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

FLIGHT LOG - 20210906I1

MISSION PLAN			
FLIGHT ID	20210906I1	**STORM**	AL12 / LARRY
MISSION ID	WB12A	**TAIL NUMBER**	NOAA43
TASKING	HRD	**PLANNED PATTERN**	Butterfly
MISSION SUMMARY			
TAKEOFF [UTC]	1447	**LANDING [UTC]**	2330
TAKEOFF LOCATION	St. Croix	**LANDING LOCATION**	St. Croix
FLIGHT TIME	8.7	**BLOCK TIME**	8.9
TOTAL REAL-TIME RADAR ANALYSES (Transmitted)	3 (3)	**TOTAL DROPSONDES (Good/Transmitted)**	21 (20/20)
OCEAN EXPENDABLES (Type)	8 ONR AXBT, 2 AOML/PhOD ALAMO	**sUAS (Type)**	None
APHEX EXPERIMENTS / MODULES	Mature Stage Experiment: Eye-eyewall Mixing; Ocean Observing: Sustained and Targeted Ocean Observations		
HRD CREW MANIFEST			
LPS ONBOARD	Holbach	**LPS GROUND**	Wadler
TDR ONBOARD	Holbach	**TDR GROUND**	Gamache
ASPEN ONBOARD	Hazelton	**ASPEN GROUND**	None
NESDIS SCIENTISTS	Chang, Jelenak, Sapp		
GUESTS (Affiliation)	None		
AOC CREW MANIFEST			
PILOTS	Didier, Copare, Stateler		
NAVIGATOR	Hough, Richards		
FLIGHT ENGINEERS	Darby, Bennet		
FLIGHT DIRECTOR	Holmes		
DATA TECHNICIAN	Mascaro		
AVAPS	Warnecke		

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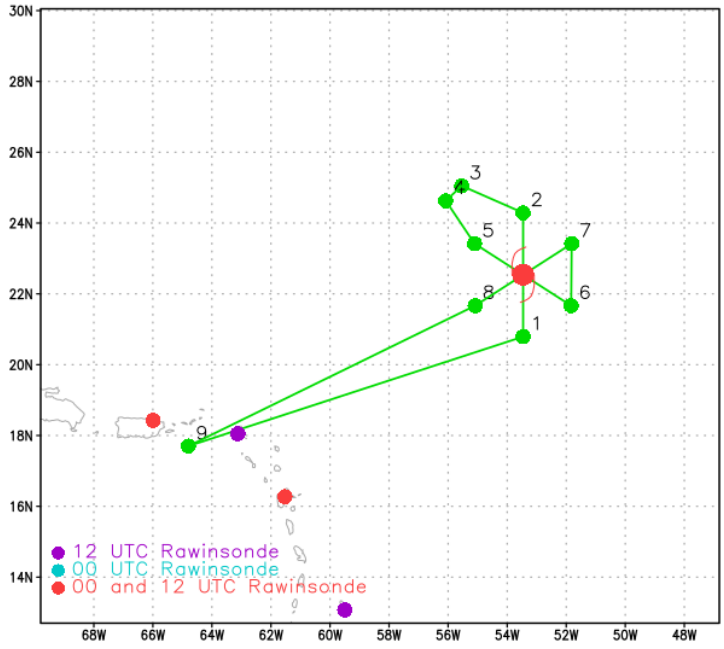
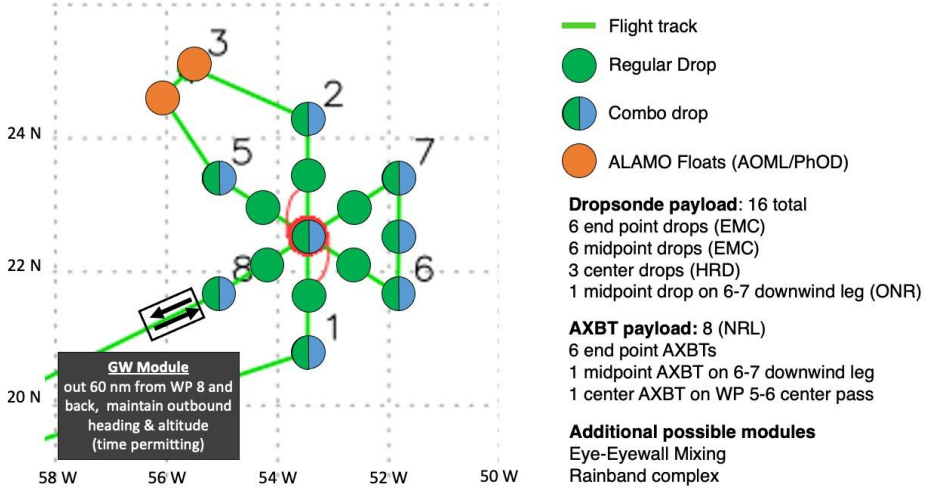
PRE-FLIGHT

Flight Plan



N43 flight into Larry: 6 September, 2021 (1500 UTC takeoff)

Tasking: HRD



Dropsonde payload: 16 total
6 end point drops (EMC)
6 midpoint drops (EMC)
3 center drops (HRD)
1 midpoint drop on 6-7 downwind leg (ONR)

AXBT payload: 8 (NRL)
6 end point AXBTs
1 midpoint AXBT on 6-7 downwind leg
1 center AXBT on WP 5-6 center pass

Additional possible modules
Eye-Eyewall Mixing
Rainband complex

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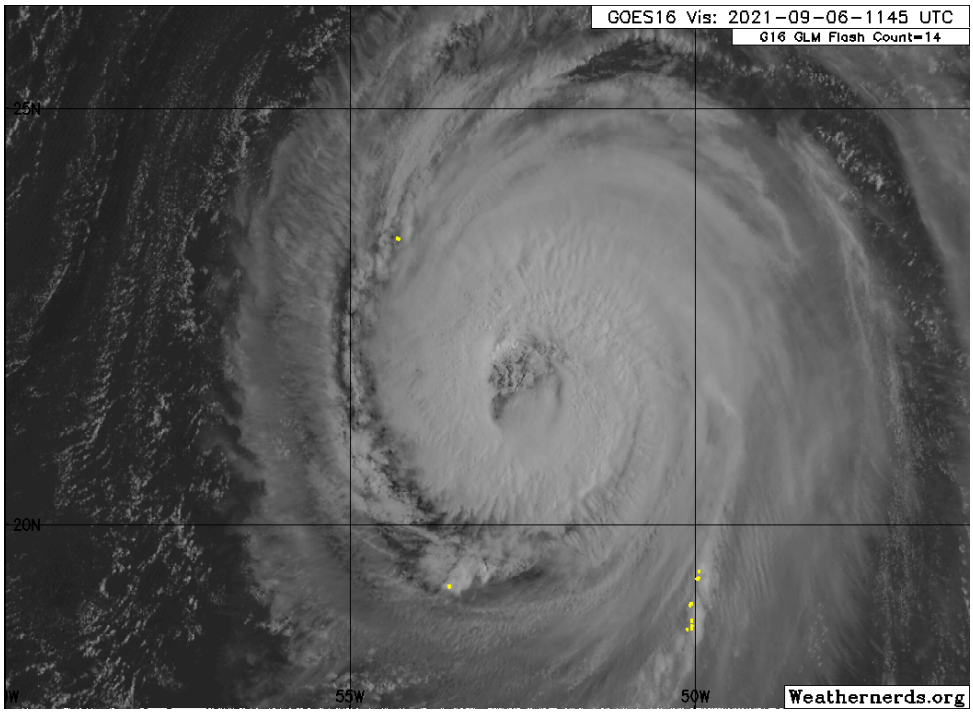
	Plan is to target the Eye-eyewall Mixing Module for either the second or third pass, if time allows. Plan would be to fly upwind around the eye to get more radar scans since we would be flying a little slower
Expendable Distribution	Flight plan described in previous section. In addition, fixes each pass and NHC also requested RMW sondes in the NE and NW.
Preflight Weather Briefing	From NHC discussion: *"Larry currently has an annular structure, with a 60 n-mi diameter eye and a relatively thick eyewall. High-resolution visible imagery shows several meso-vortices rotating within the eye, which is typically observed in strong hurricanes. The upper-level outflow has become better defined over the western portion of the circulation, indicative of decreased shear in comparison to yesterday. The advisory intensity is kept at 105 kt, in reasonable agreement with the latest Dvorak estimates from TAFB and SAB."* *Current satellite imagery:* 

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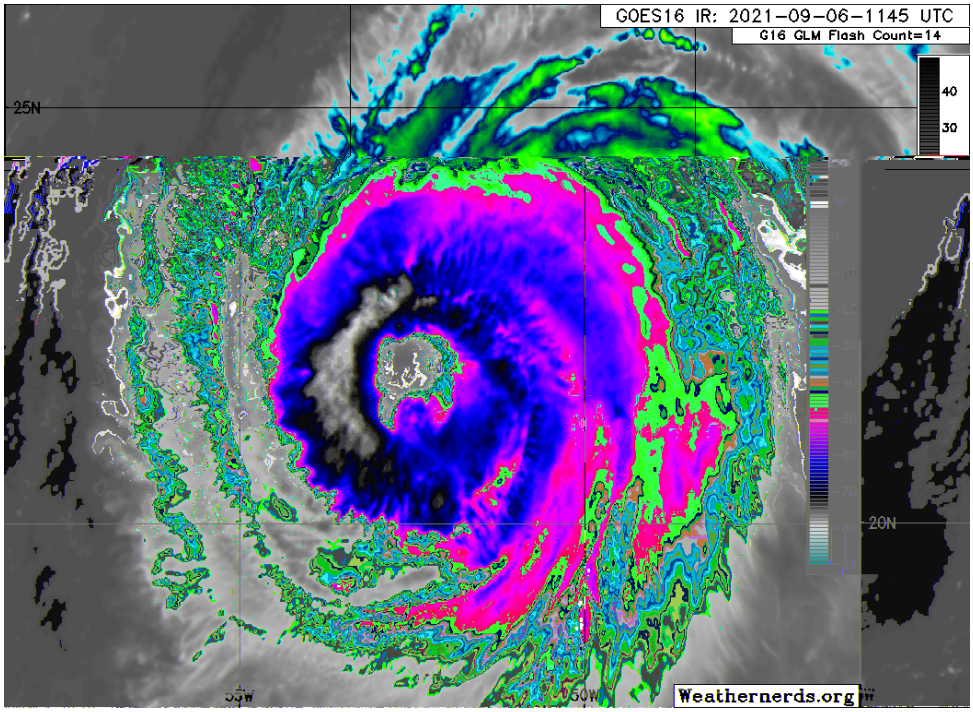

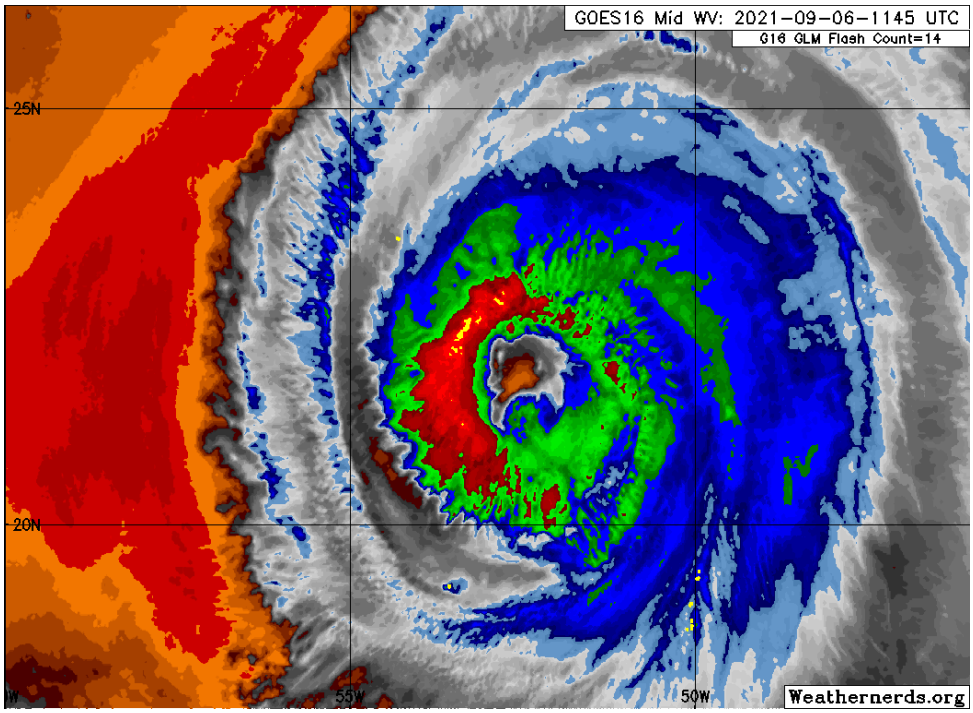

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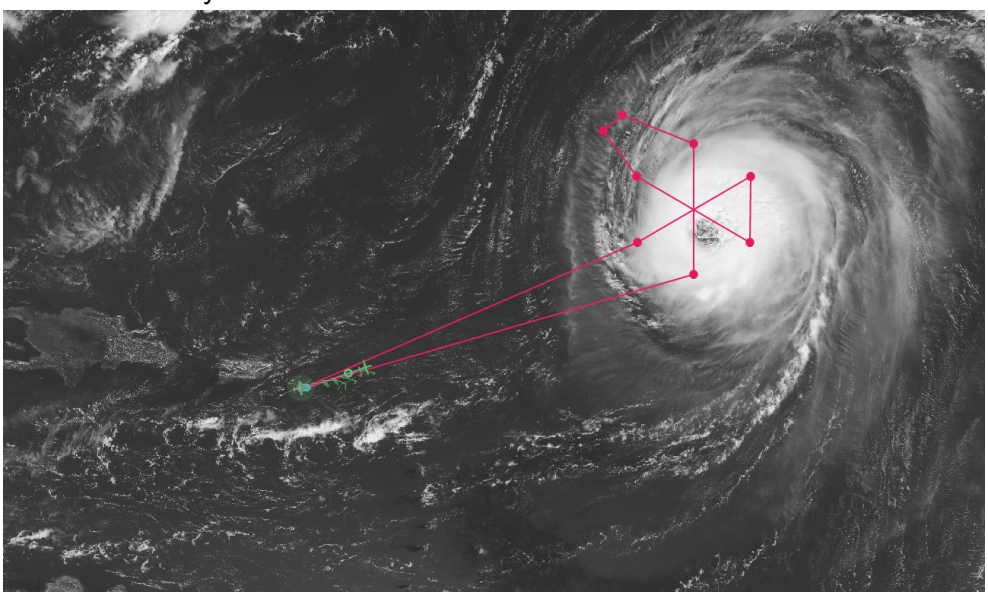
Instrument Notes	*[Notes about instrument status prior to the mission]*

IN-FLIGHT	
Time [UTC]	**Event**
1448	Takeoff from St. Croix
1513	En route to Larry… 
1618	Data comms issues. Everyone on N43 logged off of x-chat. Also, no flight-level wind data showing up in MTS
1630	Comms is back. Heather reported that they can see some pretty decent swells propagating towards us (outward from Larry)
1644	Crew reported that they can see the curvature in the outer banding as we're approaching the outer edge of Larry

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	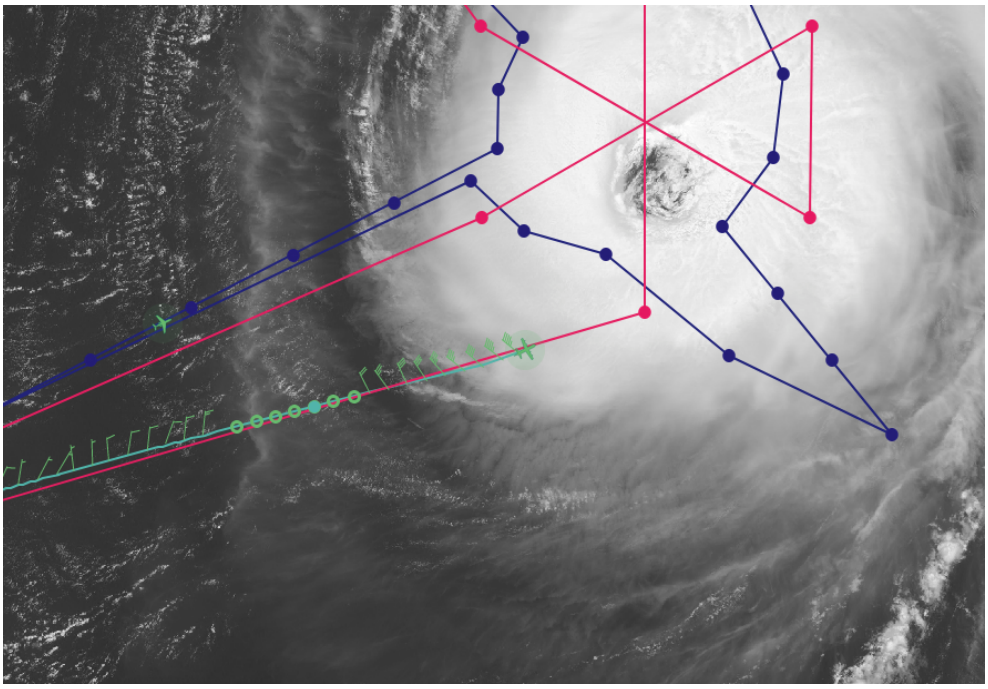
1654	Started descent
1659	Quite a few visuals of whitecaps before starting the pattern. SFMR reports ~24 m/s
1703	Starting pattern at 10 kft. Combo drop 1 out. SST is 27.5°C which was questioned by the flight crew. It is possible since the storm is near a SST

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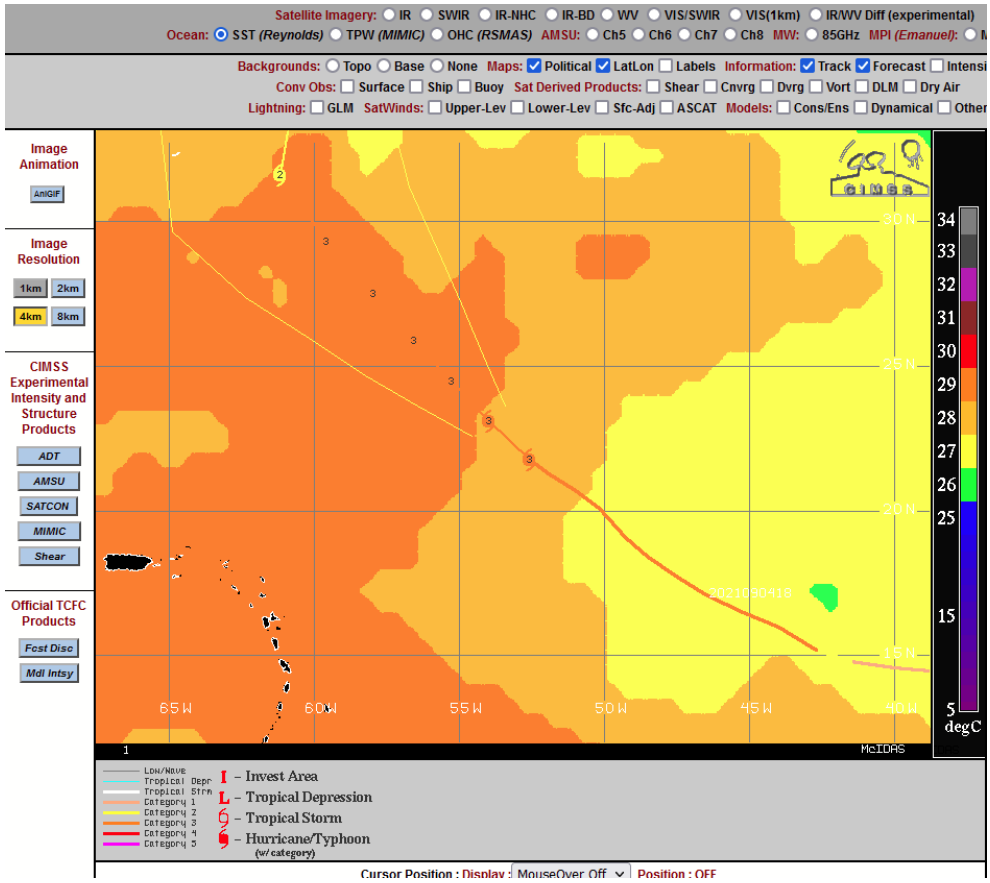
gradient



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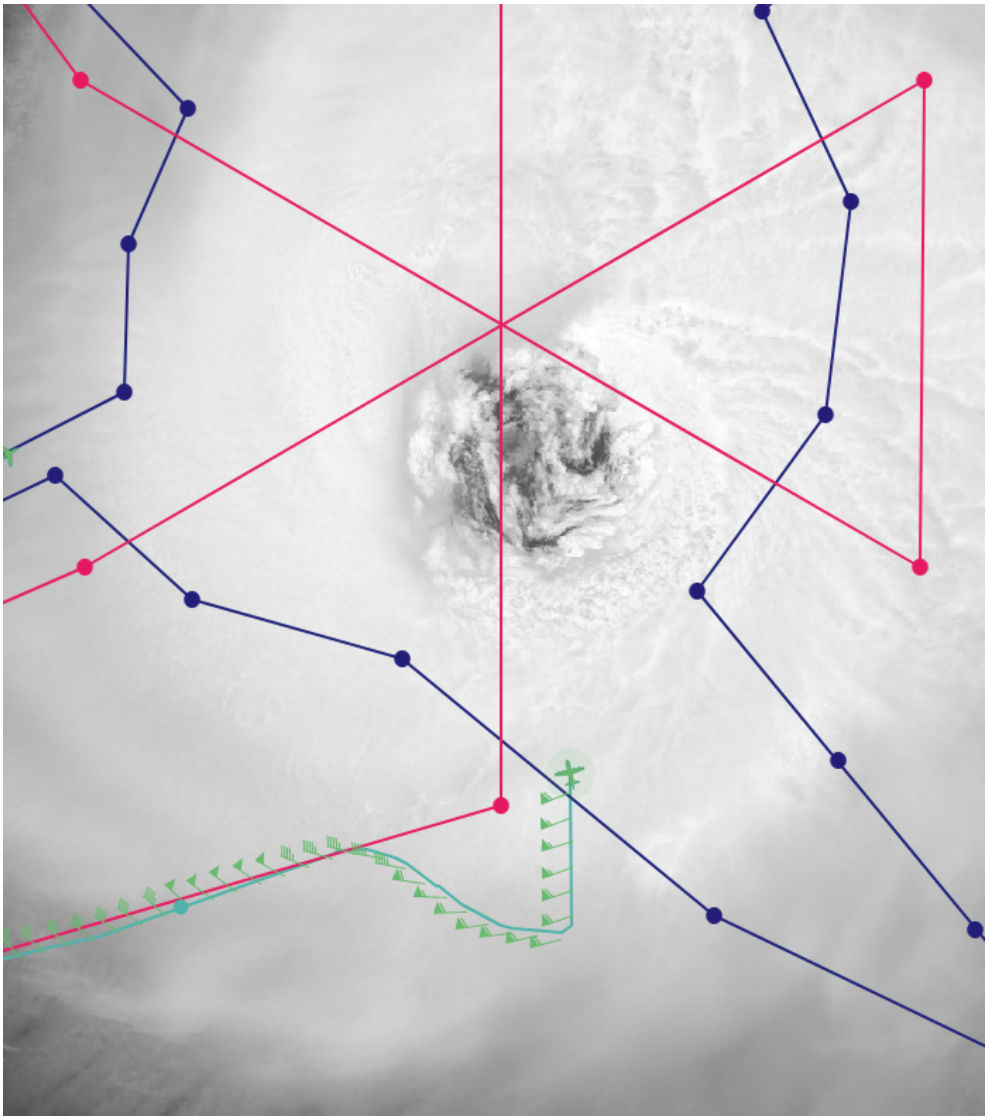
1709	Heading towards the eye 
1718	Sonde 2, Midpoint inbound pass 1 (2nd sonde)
1722	Penetration through the eyewall reported different. Not as defined as usual
1725	Hunting the center in the eye (marked at 1326) Gamache gave center fix for radar analyses: 172607, 22.06N, 53.45W
1726	Center sonde, pressure of 957.5 mb (3rd sonde)

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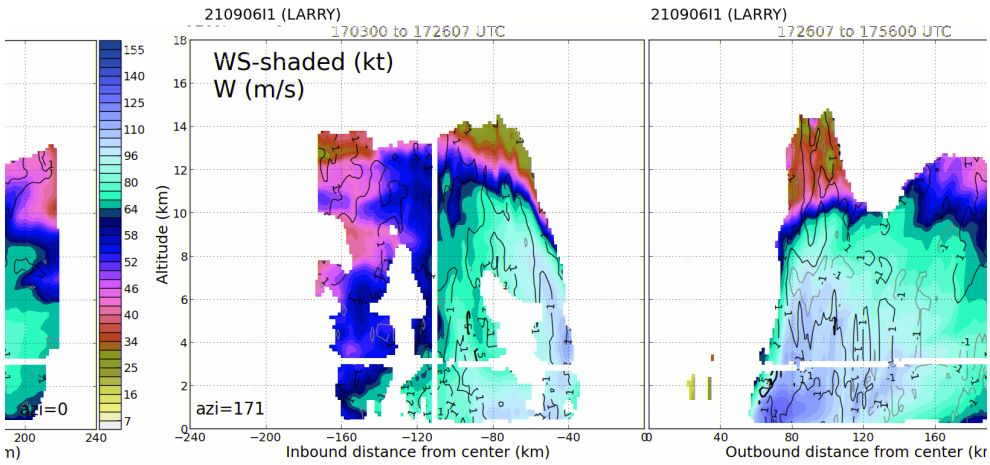
1731	Echo tops are only showing to ~ 5-6 km on the edge of the scans (as going into northern eyewall)
1738	Heather reported much broader area of moderate precip on the N side
1744	Midpoint outbound sonde. Leg 1 (4th sonde)
1754	EP combo drop out (5th sonde), 28.31°C SST. Interesting comparison to SHIPS which has 28.8°C, though there might be a gradient with higher SSTs ahead of storm motion
1821	1st ALAMO float released 
1831	2nd ALAMO float released
	Radar analyses from 1st pass

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	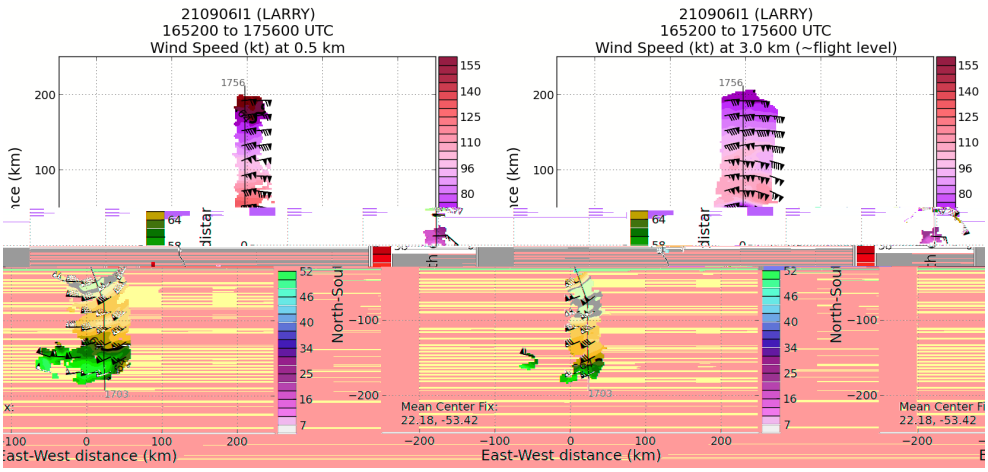
1853	Combo sonde, inbound pass 2 (sonde 6)
1905	MP sonde inbound pass 2 (sonde 7)
1912	RMW sonde inbound pass 2 (sonde 8, NW eyewall)
	Once we were inside the reflectivity eye, we hit our worst turbulence of the flight. They wonder if that was one of our mesovortices
1918	Center sonde (sonde 9)
1933	Midpoint sonde outbound pass 2 (sonde 10)

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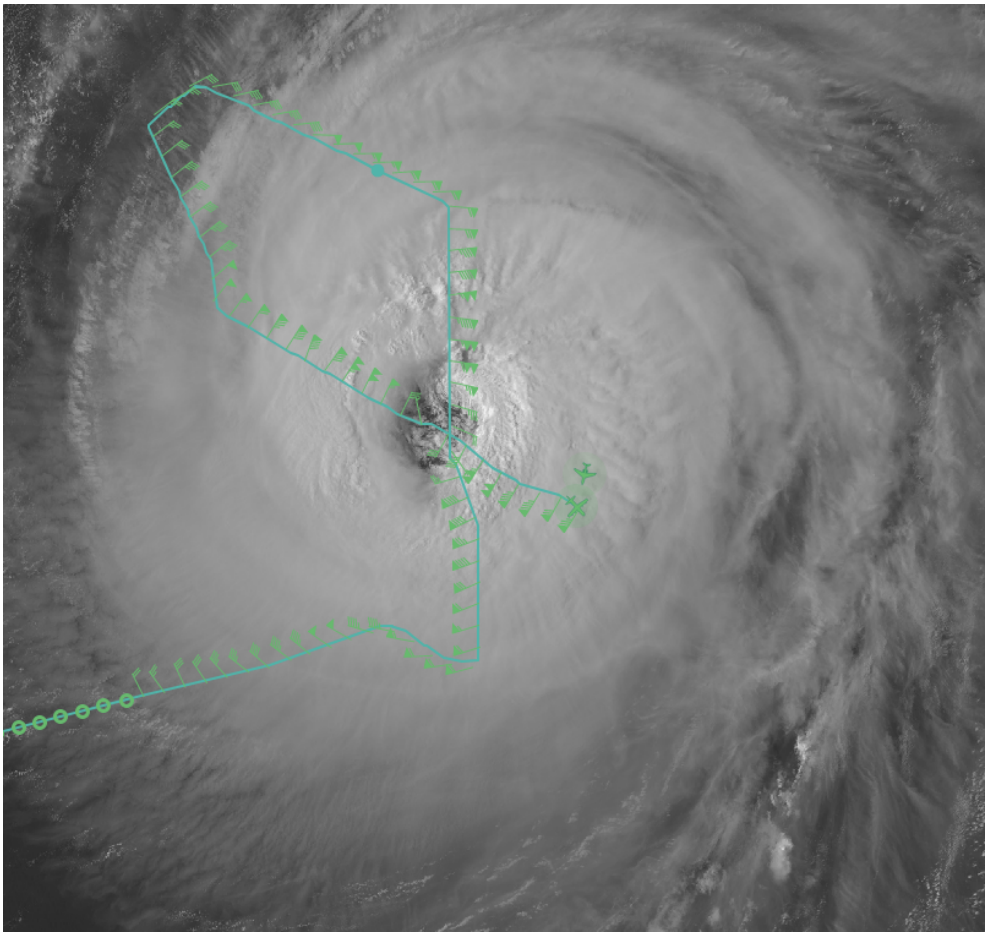
1940	Close overlap between P-3 and G-IV 
	Snapshot from tidbits to highlight the “bounce” the aircraft took during the pass (bottom right plot)

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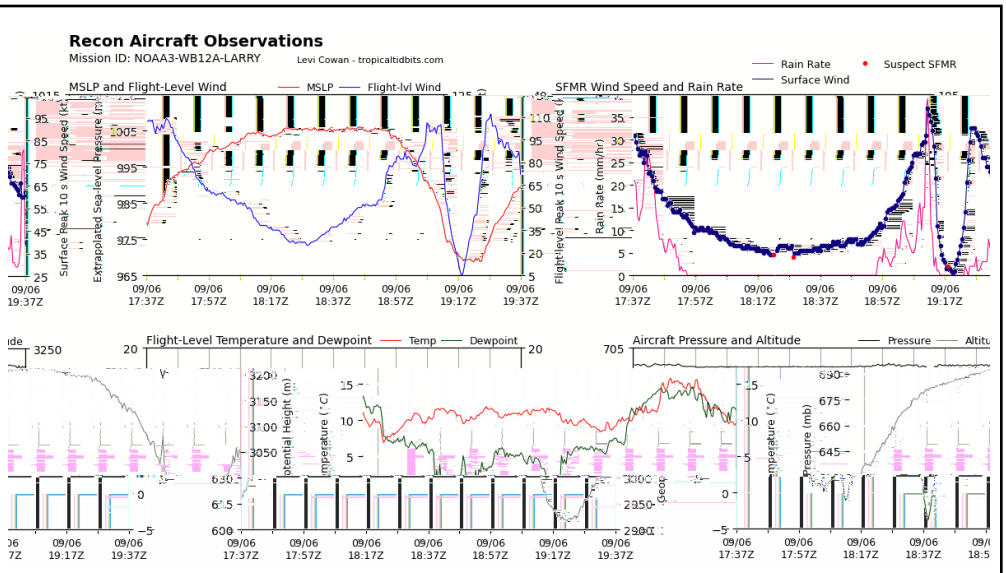
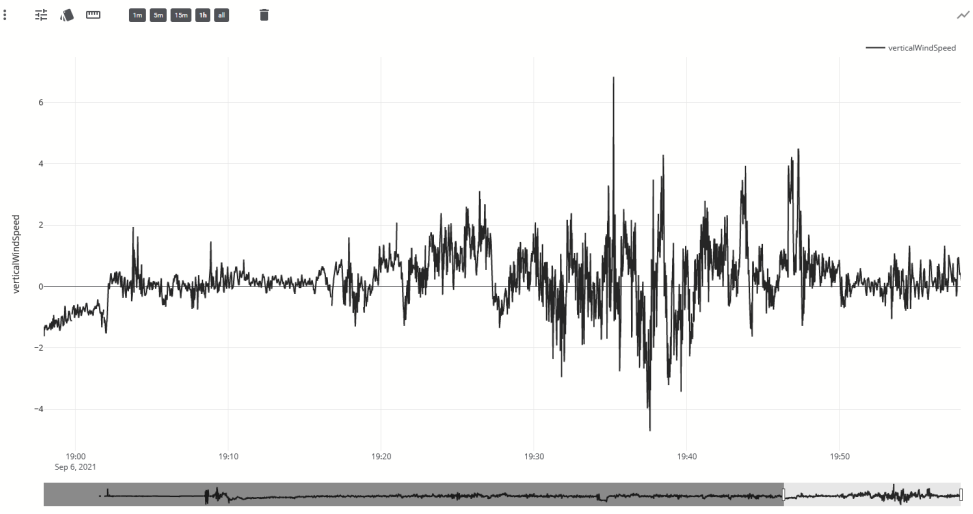
	
1945	EP combo sonde pass 2 (sonde 11) (26.92°C SST)
	Last hour of vertical velocities. Very turbulent on the outbound of the previous pass 
1959	Midpoint sonde on downwind leg (sonde 12)
2011	Initial point (IP) combo drop pass 3 (27.96°SST) - sonde died (sonde 13)
2015	Backup IP sonde (sonde 14)

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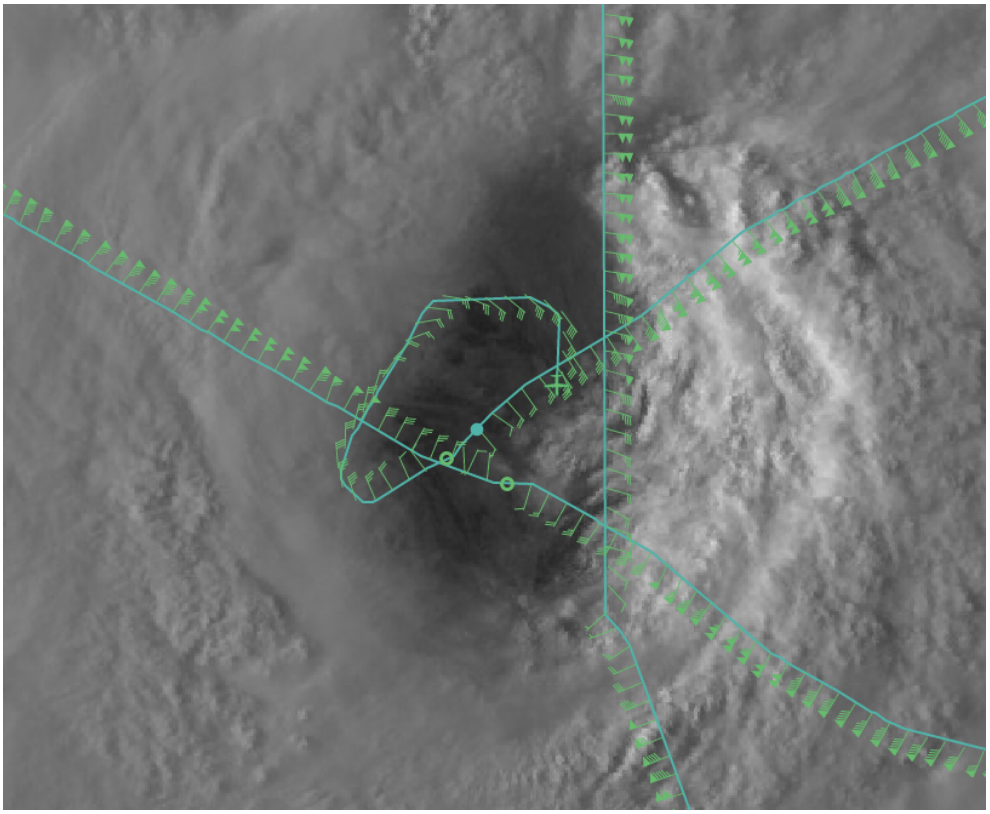
2023	Midpoint sonde Inbound leg 3 (sonde 15)
2028	RMW sonde inbound leg 3, NW eyewall (sonde 16)
2036	Center sonde (sonde 17)
2039	Begin Eye-eyewall Mixing Module. Circling eye clockwise
2053	Image captured orbiting the eye 

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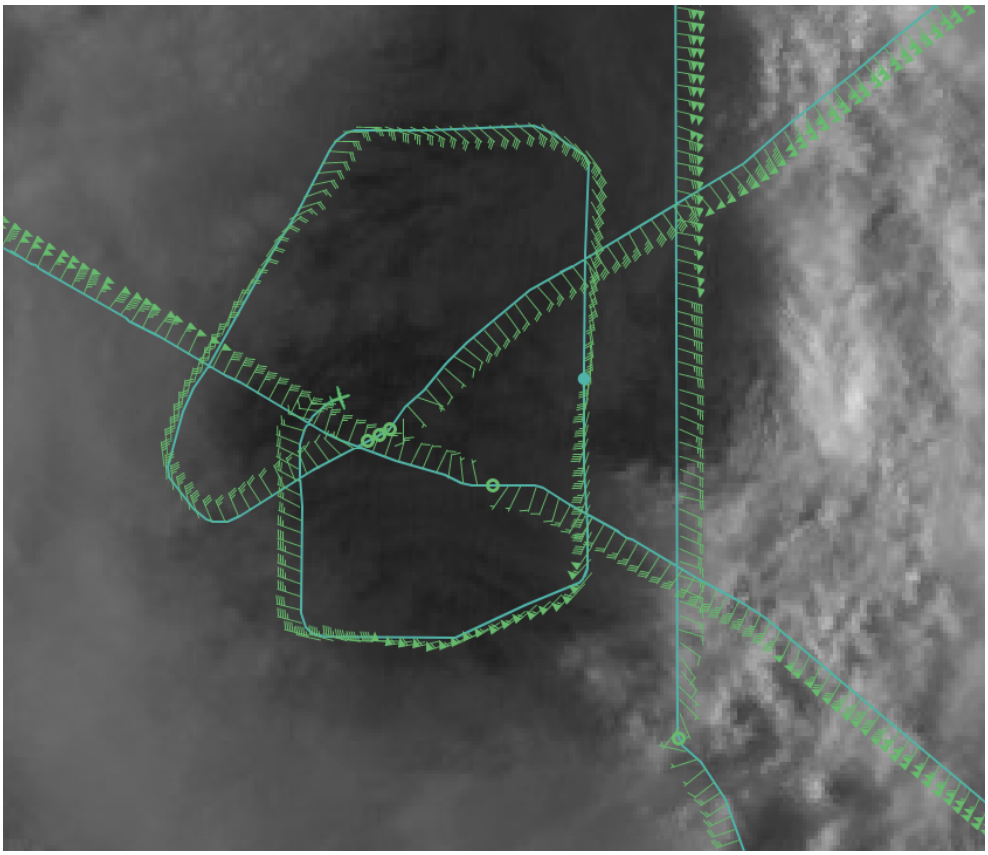
2107	Sonde (#18) in mesovortex for Eye-eyewall Mixing Module. Visible imagery is fading, so hard to see where it was 
2116	RMW sonde outbound pass 3 (SW eyewall) (sonde 19)
2122	Midpoint sonde outbound pass 3 (sonde 20)
2136	Endpoint combo sonde (sonde 21)
	Updated satellite loops at the end of mission

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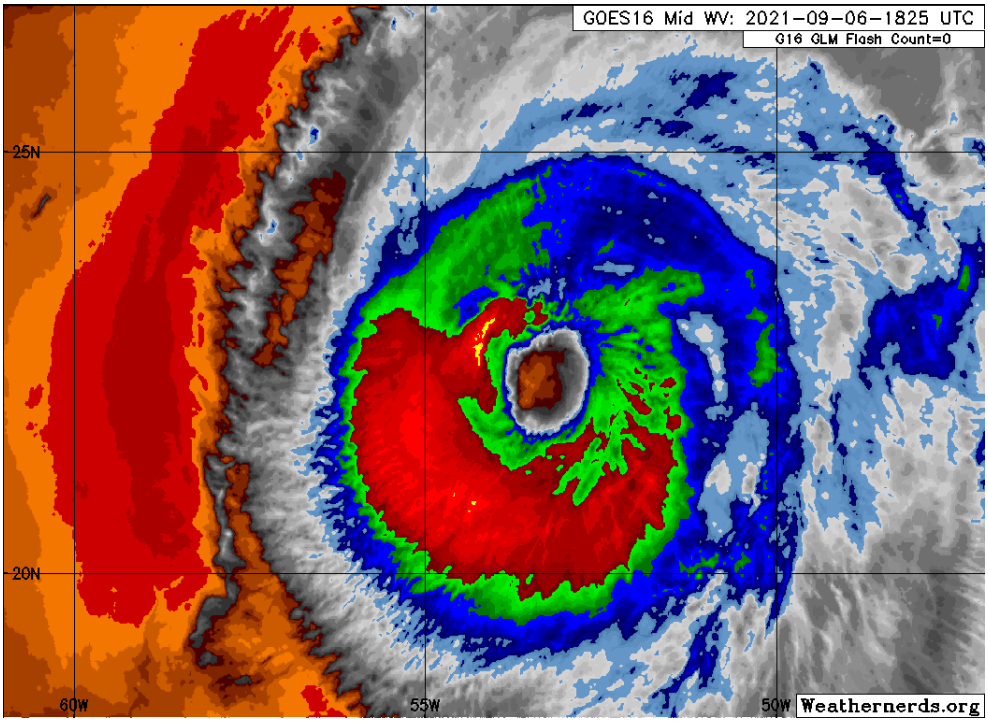

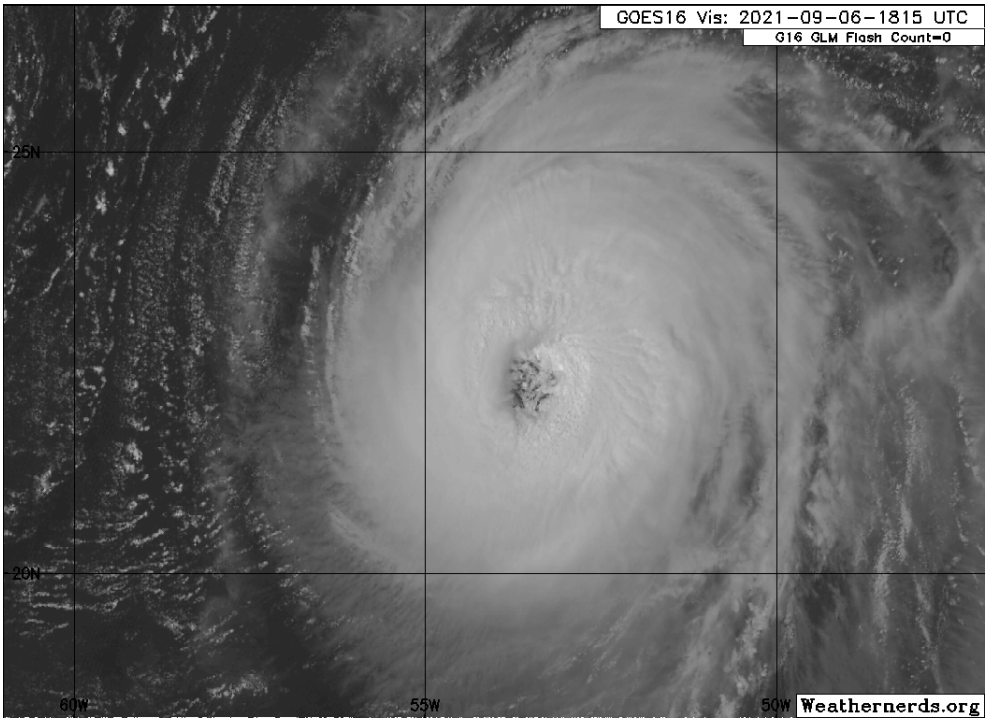

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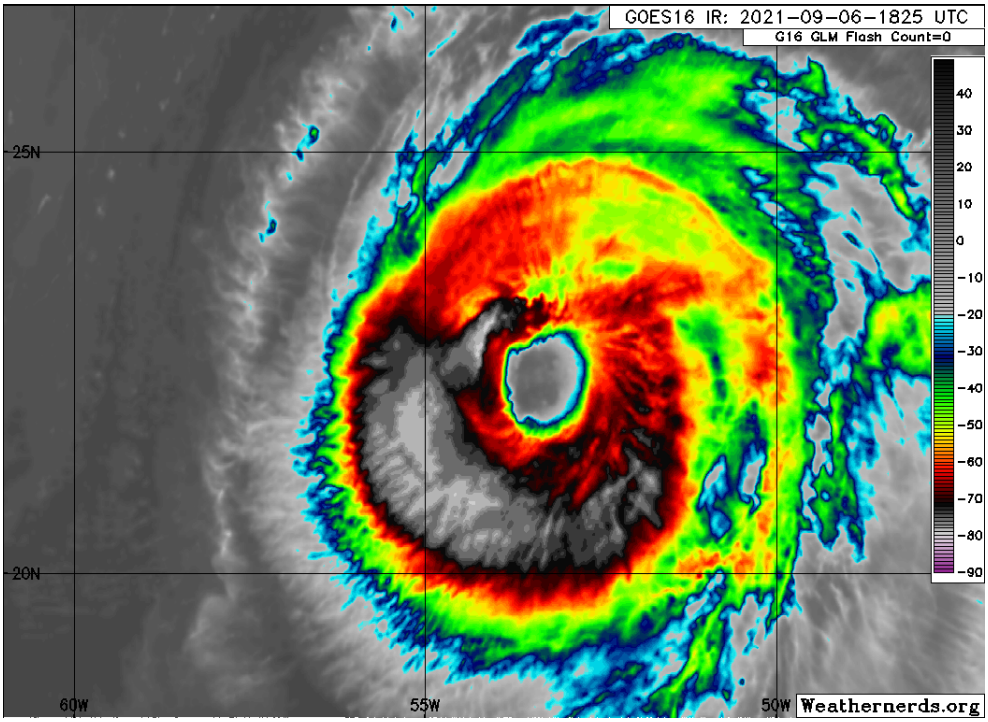
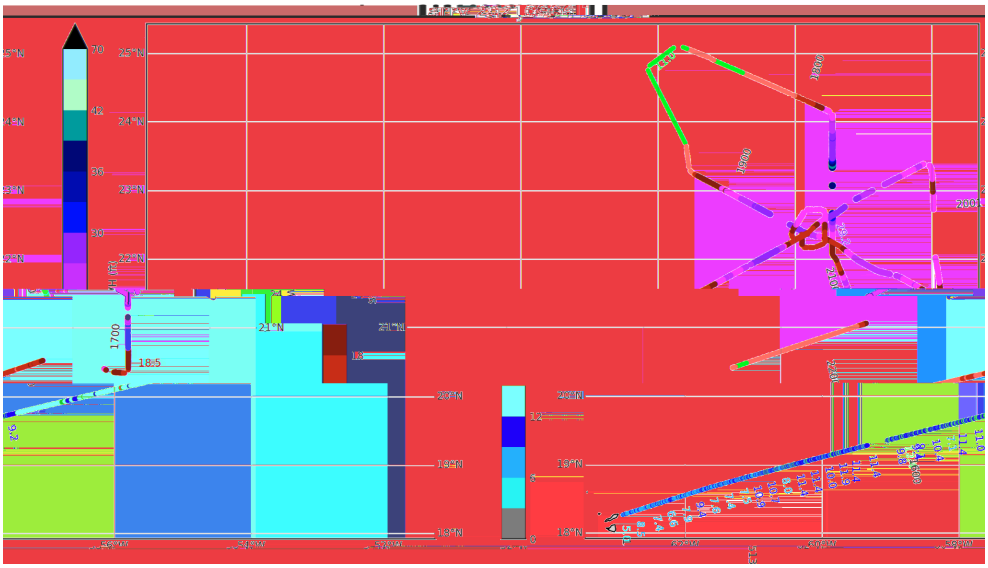


KAIA Significant Wave Height from mission



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POST-FLIGHT	
Mission Summary	This was a highly successful mission. A butterfly pattern was flown with two ALAMO floats released ahead of the motion after the 1st pass through the center. On the third pass, an Eye-Eyewall Mixing Module was flown which consisted of a clockwise circumnavigation of the eye and a dropsonde in a potential mesovortex. In addition to the standard pattern, three RMW sondes were launched and a center fix was made for each pass for NHC. The radar data was used for the 5 PM ET NHC forecast discussion to discuss surface winds, which we believe is a first. *"During that pass through the hurricane, the aircraft tail Doppler radar measured winds of 121 kt at a height of 3 km in the northeastern eyewall, which equate to about 109 kt at the surface. Therefore, the initial intensity has been adjusted up to 110 kt for this advisory. A pair of dropsondes into the eye of Larry measured a minimum central pressure of 956 mb."* 21 total dropsondes were released (14 for EMC, 2 for NHC, 4 for HRD, 1 for ONR), as well as 2 AOML/PhOD ALAMO floats (both failed) and 8 NRL AXBTs (1 bad)
Actual Standard Pattern Flown	Butterfly + Eye-eyewall Mixing Module
APHEX Experiments / Modules Flown	Released 2 AOML PhOD ALAMO floats ahead of storm motion, part of the *Ocean Observing Experiment: Targeted and Sustained Ocean Observations* and flew an *Eye-eyewall Mixing Module, part of the Mature Stage Experiment;* mission flown in collaboration with ONR TCRI.
Plain Language Summary	● A highly successful research mission which collected radar data, temperature, humidity and wind speed data from dropsondes. ● We worked collaboratively with the National Hurricane Center to meet both of our goals ● We released two ocean sensors ahead of the storm to understand how the ocean evolves underneath the storm ● We flew a circle inside the eye to understand how the eye and violent eyewall interact with each other
Instrument	An issue with the MMR on N43. The Flight Director said that the one on

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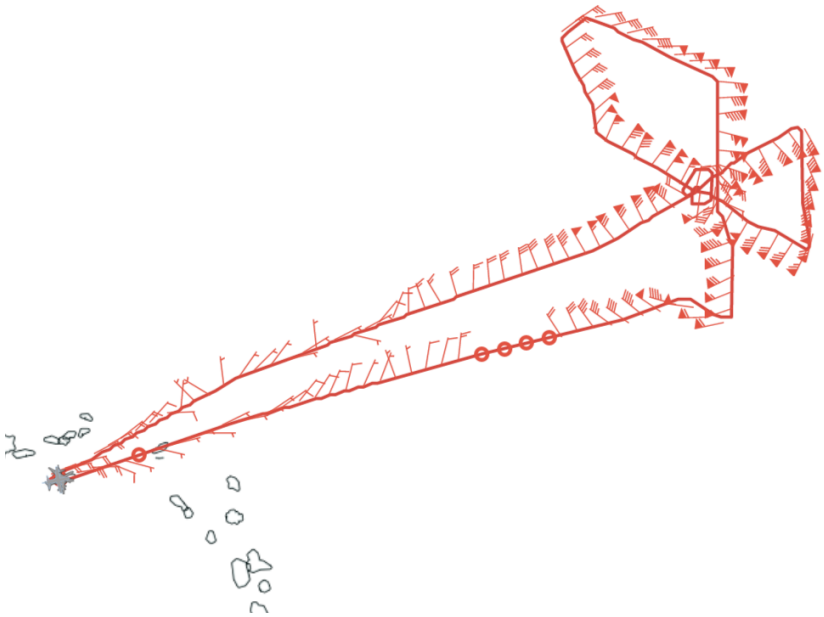
Notes	N43 is worse than on N42. Surface roughness field is ok, but HWX and NAW are bad -- lower than expected reflectivity on the MMR.
Final Mission Track	

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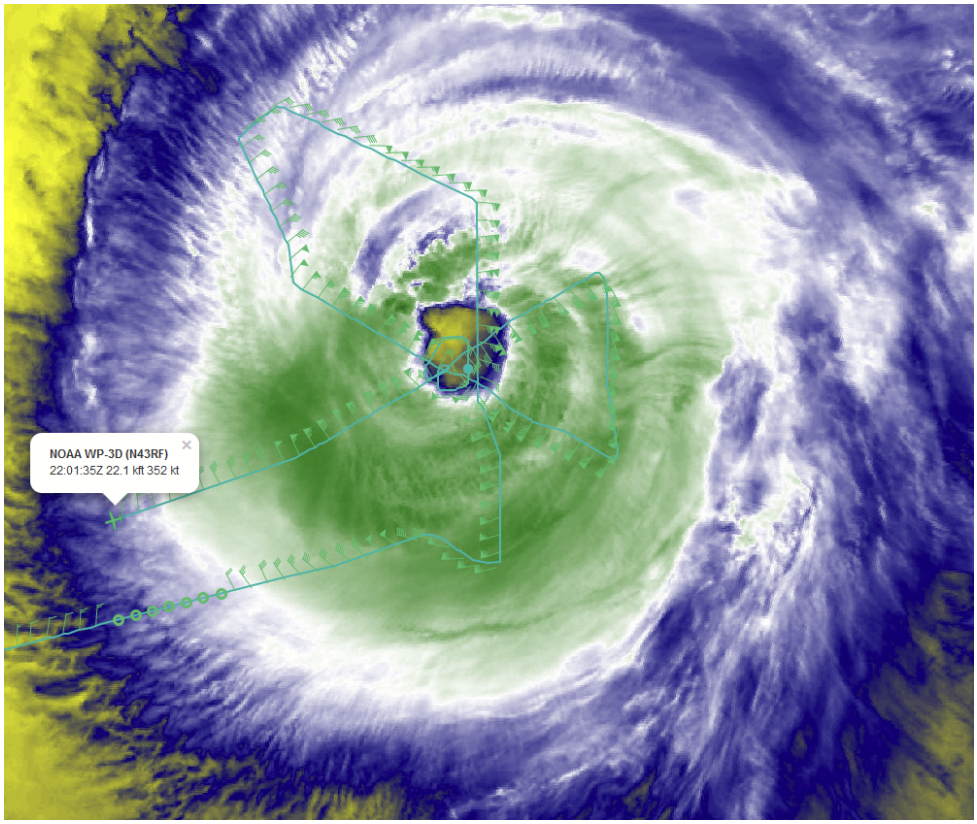

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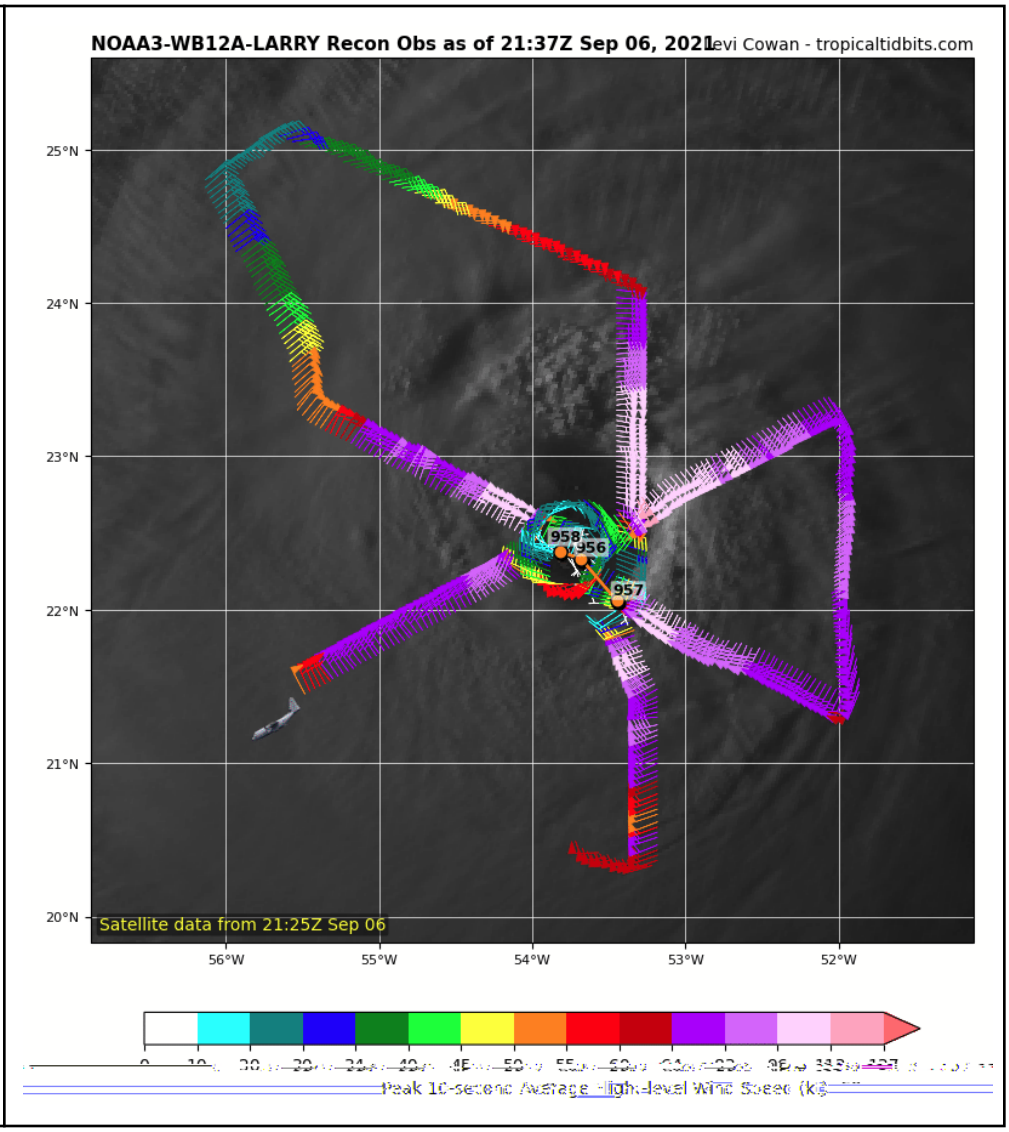

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