

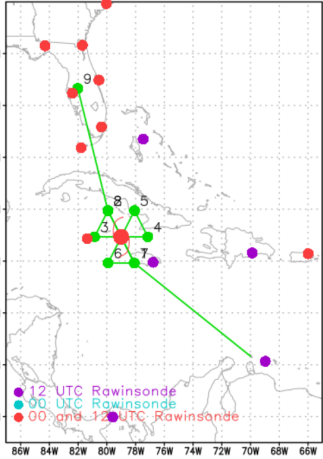
**NOAA / AOML / Hurricane Research Division
Hurricane Field Program
Advancing the Prediction of Hurricanes Experiment (APHEX)**

FLIGHT LOG -- 2021081711

MISSION PLAN			
FLIGHT ID	2021081711	STORM	AL07 / GRACE
MISSION ID	1007A	TAIL NUMBER	NOAA43
TASKING	EMC	PLANNED PATTERN	Butterfly
MISSION SUMMARY			
TAKEOFF [UTC]	1953	LANDING [UTC]	0337
TAKEOFF LOCATION	Aruba	LANDING LOCATION	Lakeland
FLIGHT TIME	7.7	BLOCK TIME	8.3
TOTAL REAL-TIME RADAR ANALYSES (Transmitted)	4 (4)	TOTAL DROPSONDES (Good/Transmitted)	30 (24/24)
OCEAN EXPENDABLES (Type)	AXBTs (3/3)	sUAS (Type)	None
APHEX EXPERIMENTS / MODULES	Early Stage Experiment: AIPEX		
HRD CREW MANIFEST			
LPS ONBOARD	Zawislak	LPS GROUND	Alaka
TDR ONBOARD	Zawislak	TDR GROUND	Alvey/Gamache
ASPEN ONBOARD	Sellwood	ASPEN GROUND	None
NESDIS SCIENTISTS	None		
GUESTS (Affiliation)	None		
AOC CREW MANIFEST			
PILOTS	Mitchell, Rannenberg, Copare, Legidakes		
NAVIGATOR	Freeman, Urato		
FLIGHT ENGINEERS	Darby, Wysinger		
FLIGHT DIRECTOR	Carpenter		
DATA TECHNICIAN	Mascaro		
AVAPS	Underwood		

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PRE-FLIGHT	
Flight Plan	<p><u>Pattern:</u> Fly butterfly pattern with 105 nmi radial legs, except when restricted by land</p>  <p>Rotated Fig. 4 instead today....E->W on the north shore of Jamaica, then downwind for 225/045 degree radials, then downwind to the 360/180 radials, then over to 135/315 for the final radials.</p> <p><u>Altitude:</u> 40-kft adjust to 8kft to avoid pressurization issues for AXBTs</p> <p><u>Potential Add-on Modules:</u> None</p>
Expendable Distribution	<p>Release dropsondes at endpoint (EP), midpoint (MP), center (ctr). Possible ONR TCRI extra drops ~50 km on either side of the center drop (midpoints might cover this need)</p> <p>ONR AXBTs (4 total): 1 center, 3 endpoints (points in the western quadrants)</p>
Preflight Weather Briefing	<p>Tropical Storm Grace as of takeoff is located over Jamaica, though still exhibiting a fairly clear circulation center, as well as an extensive region of precipitation on all sides except the immediate west and northwest. The expectation is that Grace will move off of Jamaica during the mission, and that the environmental conditions once it moves off of the island will be favorable enough to initiate intensification. The only immediate inhibitor to</p>

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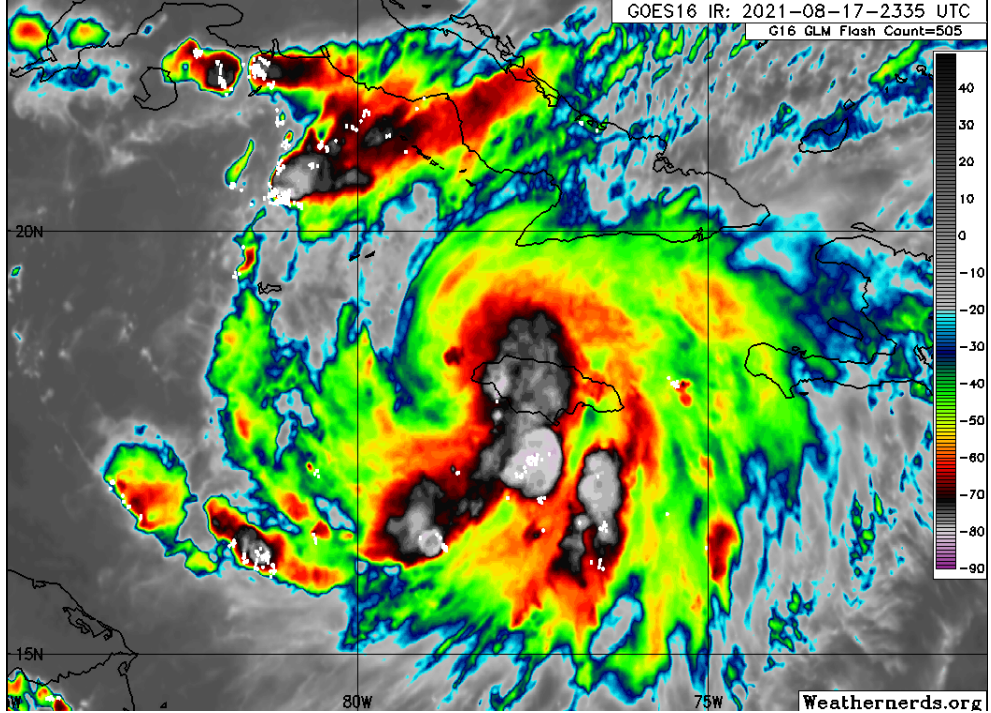
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	intensification appears to be some mid-level shear (the deep layer shear is borderline moderate, 10 kt), and the possibility of some dry air entrainment from the west of the storm. Otherwise, this case looks like a prime candidate for RI (and of research interest) as the storm heads towards a landfall in the Yucatan on Thursday. The expectation is that it will emerge in the Bay of Campeche and intensify over a brief period prior to making landfall in Mexico.
Instrument Notes	All systems up and normal. KaIA is operational; IWRAP is not being run.

IN-FLIGHT	
Time [UTC]	Event
1953	Take off from Aruba
2149	IP, Drop 01 endpoint E inbound
2201	Drop 02, midpoint E inbound
2212	Drop 03, "center" (The center was really over Jamaica at this time)
2214	Drop 04, no launch detect
2224	Drop 05, midpoint W outbound
2232	Drop 06, AXBT 01, endpoint W outbound AXBT is good ~30C
2255	Drop 07, AXBT 02, endpoint SW inbound
2300	Center appears to have emerged back over water according to radar
2306	Interestingly it looks like the flight level winds are half that of the surface...20 kt at sfc and 10 at FL. This is the upshear side of the storm.
2311	Drop 08, midpoint SW inbound
2317	Drop 09, quarterpoint SW inbound (ONR) - in between center and midpoint
2323	Drop 10, center

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2326	Drop 11, quarterpoint NE outbound (ONR)
2337	Drop 12, midpoint NE outbound
2345	Drop 13, endpoint NE outbound
2347	
2351	JZ: "interesting the RMW at lowlevels is to the NE, but at 5 km it's to the NW". Convection rotating around the center? Maybe, but mostly stratiform to the NW. RI onset?
0000	Drop 14, endpoint N inbound
0013	Drop 15, midpoint N inbound
0019	Drop 16, quarterpoint N inbound (ONR)
0024	Deep convective cell popped up near the center

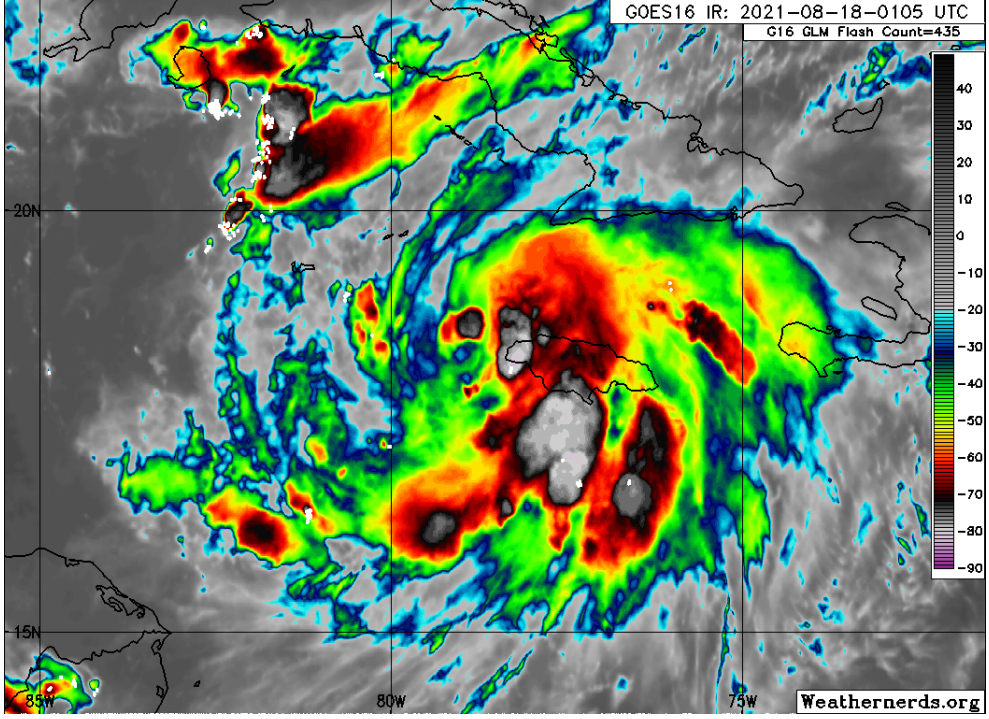
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0028	Drop 17, center, no pressure/temp/humidity
0029	Drop 18, center, backup successful
0037	Drop 19, quarterpoint S outbound (delayed due to ship and rainband) (ONR)
0044	Drop 20, midpoint S outbound, no launch detect
0045	Drop 21, midpoint S outbound (backup)
0055	Drop 22, endpoint S outbound
0105	Inner core developing with curved banding in the eastern semicircle

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0106	Drop 23, endpoint SE inbound
0118	Drop 24, midpoint SE inbound
0123	Drop 25, quarterpoint SE inbound (ONR)
0133	Drop 26, center
0138	Drop 27, quarterpoint NW outbound (ONR) (failed)
0139	Drop 28, quarterpoint NW outbound (ONR) (backup)
0145	Drop 29, midpoint NW outbound

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0146	
0158	Drop 30, AXBT 03, endpoint NW outbound AXBT is good: 29.6C

POST-FLIGHT	
Mission Summary	<p>As expected, once in pattern Grace began to move off the coast of Jamaica. As soon as it moved off, some deep convection developed very near the center, and in the last pass had a lot of curvature and was nearly closed. Having said that, other than that convection and some banding developing on the south side, Grace exhibited extensive stratiform rain areas, particularly on the north side. There was less precipitation coverage in the upshear (west side) quadrant, but what did exist in those quadrants were some small stratiform rain areas and moderate convection (consistent with the research that indicates that those precipitation types could be a symptom of intensification when they appear upshear). While the precipitation coverage was extensive in pattern, in the hours that followed the convection waned near the core, and the precipitation became highly asymmetric again over a large radius from the center -- an indication perhaps that the storm was still experiencing shear. The peak flight level winds were observed at around 55 kt, while 50 kt at the surface</p>

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	<p>in SFMR and dropsondes. So some slight intensification occurred during the mission. In addition to the precipitation observed, a few other interesting observations were made; 1) that in the upshear quadrant the surface wind exceeded the flight level wind; 2) on the first pass the radius of maximum wind at 1 km was to the north/northeast, while at 5 km it was actually rotated cyclonically downwind to the northwest quadrant -- this configuration wasn't really seen in subsequent passes; 3) the vortex is still somewhat tiled with height as the 5-6 km vortex was displaced downshear -- interestingly at higher levels, those centers were displaced clockwise around from the low-level centers. The tilt indicates that the storm still needs to gain alignment and build upwards before it can potentially intensify significantly.</p> <p>During the mission the ONR TCRI team requested "quarterpoint" dropsondes, which during the last 3 passes were released both inbound and outbound the approximate middle point between the midpoint and center sondes. A total of 7 were released for the 6 points (there was one bad sonde). TCRI also requested AXBTs to be released on some of the endpoints on the western side of the pattern (released with dropsondes), such that the ocean can be profiled in the path of the storm (and potentially where it will be intensifying).</p> <p>Expendables: 3 ONR AXBTs, 7 ONR TCRI sondes, 23 NWS sondes; 30 total sondes released.</p>
Actual Standard Pattern Flown	Rotated Fig. 4 flown as modified from the original pattern.
APHEX Experiments / Modules Flown	Though no specific modules were flown, the data sampling will be very valuable to the <i>Early Stage Experiment: AIPEX</i> and the flight was flown collaboratively with ONR TCRI
Plain Language Summary	<ul style="list-style-type: none"> ● Tropical Storm Grace had a number of symptoms that the storm may very well begin to intensify, and even potentially rapidly in the next day: perhaps the most relevant being that the precipitation appeared to be favorable to become more symmetric around the center. The circulation, though, is still somewhat tilted with height, which must be aligned to get subsequent intensification. ● Extensive coverage of stratiform precipitation was observed, and was the dominant precipitation type, but there was also the makings of a nascent eyewall as, once the storm moved offshore of Jamaica, a convective ring developed around the low-level center, and almost encompassing the entire circle.

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Instrument Notes	More issues than usual with dropsonde dropouts as there were difficulties acquiring GPS during initialization of the sonde. There were a few no launch detects, and a few had sporadic winds in the profile due to that GPS satellite issue.
Final Mission Track	