19940925I1.LPS

9409 25I

SEP 25 1994

E.2 Lead Project Scientist (On-Board)

Olivia Marler

E.2.1 Preflight

↑ 1. Participate in general mission briefing.

↑ 2. Determine specific mission and flight requirements for assigned aircraft.

↑ 3. Determine from CARCAH or field program director whether aircraft has operational fix responsibility and discuss with AOC flight director/meteorologist and CARCAH unless briefed otherwise by field program director.

↑ 4. Contact HRD members of crew to:

   a. Assure availability for mission.
   b. Arrange ground transportation schedule when deployed.
   c. Determine equipment status.

9 5. Meet with AOC flight crew at least 90 minutes before takeoff, provide copies of flight requirements and provide a formal briefing for the flight director, navigator, and pilots.

9 6. Report status of aircraft, systems, necessary on-board supplies and crews to appropriate HRD operations center (MGOC in Miami or FGOC at remote recovery location).

E.2.2 In-Flight

____ 1. Confirm from AOC flight director that satellite data link is operative (information).

____ 2. Confirm camera mode of operation.

____ 3. Confirm data recording rate.

____ 4. Complete Form E-2.

E.2.3 Postflight

____ 1. Debrief scientific crew.

____ 2. Report landing time, aircraft, crew, and mission status along with supplies (tapes, etc.) remaining aboard the aircraft to the appropriate HRD operations center (MGOC or FGOC).

____ 3. Gather completed forms for mission and turn in at the appropriate operations center. [Note: all data removed from the aircraft by HRD personnel should be cleared with the AOC flight director.]

____ 4. Obtain a copy of the 10-s flight listing from the AOC flight director. Turn in with completed forms.

____ 5. Determine next mission status, if any, and brief crews as necessary.

____ 6. Notify the appropriate operations center (FGOC or MGOC) as to where you can be contacted and arrange for any further coordination required.

SEP 25 1994

On-Board Lead Project Scientist Check List

Date 25 Sept 1994 Aircraft 43RF Flight ID 940925I

A. Participants

HRD Function	HRD Participant	OAO Function	OAO Participant
Lead Proj. Sci.	Marks	Flight Director	Parrish
Cloud Physics	R. Black	Pilots	McKim/Tennison
Radar	Willoughby	Navigator	Rathburn
Workstation	Griffin	Sys. Engr.	~~Lynch~~ Moore
Photographer		Data Tech.	Pradas/Delgado
Omegasonde	Franklin/Fremel	El. Tech.	Lynch
AXBT/AXCP	—	Other	2 IMAX, 1 Mexican

10.3

Take-Off ~~1734~~ 17~~20~~ Location PVR Landing ~~0338~~ 0341 Location PVR

B. Past and Forecast Storm Locations

Date/Time	Latitude	Longitude	MSLP	Max. Wind
25/~~2~~20Z	19.5	120.5	930	130 kts

C. Mission Briefing

see p19 in 1993 HFP (inner core dynamics)

Form E-2
Page 2 of 5

SEP 25 1994

D. Equipment Status

Equipment	Pre-Flight	In-Flight	Post-Flight	
Aircraft	↑	↑	↑	
2 DATS Radar/LF	↑	↑	↑	
Radar/TA (Doppler)	↑	↑	↑	
1 DAT Cloud physics	↑	↑ 2DP problems?	↑	2DP gets water inside in heavy precip fails
2 DATS Data system	↑	↑	↑	
9 sondes Omegasondes	↑ LOD2 may work	↑	↑	
AXBT/AXCP	—	—	—	
Workstation	↑	↑	↑	
Photography	↑ no right camera VCR	↑	↑	

REMARKS:

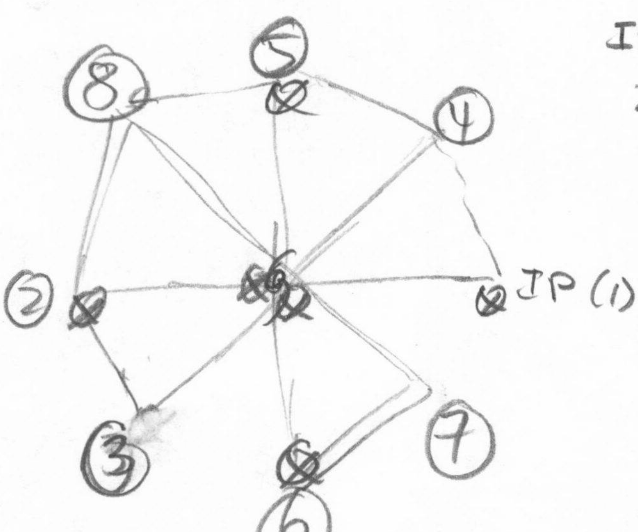
- No right camera VCR
- 2DP leaking causes failure in heavy rain
- Radar system down at start for 5 min (~1950) and from 2220-2237 circled W of 69 to fix it.
- Nose radar display failure

SEP 25 1994

E. I. Proposed Flight Pattern (sketch or designate by number)

See attached sketch from p19
1993 HFR

E. II. Actual Flight Pattern



IP-2-3-4-5-6-7-8-
2-1-4-3-6-5-6-1

8 penetrations

9 ODWS

36 drops

4 cardinal pts

Form E-2

SEP 25 1994

(1)

Lead Project Scientist Event Log

Date 25 Sept 94 Flight 940925I LPS Marks

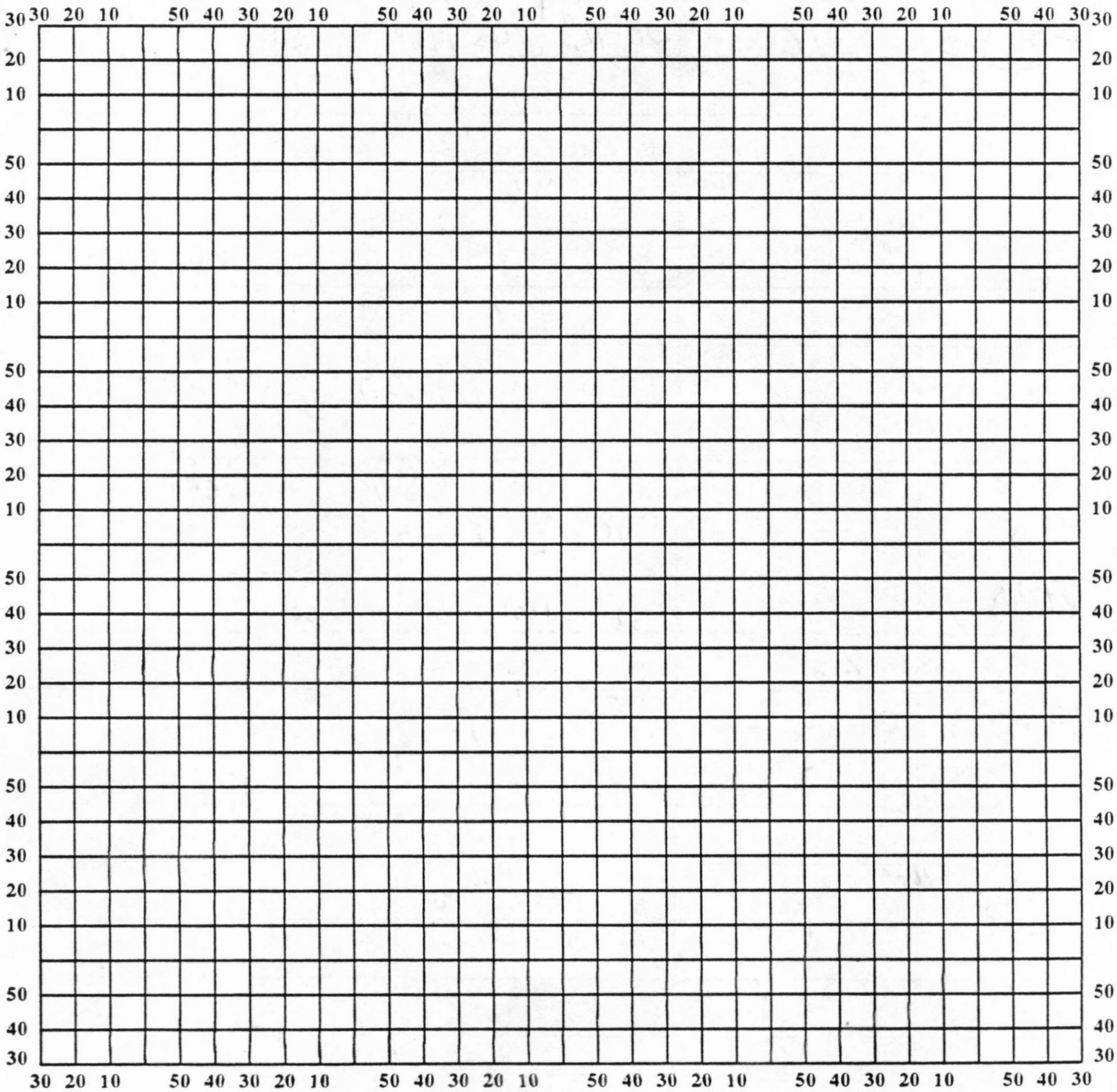
Time	Event	Position	Comments
173353	TO	PVR 20°41.3, 105°14.6"	
1931		19°45" 115°8"	talked to John - picking up outer band at 200nm
			- told him LODZ is ↑
			- mentioned contingency for larger 6
1950			Radar down for a few
			minutes, Hugh & Terry restarted
			~~restart tape #1~~
			- looks like multiple rings
			around eyewall
1956			start descent
2003			at altitude set up
			new IP (6 at 19°10' 120°12")
200845		19°18" 118°23"	entering outer edge of outer band
			(possible ring) good bright band
201045		19°17" 118°32"	in heavy stratiform
			6 has to be S of 19 by radar
202234	IP	18°57 119°19"	
202321	ODW #1 bad	18°57.3 119°22"	ODW bad (no signal)
203254	6	18°57.8" 120°39"	What a sight!! 9-10nm diameter

TK 080

Hurricane Recco Plotting Chart

True at 25° Latitude, in Degrees and Minutes of ϕ and λ.

Date________________ Longitude ________________ Observer ________________



Note: Label full degrees according to location of flight area.

Lead Project Scientist Event Log

2

Date 25 Sept 94 Flight 940925I LPS Marks

42 fix
2033
18°58"
120°04"

Time	Event	Position	Comments
204503	2	18°58" 120°58"	
	ODW2 (bad)		
205345	3	18°21.3" 120°39"	TK 040
2055 leg start			2101 enter outer band (ring)
210610	9	19°01.9" 120°04.9"	what a sight!!
CP 925mb 124 kts NE	ODW3 in 9	Over 42	- nose radar problems
211838	4	19°44" 119°27"	TK ~~280~~
			LOD2 out at 4
212604	5	19°53." 120°04.5'	TK 180 ODW#4 after turn PTH good
212730 leg start	(2134 in 2nd wind max)		
213818	9	19°04.9" 120°02.8"	nice shelf over S eyewall edge
storm turning NE		NE of prev. 9	above our level 134 kts S
2150 07	6	18°15" 120°3.7"	Turn TK 070
	ODW5 bad	LOD2 (215325)	
215745	7	18°28.9 119°25.2"	TK 320
215915 start leg			
2211	9	19°13" 120°04"	Hugo type hook in NW of 9
	221130 striation	in NW eyewall all down	
222217	8	19°48.5" 120°42.3"	2220 radar down
			2237 radar up
223730	2	19 04" 121°03"	TK080

CP 925mb
9 TK 355/10

42 fix
2107
19°02"
120°06"

2DP leaking
Craps out in heavy precip

Terry on it

2238 start leg ODW 6 good

Lead Project Scientist Event Log

Date ________________ Flight ________________ LPS ________________

Time	Event	Position	Comments

Form E-2
Page 4 of 5

Olivia

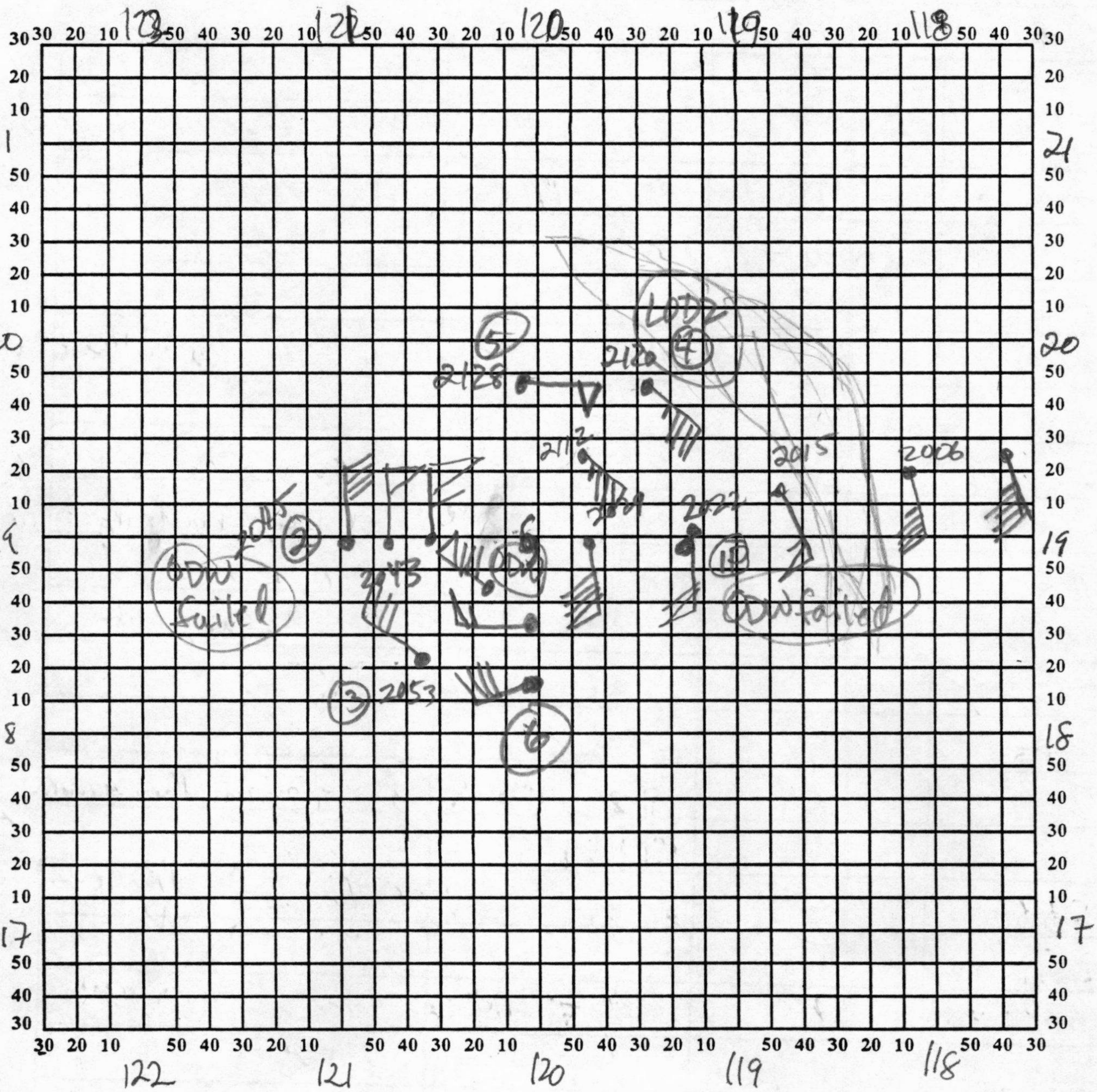
SEP 25 1994

(1)

Hurricane Recco Plotting Chart

True at 25° Latitude, in Degrees and Minutes

Date 25 Sept 94 Aircraft 43RF Observer Marks



Note: Label full degrees according to location of flight area.

8 penetrations

Form E-2
Page 5 of 5

(3) (3)

SEP 25 1994

Lead Project Scientist Event Log

Date 25 Sept 94 Flight 940925I LPS Marks

Time	Event	Position	Comments	
224910	9	19°16.8" 119°58.7"	1kft camera should be amazing	
			passed 3-4 nm S of 9	
			hook in NE corner	2249 42RF 19°14" 128 02"
2300	1	19°23 119°06"	TK 320	
	ODW 7			
230700	4	19°52" 119°30"	TK 320 through the big stuff	
2304 start leg				
231806	9	19°18.8" 120°00.1"	over 42 231820	42 2318 19°9.7" 119°58.1"
		recurving TK	(been running 10° tilt?)	
232935	3	18°42" 120°33"	TK 110	
			FAST along outside edge of band	
233735	6	18°33" 119°56"	TK 360	
start leg	2338	ODW8		
234903	9	19°23.1" 119°56.3"	through the heavy rain	42 2349 19°25" 119°59"
		ODW9		
235945	5	20°13.1" 119°56.5"	TK 180 to 9	
000145 start leg				
001230	9	19°24.5" 119°57.6"	heavy rain 000955 in N eyewall	
			TK085	42 fix 0012 19°28" 119°58'
001909	1	19°27" 119°22"	climb to ferry home	
002400	1	19°30." 118°59.5"	at 22kft heading home	

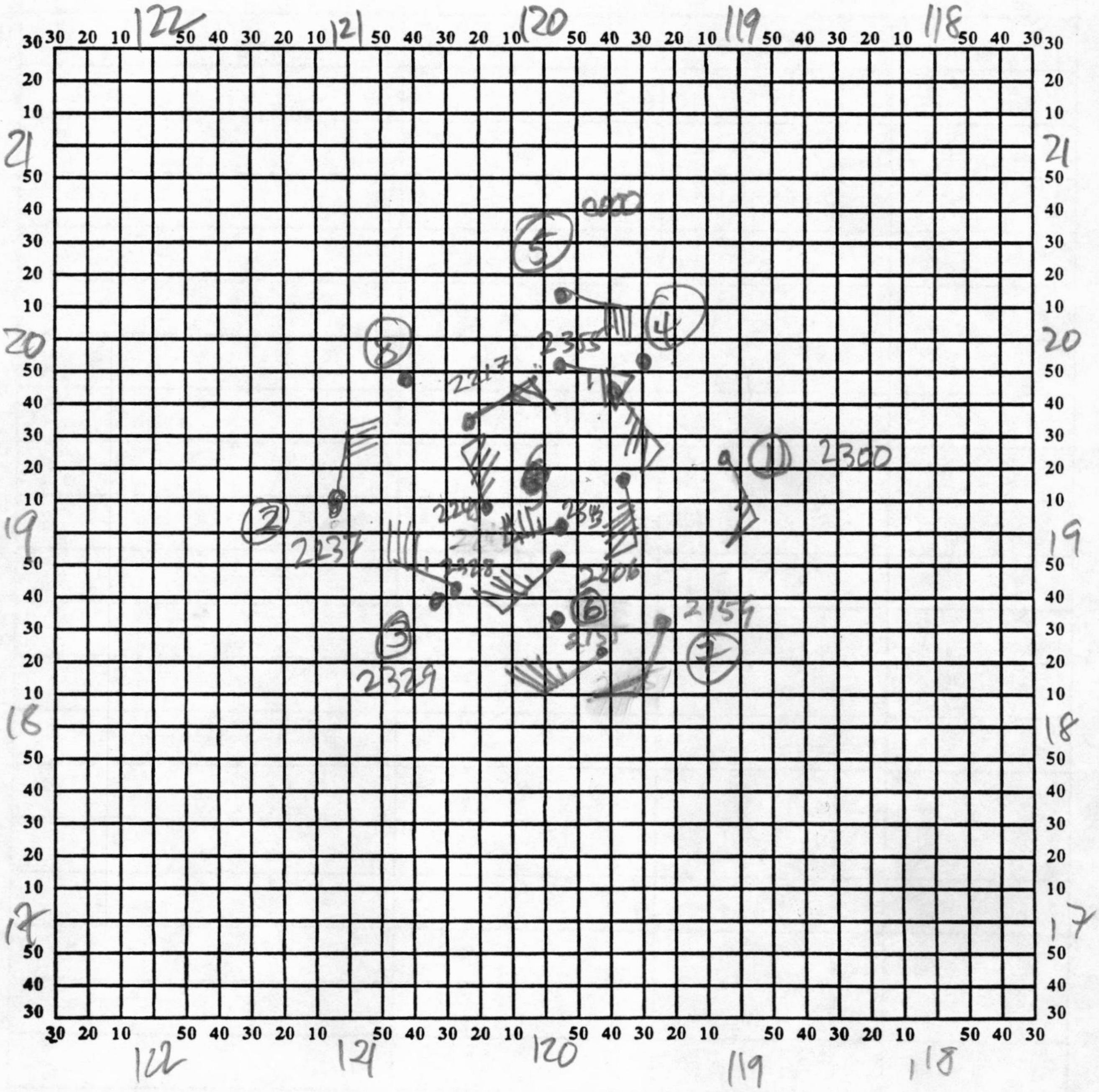
Hurricane Recco Plotting Chart

True at 25° Latitude, in Degrees and Minutes

SEP 2 5 1994

(2)

Date 9/25/94 Aircraft 43RF Observer Marly



Note: Label full degrees according to location of flight area.

SEP 25 1994

Lead Project Scientist Event Log

Date ________________ Flight ________________ LPS ________________

Time	Event	Position	Comments

Mission Summary
940925I Aircraft 43RF

Scientific Crew (43RF)

Chief Scientist	Marks
Doppler Scientist	Willoughby
Cloud Physics	R. Black
Dropwindsondes	Franklin
Workstation	Griffin
Observers	Fremmel (Radian Corp.)
	two IMAX
	Mexican AF meteorologist

Mission Briefing:

In the morning of 25 September Olivia was an intense hurricane with peak winds estimated at 130 kts, ~750 nm WSW of Puerto Vallarta, tracking N at 5 m/s. Over the preceding 24 h the storm had continued to intensify as the track recurve more northerly. The models continued the northward movement and the Hurricane Specialists forecast diminishing intensity over the next 24 h as the storm moved over colder water. Fortunately, the storm was far enough north and east (location 17.8°N, 119.8°W) to do a repeat of the Inner Core Dynamics Experiment. We briefed for a takeoff at 1100 local time (1700 UT). The intended flight tracks were the same as executed the previous day, a "rotating Figure 4" pattern with 50 nm radial legs about the storm center. N42RF would enter the pattern from the N and maintain 10 kft RA throughout the flight, while N43RF would enter the pattern from the E and maintain 14 kft RA. Thanks to the more northward storm location we planned to get 4 h of on station time, allowing for at least 8 legs across the eye. N43RF would drop one ODW along the ferry, one ODW at the end of the flight legs in each of the four cardinal locations around the storm, and one ODW in the eye. If the Radian system could be repaired on the ferry, each ODW drop would be accompanied by a Radian LOD2 for intercomparison.

Mission Synopsis:

Departure from Puerto Vallarta was delayed until 1734 UT. The approach to Olivia was from the E with an expected ETA of 2000 UT near 19.5°N 120.5°W, with an IP 50 nm E of that position. The ODW/LOD2 drop along the ferry was canceled because the LOD2 system was still inoperative. At 1953 UT, ~200 nm from the IP, we started picking up the center with the lower fuselage (LF) radar. The LF indicated that there was a smaller eye than the day before (10-12 nm in diameter). The eyewall reflectivity appeared less intense than the day before and there were multiple rainbands surrounding the eye. The principal rainband and the bulk of the stratiform precipitation was in the NE quadrant, as opposed to the SW quadrant the day before.

N43RF reached the IP (18.95°N 119.3°W) at 2022 UT, dropped an ODW (failed) in a region of stratiform rain, and tracked W across the eye. Both aircraft crossed the center of the eye at 2033 UT, within 10 s of each other, fixing the center at 18.95°N 120.05°W. The eye was magnificent, with a "stadium" appearance above the flight level and swirls of low cloud below. The inner edge of the eyewall cloud, at a radius of ~5 nm from the center, was very distinct, with numerous cloud striations along the inside edge above the aircraft altitude. A second ODW was dropped at the westernmost point (of the first leg (2) 18.95°N 120.95°W) in relatively clear air west of the main rainbands on that side of the storm.

The second leg started at 2055 UT from a point 50 nm SW of the center (3) (18.35°N 120.65°W), on a NE track through the center. Along the SW-NE leg we encountered what appeared to be a secondary wind maximum in a rainband 35 nm from the center. We passed through the eye at 2106 UT (19.0°N 120.1°W), dropping an ODW as we saw N42RF pass beneath us. The splash pressure was 925 mb. We had another beautiful look at the eyewall on the second pass and encountered 124 kts winds in the NE eyewall. During this SW-NE leg Bob Black noted that the 2DP seemed to be leaking when ever we were in heavy precipitation.

We reached the NE point (4) (19.7°N, 119.45°W) at 2119 UT and tracked downwind, attempting to drop an LOD2 (failed). At point (2), 50 nm N of the center (19.9°N 120.1°W), we dropped another ODW after we turned inbound. We passed through the eye at 2138 UT (19.1°N 120.05°W), within 5 s of N42RF. We passed under a "shelf" of cloud as we entered into the S eyewall. The shelf appeared to be part of a major cloud striation along the NE portion of the eyewall. We dropped an ODW and a LOD2, both of which failed, at the point 50 nm S of the center (6) (18.25°N 120.05°W). On leg 4, which started 50 nm SE of the center (7) (18.5°N 119.4°W), we dropped an ODW in the eye at 2211 UT (19.2°N 120.05°W) as we saw N42RF pass beneath us. The splash pressure was 930 mb, but the ODW may have missed the center. As we entered the NW eyewall we passed through the large cloud striation associated with the shelf cloud from the N-S leg. The striation sloped downward and downwind from the aircraft flight level, ending in a swirl of low clouds just south of the aircraft position. We encountered strong downward motion (-10 m/s) and intense precipitation upon passing through the striation. The radar system failed at 2320 UT near the end of the SE-NW leg (8). Terry Lynch worked on the radar system during the downwind leg to a point 50 nm W of the center (2). We orbited at 2 until the radar system was restarted and then started our fifth leg at 2238 UT, dropping an ODW in the clear at 2 (19.05°N 121.05°W).

Along the W-E leg we skirted along the S eyewall as we passed 2-3 nm S of the center at 2249 UT (19.3°N, 119.95°W). The eyewall had taken on a very distorted state since the last pass through the center, appearing more elliptical. There was a large outward bulge in the NE quadrant of the eyewall, with intense reflectivity centered in the N quadrant. We reached (1) (19.4°N 119.1°W) at 2300 UT and turned toward a point 50 nm NE of the center (4), dropping an ODW in the stratiform rain region. The next leg started at 2309 UT from 4 (19.85°N 119.5°W), passing through the eye at 2318 UT (19.3°N 120.0°W), 10 s ahead of N42RF (the worst synchronization of the day). When we reached 3 (18.7°N 120.55°W), I realized that the TA radar was tilted +10° (likely for the whole NE-SW leg).

The next leg started at 2338 UT at 6 (18.55°N 119.9°W), where we dropped an ODW. We passed through the eye at 2349 UT (19.4°N 119.9°W), dropping a third ODW in the eye after N42RF passed below us. On this S-N leg we encountered the most intense reflectivity in the N quadrant of the eyewall, with heavy rain and occasional graupel. At 5 (20.2°N 119.9°W) we turned around and tracked S toward the eye at 0002 UT. At 0013 UT we turned toward the E in the eye (19.6°N 119.9°W) and finished the pattern at 0019 UT about 20 nm E of the center. We passed 1 (50 nm E of the center) at 0024 while climbing to our ferry altitude back to Puerto Vallarta. The navigator computed a storm motion of 360° at a speed of 4 kts over the 3.75 h of the experiment.

Evaluation:

Another fantastic flight!! Bob Burpee says that the last two missions were probably the best set of back-to-back missions HRD/AOC has flown in the last 15 years. Once again the aircraft coordination was outstanding, with the AOC flight directors and navigators deserving the lion share of the credit. We achieved seven complete mappings of the inner core within 50 nm radius of the storm center for true dual Doppler analyses over a 3.75 h period. The EVTD analyses performed on the aircraft showed that the storm had reached maximum intensity near the beginning of the mission and may have decayed during the mission. The azimuthally-averaged tangential winds were 60-65 m/s during all but the last pass through the center. The radius of maximum winds had contracted from 16 km radius the previous day to 12 km radius during this mission.

Nine ODWs were dropped, of which three were in the eye, four at the cardinal points and 2 failed. The three ODW drops in the eye had a much different structure to those the previous day and in Hurricanes Gloria, Emily and Gilbert. All three ODWs were characterized by relatively dry isothermal layers from the aircraft altitude to the height of a distinct inversion between 825 mb on the first drop and 750 mb on the last drop. Below the inversion ,the air was nearly saturated.

This data set, combined with that from the previous day, will be outstanding for studies of inner core dynamics and evolution. The storm's small size and intensity, were ideal for this experiment. The inner core out to at least three eye radii distance were within the domain mapped by the Doppler radars. The fourteen complete mappings over the two days (one analysis every 33 min) while the storm was intensifying the first day and filling the second day should provide an excellent opportunity to study the temporal evolution of the primary and secondary secondary circulations in the eyewall. These data should also help improve our understanding of the interaction of the inner core and the environment as the storm recurved.

N43RF also transmitted three radar composites and 6 of the 9 ODWs back to NHC via ASDL. All the radar composites were received and decoded for the hurricane specialists. They were very happy to receive all the information as it confirmed that the storm was intensifying and starting to recurve.

Problems:

1. VCR for the right side video camera failed. No video from that camera was recorded.

2. LOD2 system failed to come up. Jim Fremmel worked on it the whole flight - no luck. May be a bad receiver.

3. 2DP seems to fill with water when in heavy precipitation. Unclear how much data were lost.

4. The radar system locked up twice, once just after takeoff, and again at 2220 UT on the downwind leg NW of the storm (between 8 and 2). Both time the system needed to be restarted and was up again within 10 min. The second time Terry Lynch restarted the system at 2237 UTC at 2, 50 nm W of the center.

5. Nose radar display periodically failed during the penetrations causing the pilots much consternation. Each time Jack Parrish kept the mission rolling despite the pilots unease.

Frank Marks

INNER CORE STRUCTURE AND EVOLUTION EXPERIMENT

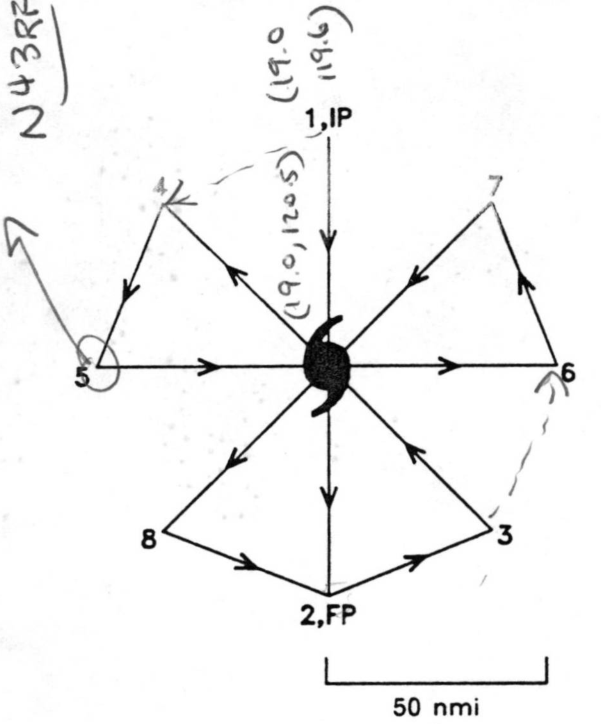


Fig. 9. Inner Core Structure and Evolution Experiment: Upper aircraft pattern.

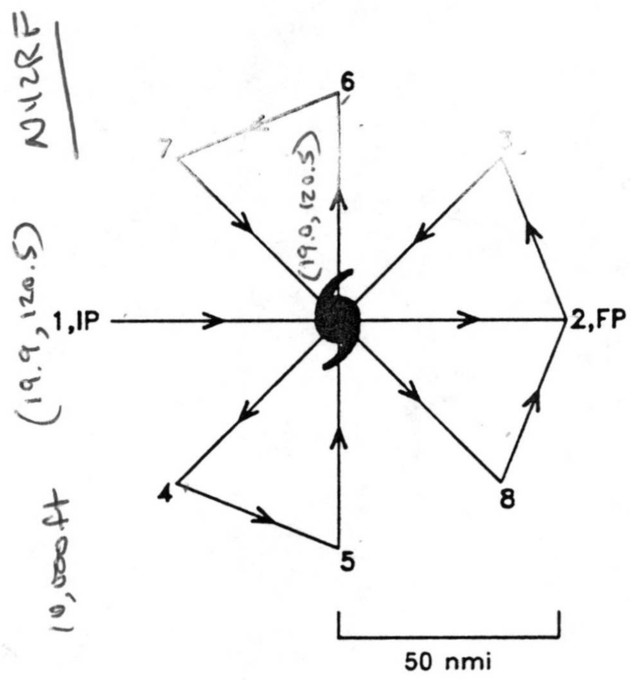


Fig. 10. Inner Core Structure and Evolution Experiment: Lower aircraft pattern.

Note 1. AOC upper and lower aircraft fly 1-2-3-4-5-6-7-8-2 in their respective patterns (Figs. 9 and 10, respectively).

Note 2. Each aircraft should be at the designated altitude upon reaching the IP and should maintain that altitude until point 8.

Note 3. True air speed calibration is required (Fig. C-1).

Note 4. The patterns may be entered along any compass heading, but the upper aircraft pattern should always be rotated 90° counterclockwise from the lower pattern.

Note 5. Aircraft may attempt to find a wind center on each pass, but should not "hunt" unless directed to do so. Track deviations should be kept to a minimum (10° or less).

Note 6. Cross checks between the aircraft INE and hard reference points or radio navigation aids are essential.

Note 7. During each pattern, the ODW drop in the eye should occur during the first pass through the center (a backup would be dropped in the second pass). During passes with ODW drops, the upper aircraft should be 5 min behind lower aircraft.

Note 8. During downwind legs, Doppler radar should be operated in FAST (forward/aft scanning technique) mode. (Not applicable to aircraft with dual-beam antenna.)

N43RF
MARKS
WILLOUGHBY
FRANKLIN
GRIFFIN
R. BLACK

N42RF
GAMACHE
DODGE
P. BLACK
BURPEE
LAWRENCE

INNER CORE STRUCTURE AND EVOLUTION EXPERIMENT

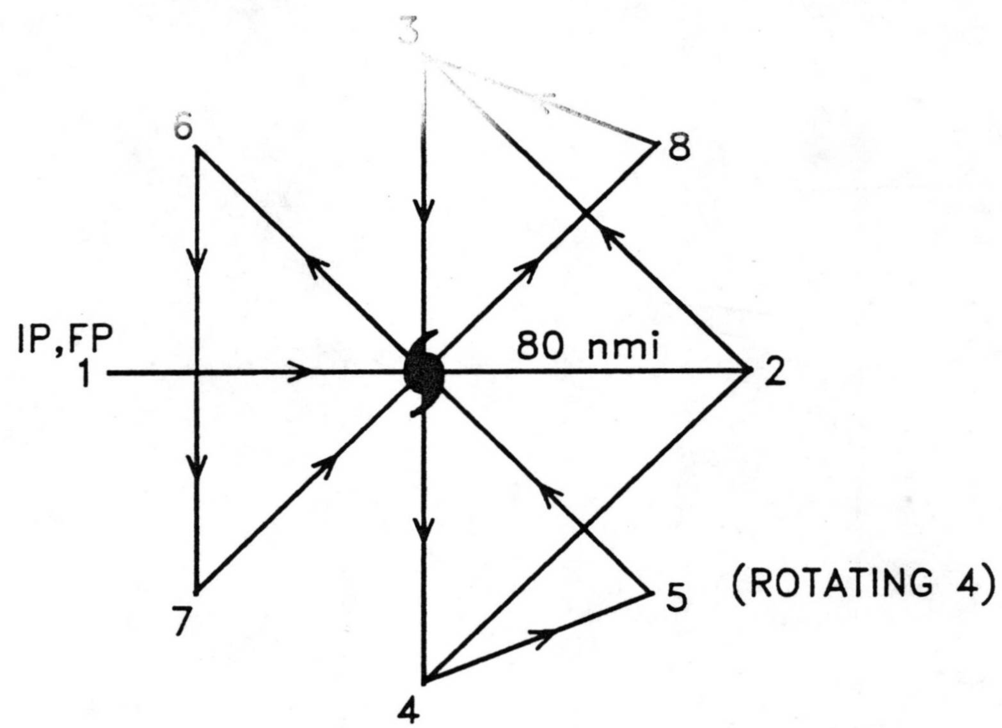


Fig. 11. Inner Core Structure and Evolution Experiment: Single aircraft/dual-beam radar flight pattern.

Note 1.	AOC aircraft with dual-beam radar antenna flies 1-2-3-4-5-6-7-8-3-4-2-1 at 10,000 ft PA.
Note 2.	Aircraft should be at the designated altitude upon reaching the IP and should maintain that altitude until point 8. Climbing to a new level should be done at the IP,FP.
Note 3.	True airspeed calibration is required (Fig. C-1).
Note 4.	The pattern may be entered along any cardinal compass heading.
Note 5.	Aircraft may attempt to find a wind center on each pass, but should not "hunt" unless directed to do so. Track deviations should be kept to a minimum (10° or less).
Note 6.	Cross checks between the aircraft inertial navigation equipment (INE) and hard reference points or radio navigation aids are essential.
Note 7.	During each pattern, ODW drop in eye should occur during first pass through the center (a backup would be dropped in second pass).

Single-plane option: This experiment normally requires two aircraft; however, if the dual-beam antenna is aboard one aircraft, that aircraft may be operated alone to perform this mission. The pattern flown would then be the "rotating-4" pattern shown in Fig. 11. ODW's should be dropped in that pattern at points 1, 2, 3, 4, and in the eye during pass 1-2 (a backup may be dropped in the eye during pass 3-4).