19980823H1-LPS

E.2 Lead Project Scientist (On-Board)

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.

_____ 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.

_____ 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.

_____ 7. Prepare written mission summary.

On-Board Lead Project Scientist Check List

Date ____________ Aircraft 42RF Flight ID 980823H

A. Participants:

HRD Function	HRD Participant	AOC Function	AOC Participant
Lead Project Scientist	P. Black	Flight Director	Stan Cygnyk
Cloud Physics	J. Cione	Pilots	Jim O'Meara, R. Philippsborn, Brian Taggart
Radar	M. Black / F. Marks	Navigator	Dave Rathbun
Workstation	P. Leighton	Systems Engineer	George Delgado
Photographer/Observer		Data Technician	Sean McMillan
GPS ~~Omega~~sonde	M. Black, W. Bracken	Electronics Technician	Jim Barr
AXBT/AXCP/Guest	J. Cione	Other	

Take-Off: 1745Z Location: St. Croix

Landing: 0145Z Location: Tampa/MacDill

Number of Eye Penetrations: ______

B. Past and Forecast Storm Locations:

Date/Time	Latitude	Longitude	MSLP mb	Maximum Wind kt	
23/12Z	24.0	71.7	959	105	stationary
* 23/21Z	24.0	72.0			
23/1532	24.17	71 38	957	110	eye open SWSW mod turb E quad

* forecast

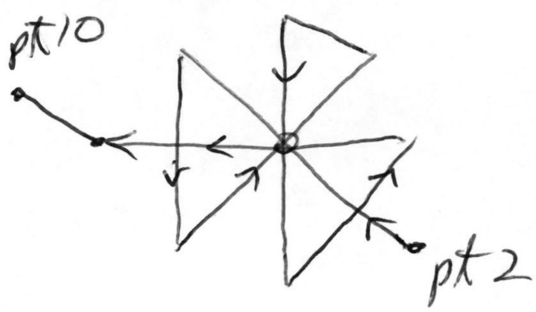
C. Mission Briefing:

3 plane synoptic flow; P-3's do 2 rotated Fig 4; will fly RA, not δA; NASA DC-8 at 39K ft making drops + ER-2; no AFRES C-130 so 42 has recco respons.

D. Equipment Status (Up, Down, Not Available, Not Used)

Equipment	Pre-Flight	In-Flight	Post-Flight
Aircraft	✓		
Radar/LF	✓		
Radar/TA (Doppler)	✓		
Cloud Physics	✓		
Data System	✓		
GPS ~~Omega~~sondes	✓		
AXBT/AXCP	✓		
Workstation	✓		
Videography			

REMARKS:



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

E. (II) **Actual Flight Pattern**

17

#1

Lead Project Scientist Event Log

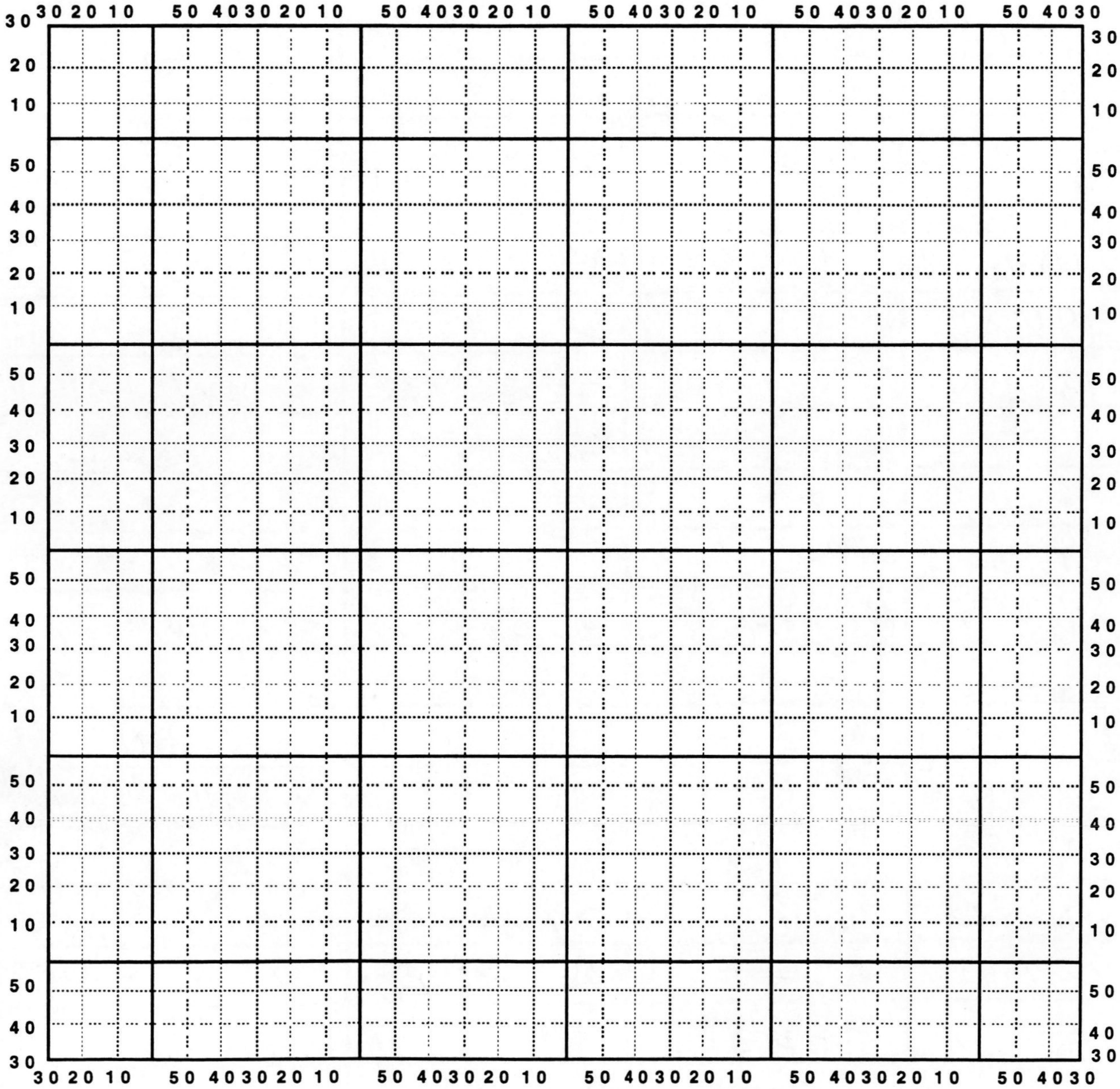
Date 980823H Flight ______ LPS R. Black

Time	Event	Position	Comments	
183010	drop #1	2100 6503		NASA 817 37K ft
1835	dense dust / haze to 15K ft			2436 7142
185939	drop #2	2131 6730	43: 15K ft RA?	1850Z
	NASA call!	NASA 817 DC-8	NASA 804	
1918	at NASA pt 4	2147 6857		2437
193152	drop #3	~~[illegible]~~		7138
1930		2433 7138	est radar eye fix	2424 7138
			eye dia 25 n mi	
2004		2004	NASA est for center	
1953			NASA 804 52-53K ft Topo	
① 195845	drop #4 SE 50 mi	2357 7058	winds drop 80 -> 65 kt inside band	
			55-60 K ft NASA	
② 200708	wall drop #1 drop #5	2422 7126	83 kt - SE eyewall - strong convection	
200731	BT #1	2225 7128	SST = 26.1 MLD = 90 m	
③ 200825	wall #2 drop #6	2426 7129	SE eyewall NG	
④ 201222	drop #7 eye 1	2439.4 7142.9	eye drop NG	
AVAPS down reboot 201312	BT #2		NG	
2010		2435 7150	NASA 37K ft	SW 8 mi from 8-3
⑤ 202158	drop #8	2510 7218	WS = 58, max was 70 kt	
	BT #3	~50 mi point NW	NG	

Hurricane Recco Plotting Chart

True at 25° Latitude, in Degrees and Minutes

Date ______________ Flight ID ______________ LPS ________________.



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

H2

Lead Project Scientist Event Log

Date 080823H   Flight ________   LPS Black

	Time	Event	Position	Comments	
	202425	turn pt 13	2509 7227	NW pt	2047
	203540	turn pt C		SW pt	
				2049 NASA eye	
6	204245	drop #9 wall 3	2423 7201	SW ~~[illegible]~~ wall	
[illegible]	204436	BT #4	2430 7153	SST = 27.0	
7	204543	drop #10 wall 4	2434 7145	SW wall	
8	204724	drop #11 eye 2	2439 7144	center eye drop	
	2047	center	2439.1 7144.4	eye 956 mb	
9	205048	drop #12 wall 5	2451 7130	NE wall	
		BT #5	2454 7127	SST = 27.5	
10	205220	drop #13 wall 6	2456 7124	NE wall	
	2055			75 kt	
[illegible]	205800	turn pt D	2515 7106	NE 50 mi pt	
11	205945	drop #14	2520 7115	NE 50 mi sonde	
	210545		2526 7146		
12	210825	drop #15	2515 7146	in rainband	
	211230			80 kt	
13	211300	drop #16 wall 7	2453 7146	N eye	
		BT #6		SST=27.5	
	211551		2440.7 7145.8	eye center	

3

Lead Project Scientist Event Log

Date 980823H   Flight ____   LPS P Black

	Time	Event	Position	Comments
	211930	~~drop #17~~	2423 7145	92~~87~~ kt no sonde drop
(14)	212055	drop #17 wall 8	2415 7146	drop NG S eyewall
		BT #7		SST = 26.5
(15)	212302	drop #18 wall 9	2407 7146	drops on S side eyewall
				missed eyewall; earlier
				drops on SE side missed
	212624	turn pt F		
(16)	212753	drop #~~18~~19	2354 7139	1 sonde CH bad 50 mi S
				NASA 956 mb ridge
			from drop →	102 kt lo lvl ? in
				60 mi N of center band
	214021	turn pt G	2447 7054	
(17)	214120	drop #20	2448 7056	50 mi E
(18)	214800	drop #21 wall 10	2446 7130	77 kt Eyewall sonde
		BT #8		SST = 26.2
(19)	214847	drop #22 wall 11	2445 7133	E eyewall sonde
(20)	215140	drop #23 eye 3	2445 7149	of center 3 mi S eye
	2151		2442.7 7145.9	center Pmin = 956 mb
50 mi W (21)	220258	drop #24	2444 724?	ws = 80 kt: secondary max
50 mi W (22)	220426	drop #25	2445 7257	
Stip outer rainband				10 more drops in synop. flow pattern

#21

Lead Project Scientist Event Log

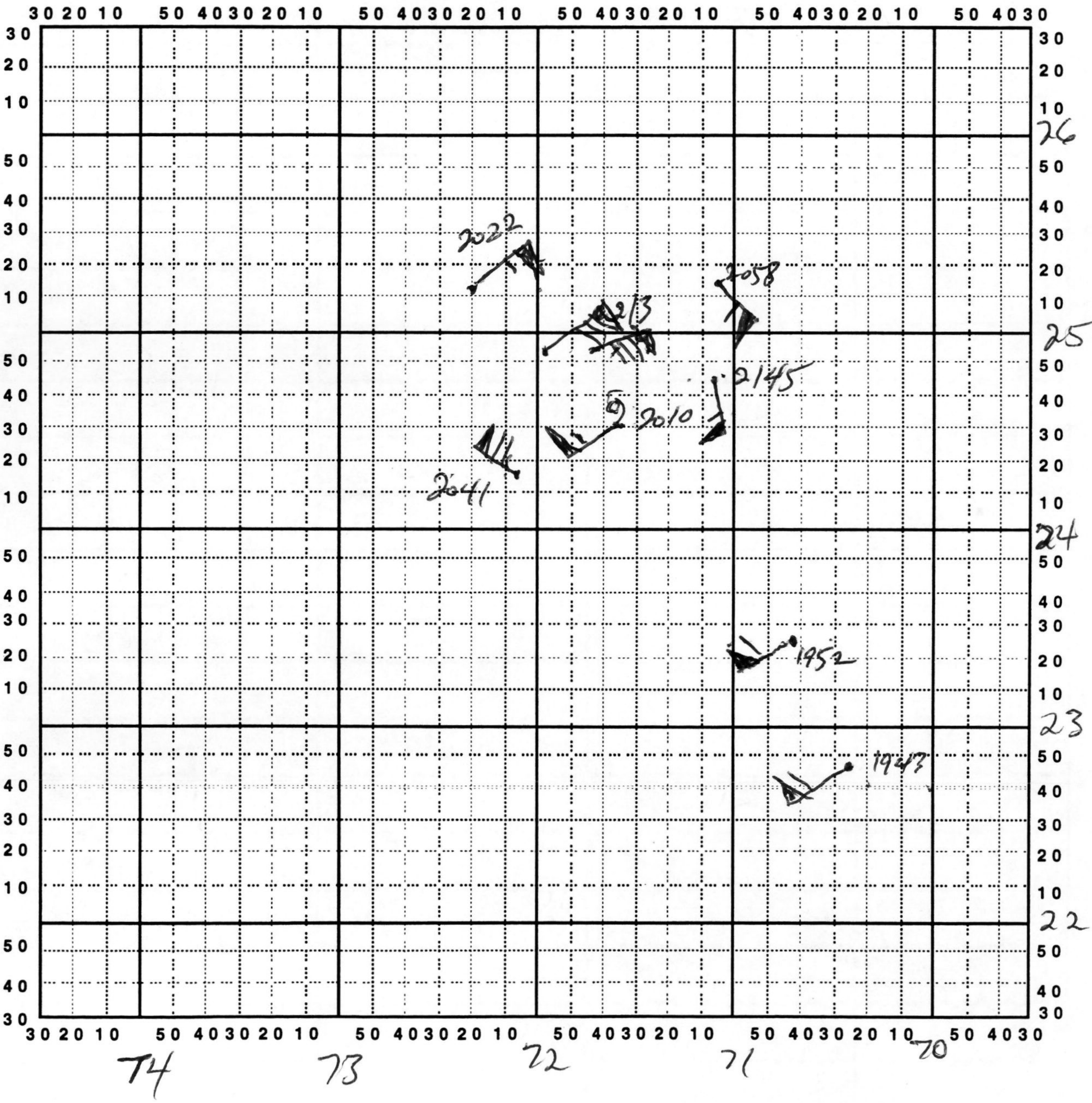
Date 980823H   Flight ________   LPS P Black

Time	Event	Position	Comments
223054	drop #26	2455 7459	

Hurricane Recco Plotting Chart

True at 25° Latitude, in Degrees and Minutes

Date 980823H Flight ID ______________ LPS R. Black.



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

Mission Summary
980823H Aircraft 42RF
Bonnie Five-Aircraft Synoptic Flow

Scientific Crew (42RF)

Lead Scientist	P. Black
Radar	F. Marks
Workstation	P. Leighton
GPS sonde scientist	M. Black
AXBT scientist	J. Cione
Observer	W. Bracken

Mission Briefing:

This flight was part of a 5-plane (two NOAA WP-3D Orion aircraft, NOAA G-IVSP Gulfstream jet aircraft, NASA DC-8 jet aircraft and high-altitude NASA ER-2 aircraft), synoptic-flow mission to drop GPS sondes in the environment around a developing tropical storm. This flight was the third in a series. This mission dropped 22 GPS sondes into the inner core (within 50 nm of the center. Of these, 11 were droped into the eyewall along 8 radial legs in 8 octants of the storm (two failed) and 3 were dropped in the eye (one failed). Seven AXBTs were dropped into the eyewall (1 failed) and one in the eye which failed. Three interesting drops were also obtained in the feeder band wrapping around the storm at a radius of 50 mi from E to N to W. The flight was flown at max altitude 500-450 mb, except for the two rotating Figure 4 patterns in the inner core which were flown at 550 mb (15 kft). The purpose of the flight was to provide improved initial conditions for track models and to discern the eyewall structure of a minimal stationary hurricane.

Mission Synopsis

The flight departed St. Croix International (TISX) at 1745 UTC, 23 August and landed at MacDill AFB, FL at 0145 UTC, 24 August. A total of 33 GPS sondes and 8 AXBTs were dropped during this mission, from 20 kft (15 kft in the inner core), 8 of which were coincident. Two AXBTs and 3 GPS sondes failed. The Figure 4 legs were oriented SE-NW, SW-NE, N-S and E-W. Maximum flight-level wind in the inner core was 85 kt in the western feeder band and SE eyewall, 70 kt at the surface and 106 kt at 925 mb in the E eyewall. Minimum central pressure was 956 mb and the inner eye diameter was 25 nm, while the outer eye/rainband diameter wa 80-90 nm. The storm was stationary.

A major feeder band consisting of several thinner bands was observed spiraling into the inner core to form an outer eyewall from the SE, E, through NE, N and NW. Strongest eyewall convective bands, with cloud turrets extending to 55-60 K ft (as observed by the ER-2),were along the E sector of the inner eyewall (45 dBZ reflectivities). The eyewall was open to the west. A strong CB developed within the clear eye region on the south side as we traversed from N-S, and containing the flight level wind max of 85 kt. 85 kt flight level wind maxima were also observed in the outer band to the N, NW and W of the center. The inner E eyewall had only 65 kt winds at flight level, but 105 kt at 925 mb.

GPS dropsonde wind profiles in the W eyewall, where convection was weak, differed dramatically from those in the E eyewall, where convection was very strong. Profiles in the W showed nearly constant 65-70 kt winds with height down to 400m, near the top of the well-defined boundary layer. Winds decreased linearly from there to the 10-m level where winds were 45 kt. In the E, winds increased downward from 60 kt to 106 kt at 850 mb, maintaining nearly constant wind with height to 60 m, then decreasing rapidly to 70 kt at the 10-m level. In the 106 kt high wind layer, strong inflow was observed with wind direction veering inward by more than 60 deg between 850 mb and the surface. The convection was therefore associated with an enhanced inflow jet in the lowest levels on the E side of the storm. The strong inflow, enhanced southeasterly horizontal flow and strong convection associated with strong updrafts on the east side coupled with enhanced horizontal flow in the upper levels on the W side, some outflow in the low levels and subsidence in the W suggest the vortex was interacting with westerly or northwesterly shear (strong environmental SE low level winds, weak upper level winds). This notion is supported by hodograph plots of mean storm-domain winds computed from TA Doppler radar data.

Doppler radar showed a strong low level wind max of over 100 kt on the east side of the center. The 500 mb center seemed to be displaced about 12 km NE of the surface center, which could be clearly identified by a swirl in the low clouds within the 500 mb eye.

Excellent tail Doppler and lower fuselage radar data were also obtained (3 radar composites were transmitted to NHC in real-time, but no EVTD wind fields were sent). We also collected some good F/AST data along a N-S line of convection 10 nm W of the west eyewall. Cloud microphysics data were also collected (good ice data in the rainbands W of the center and rain data in the inner core).

The successful AXBT launches in the S, SE and E eyewalls reported SSTs between 27.2-26.2C, about 2-3 deg cooler than the 29.0 C SSTs observed 2 days ago. Estimates of ocean mixed layer depth in this region ranged between 60-90 m in this area, about 20-30 m deeper than 2 days ago, suggesting that strong mixing had occurred beneath the storm in the 12-18 hrs that it had remained stationary. This cooling under the eye and E eyewall semicircle may have been priarily responsible for the cessation of the storm deepening and decrease in convection.

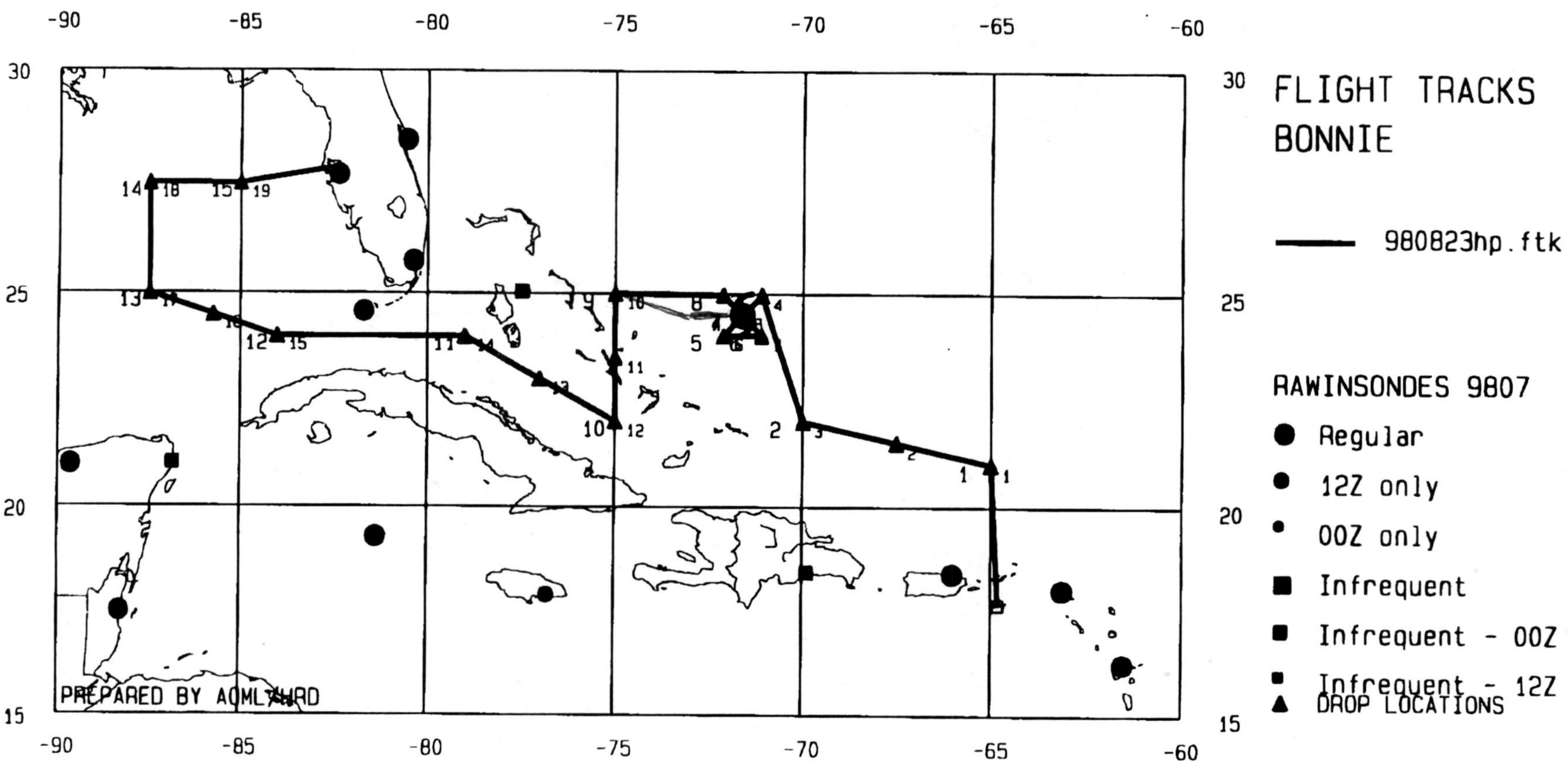
Evaluation:

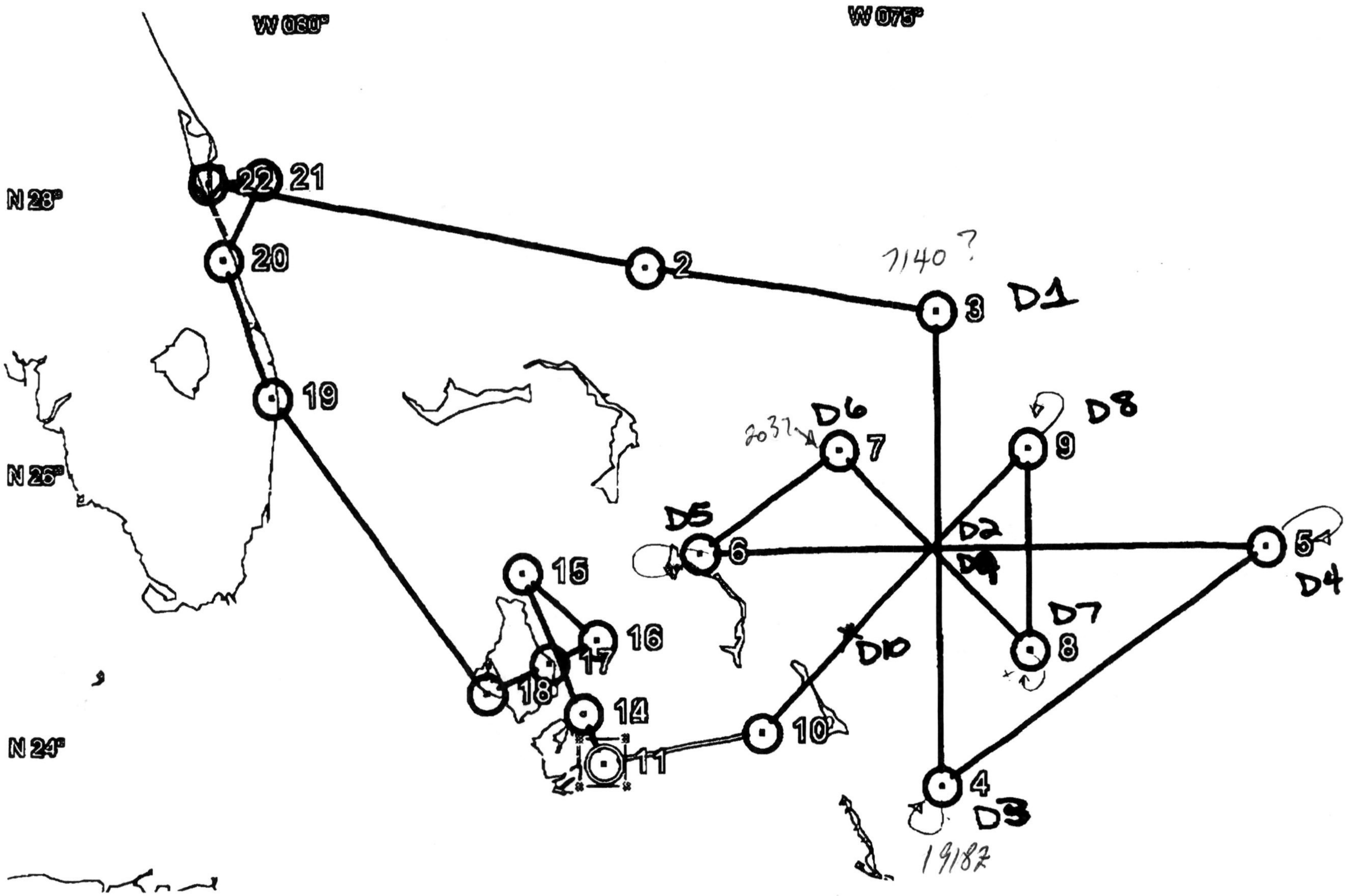
This flight is part of a landmark 5-plane synoptic flow experiment for determining the environmental flow structure of the atmosphere around a developing TC while also determining the oceanic thermal structure beneath the inner core. It marks the first time in history that 5 research aircraft have flown a coordinated pattern simultaneously in a hurricane.

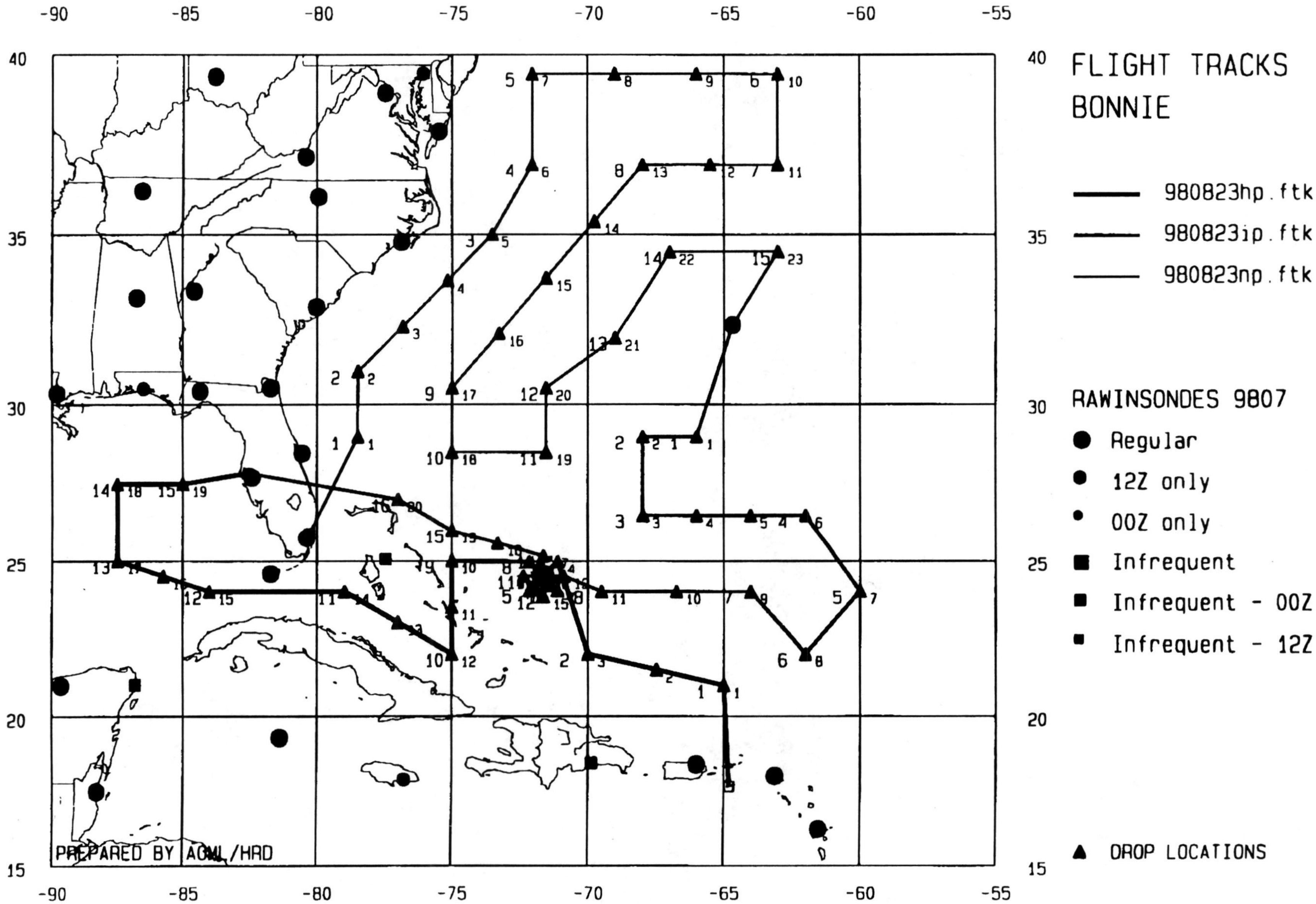
Problems:

Difficulties were again encountered in deploying GPS sonde pairs on either side of the convective eyewall during the SW-NE transit due to a GPS receiver channel failure in the aircraft. This lead to missed drop points in the eyewall.

Peter G. Black

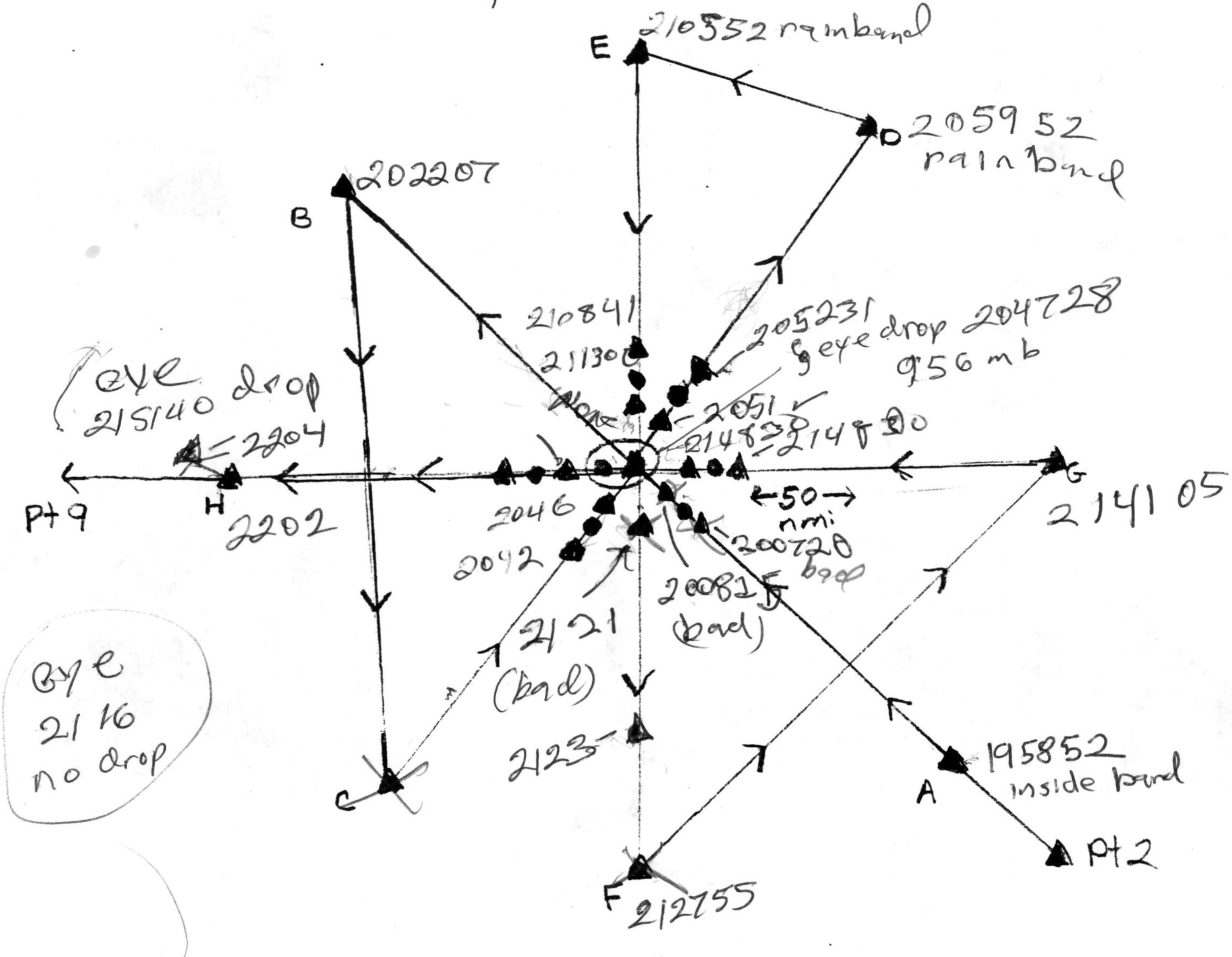

FLIGHT TRACKS
BONNIE
980823hp.ftk
RAWINSONDES 9807
Regular
12Z only
00Z only
Infrequent
Infrequent - 00Z
Infrequent - 12Z
DROP LOCATIONS
PREPARED BY AOML/HRD


W 080°
W 075°
N 28°
N 26°
N 24°
22
21
20
2
7140 ?
3
D1
19
D6
2031
7
9
D8
D5
6
D2
5
D4
15
16
17
18
14
D7
8
D10
10
11
4
D3
19187


FLIGHT TRACKS
BONNIE
980823hp.ftk
980823ip.ftk
980823np.ftk
RAWINSONDES 9807
Regular
12Z only
00Z only
Infrequent
Infrequent - 00Z
Infrequent - 12Z
DROP LOCATIONS
PREPARED BY AOML/HRD
-90
-85
-80
-75
-70
-65
-60
-55
40
35
30
25
20
15

2005

980823H1 Bonnie Inner Core Pattern
15,000 ft



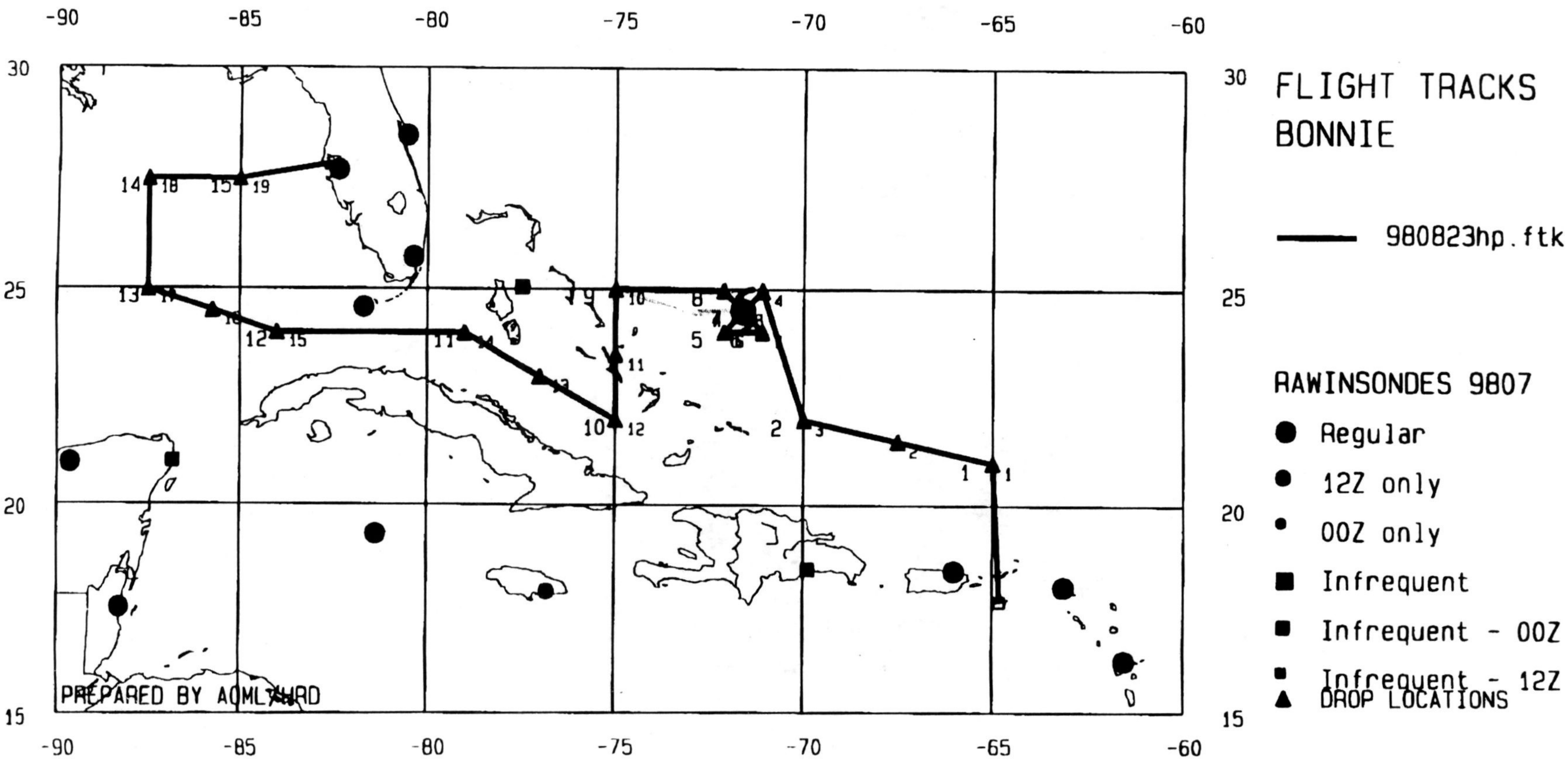
▲ - GPS Sonde

● - AXBT

●▲ - GPS Sonde and AXBT - and ineye between E and F A+B (southbound leg)

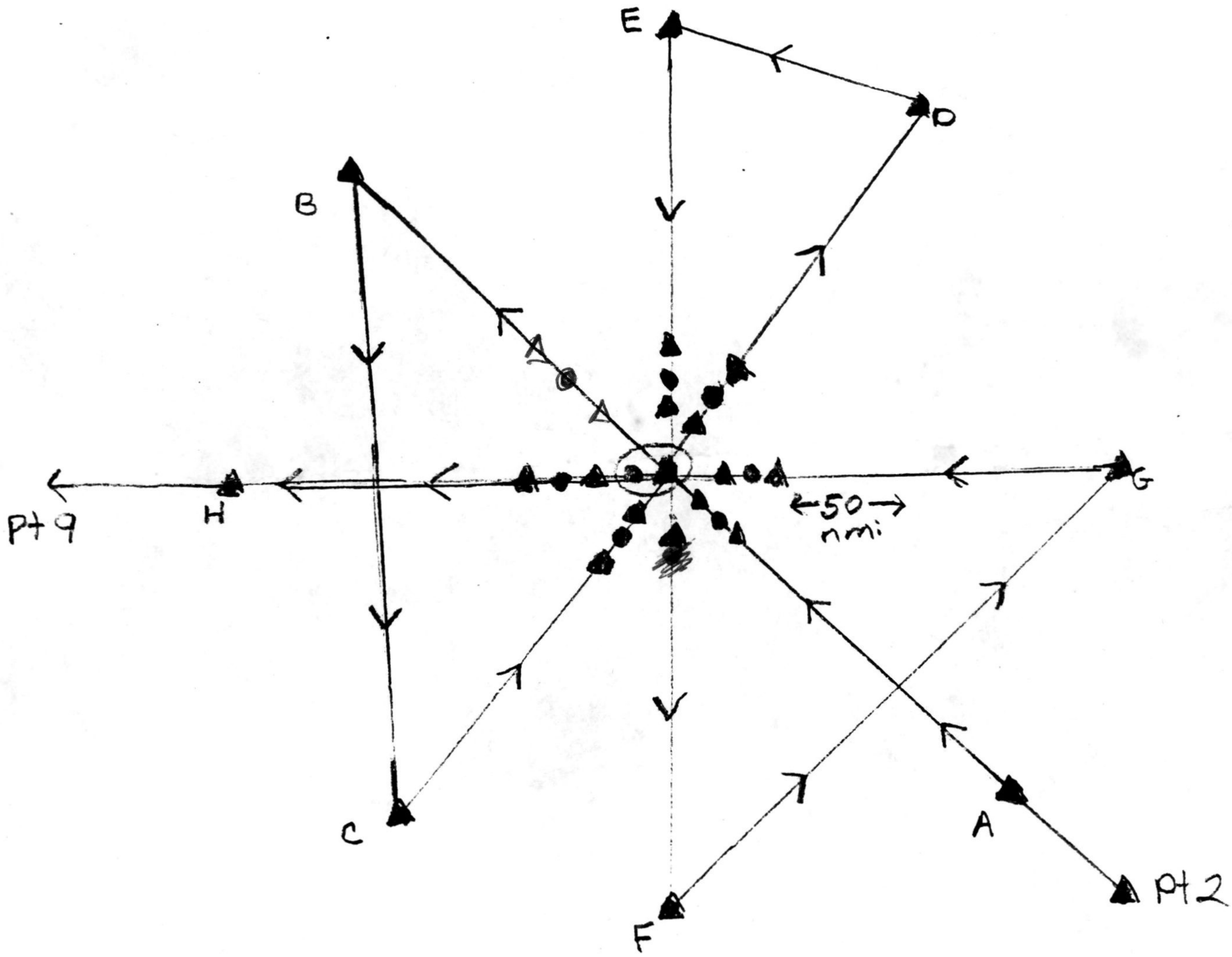
and at ⊙ between A and B

First eye drop bad - 2012


FLIGHT TRACKS
BONNIE
980823hp.ftk
RAWINSONDES 9807
Regular
12Z only
00Z only
Infrequent
Infrequent - 00Z
Infrequent - 12Z
DROP LOCATIONS
PREPARED BY AOML/HRD
-90
-85
-80
-75
-70
-65
-60
30
25
20
15

980823H

980823H1 Bonnie Inner Core Pattern
15,000 ft



▲ – GPS Sonde
● – AXBT
(●▲) – GPS Sonde and AXBT in eye between E and F (southbound leg)