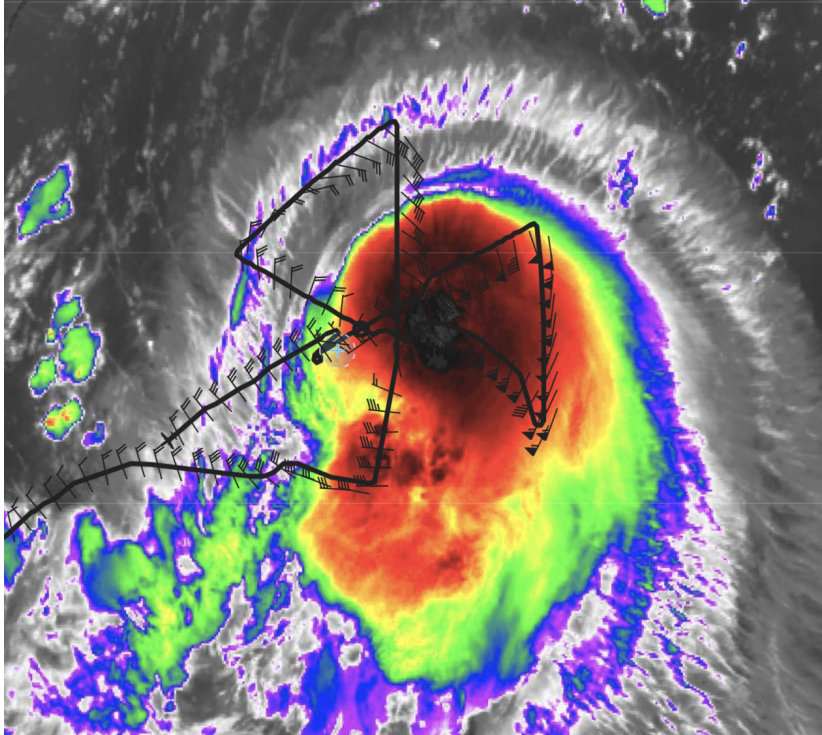
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	<p>Final Screenshot of Aeolus passing in the vicinity of the storm with the 3 aircraft (P-3, G-IV, and NASA DC-8) flying at the time of passage. The DC-8 was flying a dedicated Aeolus validation module as part of the NASA CPEX-AW field campaign:</p> 
<p><b>Actual Standard Pattern Flown</b></p>	<p>Butterfly, 105 nmi legs at 10 kft</p>
<p><b>APHEX Experiments / Modules Flown</b></p>	<p>This data collection meets the needs of the <i>Early Stage Experiment: AIPEX</i>. Coincident observations were taken near a Saildrone as part of the <i>Ocean Observing Experiment: Sustained and Targeted Ocean Observations</i>. This flight was also collaborative with <i>ONR TCRI</i>.</p>
<p><b>Plain Language Summary</b></p>	<ul style="list-style-type: none"> <li>• The NOAA P-3 flew a mission in support of data collection for NOAA's Environmental Modeling Center, sampling potentially intensifying Tropical Storm Henri</li> <li>• Tropical Storm Henri, as it has over the past several days, was observed to still have a circulation that tilts southward with</li> </ul>

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	<p>increasing altitude, which must be reduced for the storm to be more favorable for intensification</p> <ul style="list-style-type: none"><li>• A dropsonde (measures the profile of winds, humidity, and temperature as it falls the surface) and an AXBT (an instrument platform deployed from the airplane that measures the ocean temperature and salinity as it sinks below the ocean surface) were released within 10 miles of a Saildrone, which was located just southwest of the storm center.</li></ul>
<b>Instrument Notes</b>	All instruments operated nominally; THOR was non-operational.
<b>Final Mission Track</b>	

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