19990806H1_LPS

Mission Summary
990806H Aircraft 42RF
Early-Season: Tropical Cyclone Air-Sea Interaction
Gulf Loop Current/Eddy Flight II

Scientific Crew (42RF)

Lead Scientist	P. Black, L. Shay (US/RSMAS)
AXBT Scientist	J. Cione
AXCP/AXCTD Scientist	D. Jacob (UM/RSMAS)
Observers	G. Goni, E. VanCoverden

Mission Briefing:

This mission was the second early-season, air-sea interaction flight designed to map the boundaries of the Gulf Loop Current and associated warm anticyclonic eddies as well as obtain an initial estimate of the heat content anomalies associated with these features. The experiment designed to measure the current and density anomalies associated with these features as a complement to the thermal anomalies mapped during the 990803H flight, as well as relate the in situ data to TOPEX and ERS-2 satellite-derived estimates of upper layer heat content and layer thickness relative to 20 and 26°C water. The experiment is designed to determine the effect of heat content in anomalous warm eddies in the Gulf of Mexico on hurricane intensity change. A secondary objective was to test the aircraft receiver system for the AXCP (measures temperature and current vector vs. depth) and AXCTD (measures temperature and conductivity (salinity) vs. depth from which density is calculated) probes.

With the help of the thermal analysis from the 990803H AXBT flight, this second flight was designed to map the currents associated with the main Loop Current region and the main anticyclonic warm eddy in the process of breaking off from the northwest region of the Loop Current. The flight pattern zig-zagged across these features while most AXCPs were dropped across the region of strongest thermal gradient, and hence expected strongest currents.

Mission Synopsis

The flight departed MacDill AFB at 1207 UTC and landed there at 2036 UTC, a duration of 8.5 hours, and was conducted at radar altitiude of 5 kft (1.5 km, 850 mb). The flight pattern consisted of a saw-tooth pattern across the Loop Current and warm eddy to the northwest.

After the Mark 10 receiver was switched, success rates exceeded 95%. All data was recorded on 90 minute Digital Analog Tapes for processing within the laboratory. Based on the two AXCPs and AXCTDs deployed on the 3 Aug flight, AOC corrected the problem of 7 dB loss in the cable connecting the antenna to the receiver by adding a preamplifier yielding a 3 dB gain in the signals entering the Mark 10 receiver and Mark 12 cards. A second issue dealt with altitude and speed. It was decided to fly the aircraft at 5000 feet at a speed of 190 knots as per previous deployments.

A total of 18 AXBTs were deployed, all CAD-launched. Clean signals were observed to 350 m on all AXBTs. 18 AXCPs and 16 AXCTDs were also launched. One AXCTD and 4 AXCPs failed due to a defective receiver system. Following receiver replacement with a backup system excellent data was obtained to 1500 m.

Profilers deployed: 18 AXCPs, 16 AXCTDs, and 18 AXBTs
Successful Profilers: 15 AXCPs, 14 AXCTDs, 18 AXBTs
Success Rates: 83% (AXCPs) , 87% (AXCTDs) , 100% (AXBTs)

Evaluation:

Additional detail was added to the structure of the double-lobbed eddy pattern diagnosed by the AXBTs and TOPEX/ERS2 blended analysis from 3 August. Preliminary scientific findings are:

1) Upper layer thicknesses were within 5-10% of those estimated from remote sensing techniques using TOPEX and ERS-2 altimetry;
2) Deep isothermal layers were evident within the Loop Current and warm eddy regions, whereas outside of this regime, shallow mixed layers were eivdent in the data; and
3) Near-surface currents exceeded 1.5 m s^{-1} with large current gradients in the vertical including evidence of internal waves trapped within the eddy.

All data were recorded on 90-minute Digital Analog Tapes (DATs) for post-processing.

Problems:

A defective AXCP/AXCTD receiver was detected, and replaced in flight. This unit is being returned to Sippican, Inc. for repair or replacement. In addition, five profilers will be replaced since the receiver problem was due to the factory.

Peter Black and Nick Shay
8/15/99

Hurricane 1999
Warm Pool Eddy

Flight #1: 990806H N42RF

Sensor or system	Number or Name
INE	1
Accelerometer	1
Temperature Probe	1
Dew Point Probe	2
Altitude (for vertical wind)	RA-159
Static Pressure	Rosemount Fuselage
Dynamic Pressure	Rosemount Fuselage
Time Source	Micro 99
Constants File	CO2991.CON

Notes:

A number of very brief GPS dropouts occurring around 2028Z-2031Z were removed and patched with corrected INE 1 positions. GPS ground speeds were also patched during this period.

The APN-159 Radar Altimeter was patched with good APN-232 positions just before take off and just after landing.

INE1 positions were renavigated using 13 valid GPS positions during the flight.

During the flight, it appeared the Downward Radiometer was reading about 3 degrees C too cold.

	Takeoff	Landing
Aircraft static pressure	1014.8	1014.9
Corrected tower pressure	1013.2	1014.8

The aircraft INE positions were renavigated with respect to GPS.

SPECIAL NOTE!!! Locations 80, 81 and 82 of record five on the standard tape contain vertical ground, vertical air and vertical speeds, respectively, computed using Dave Jorgensen's vertical wind algorithm.
It is recommended that these values be used for vertical wind analysis.

Flight Meteorologist: Jack Parrish, (813) 828-3310 ext. 3077.

U.S. DEPT. COMM./NOAA/OAO - DATA SECTION WORK FORM NO.1 OAOWF1 FILE

FLT ID: 990806H	FM: KMCF	TO: KMCF
FLT NO:	BLK IN: 2045	ATA: 2036
ETD: 122	BLK OUT: 1157	ATD: 1208
ETE: 8+	BLK TIME: 8:48 (8.8)	FLT TIME: 8:28 (8.5)
SPONSOR ORG: HRD	PROGRAM: Research	PURPOSE: Warm Core Ring

OAO PERSONNEL

AC	Taggart ✓	SYS ENG	Roles ✓ / Goldstein ✓
CP	McKim / Philippsborn ✓	DATA SYS	Delgado ✓
NAV	Rathbun ✓	~~RADAR~~	
FE	Bast ✓	DT/ODW	Carpenter ½
RADIO		CLD PHYS	
FD	Parrish ✓	~~DOPPLER~~	Dewey Floyd ✓

PARTICIPATING SCIENTIST/VISITORS/OAO

LAST, FIRST NAME	ACTIVITY ON A/C	AFFILIATION
Black, P. ✓	PI	HRD
Shay, N. ✓	PI	↓
Cione, J. ✓	Drops	↓
Van Gaurden, E. ✓	PAO	
Daniel Jacob ✓		
Gustavo Goni ✓		
Phillip Willette ✓	PA	CBS local

PROPOSED/ACTUAL MISSION/REMARKS (RECCO, FIXES, STORM, PCNET, NHOP #)

Fly BT, CP, CTD pattern over warm ring.

9.92 Numerous rainbands S end of pattern.

13.2 ATIS 3 CTD Failures (1st due to receivers)

0/9 ~~5~~ CP failures (4 due to bad receivers)

3/23.8 Primary failure was a bad receiver from Nick Shay & U of M.

1013.2 Once replaced, much better results.

0/12

15

9.7

4.8 - It appears RD is reading about 3°C too cold.

0/17

4.9

5/23.6

990806H WARM CORE RING (WAD)

Time	LAT	LON	TK	WD	WS	P1	C1	TA	TD	SP	PS	RD		
1157	27 51	82 29.6						25.7	22.8		1013.1		BLK	
1209	27 49	82 32	185	206	11	263	279	24.6	22.3	1012.9	968	SHWRS	CS	3K
1225	27 08	83 10	241	190	8.4	3365	3555	7.7	3.8	1011.9	469			
1245	26 33	84 07	243	212	13.4	1526	1611	17.4	13.1	1014	842.9	- 5K	SHWRS	
1248	26 15	84 35											BT	2 (1)
1256	26 05	84 57	241	205	14	1522	1612	16.9	14.8	1014.7	843.2			
1303	25 46	85 13		201	16			16.5	14.9	1015		24	CTD	2 (3)
1313	25 23.9	85 35.9	226	210	16.6	1522	1610	16.2	15.0	1015.1	843	23.6	CP	14 (3)
1323	25 00	86 03	236	212	19	1522	1612	16.3	15.5	1015	843	21.9	BT	16 (4)
1330	24 50	86 26	229	213	21	1522	1607	17.7	15.6	1014.4	843.6	24.0	CTD	14 (5)
1340	24 30	86 51	223	219	16.4	1519	1607	17.0	13.7	1014.5	843.3		BT	16 (6)
1349	24 09	87 15	265	149	26	1536	1625						CTD	4 (7)
1353	24 07	87 35	276	232	26	1534	1633	16.5	12.9	1014.8	841.9		CTD	6 (8)
1401	24 09	87 56	281	226	17.8	1532	1619	16.8	15.4	1014.4	841.9		BT	12 (9)
1414	24 26	88 34	285	224	15.8	1530	1610	17.3	14.4	1013.4	842.3		CTD	16 (10)
1421	24 35	88 59		208	5.9	1531	1610	16.8	13.8	1013.6	842.5		CTD	14 (11) Drop
1427	24 55	88 50	22	176	2.5	1527	1604	17.1	15.3	1013	842		BT	12 (12)
1432	25 09	88 43	25	89	1	1532	1607	17.8	10.5	1012.6	842	23.7	CP	16 (13)
1440	25 26	88 38	Orbiting to fix current probes - laptop											(14)
1450	25 26	88 36	25	147	2.1	1529	1608	17.7	11.1	1013.1	842	23.0	CP	14 (14)
1510	25 45	88 26	26	140	2.8	1529	1607	17.0	14.4	1013.3	842.5		BT	12 (15)
1545	26 11	88 14		127	4.3			17.5	12.5	1013.4			BT	16 (16)
1534	26 38.7	88 01.7	36	127	7.6	1530	1616	17.2	14.0	1014	DEAD	AEC	CP	14 (17)
1524	27 06	87 46.5	27	145	11	1531	1620	17.5	13.4	1014.4			BT	16 (18)
1534	27 35	87 33	29	102	11	1530	1623	18.3	12.7	1014.4			CTD	26 (19)
1547	27 16	88 21	249	75	9.2	1529	1622	17.7	13.0	1014.5	842.5	24.1	CTD	12 (20)
1556	27 04	88 55	249	70	12	1530	1621	17.4	13.5	1014.6	842.6		CP	16 (21)
2138	26 56	89 16		67	12			16.9	14.5				BT	12 (22)
1607	26 49	89 38	249	67	13.3	1529	1619	18.4	9.5	1014.4	842		Drop	(22A)
1612	26 43	89 56	252	67	16.5	1530	1619						BT	16 (23)
1617	26 37	90 17	249	72	13	1531	1622	17.1	15.2	1014.5	842.6		CP	14 (24)
2222	26 30	90 36	248	66	9.4	1531	1620	17.0	13.9	1014			CP	12 (25)
2920	26 25	91 00	31	68	10	1530	1621	17.1	13.4	1014.9	842		CTD	14 (26)
3829	26 51	90 42	30	87	8.2	1529	1622	17.3	9.9	1015			CP	16 (27)
4312	27 05	90 33	29	100	10	1529	1623	17.4	11.7	1014.7			BT	12 (28)
4957	27 26	90 21	25	93	11.5	1531	1629	17.9	10.8	1015			CTD	14 (29)
5820	27 51	90 06.5	29	98	12.2	1531	1630	17.7	8.6	1015.3	842.8		BT	16 (30)
0520	27 58	89 45	178	85	14	1527	1623	17.4	9.5	1015.2	842.3		CTD	16 (31)
0926	27 44	89 44	173	64	10.8	1529	1623	18.2	11.1	1014.7			CP	12 (32)
1452	27 23.5	89 41	174	72	12								BT	16 (33)
2440	26 53	89 40	158	67	9.3	1530	1621	17.5	11.2	1014.7			CTD	14 (34)
3229	26 24	89 35	169	64	10.8	1529	1615	17.7	11.1	1014			CP	16 (35)
3645	26 09	89 32											CP	14 (36)
4315	25 53	89 23	63										CTD	12 (37)
4719	25 39	89 09	66	80	5.2	1529	1613	17.2	13.8	1014	842.6		CP	14 (38)
5011	26 03	88 59	66	61	4.9	1531	1612	17.8	13.2	1013.3	842.4		CP	12 (39)
0129	26 19	88 19	64	153	6	1527	1609	17.3	14.6	1013.3	842.4		CTD	16 (40)
1648	26 38.7	87 24.1	67	173	6.9	1529	1616	17.4	13.9	1014	842.7		CP	12 (41)

990806H WARM RING DROPS (HRD) Page 2

Time	LAT	LON	FLT	WD	WS	AT	GA	TA	DT	SP	PS			
182350	26 47	86 59	67	155	8.9	1529	1618	17.3	14.8	1014.3	842.5		BT 16	(42)
183410	26 58	86 25	202	156	8.6	1530	1621	17.7	15.4	1014.3	842.5		CTD 12	(43)
184444	26 25	86 38	195	194	7.5	1529	1616	17.2	14.4	1014.4			BP 16	(44)
185045	26 04	86 41.4	191	188	10.3	1529	1613	18.2	13.2	1013.4	842.6		BT 12	(45)
185648	25 45	86 47	193	189	7.5	1529	1614	17.8	14.0	1013.6	842.5		BT 12	(46)
190252	25 24	86 52		245	12.6			17.1	14.2				CTD 16	(47)
190610	25 14	86 49	155	245	9.5	1530	1619	17.2	13.5	1014.5	842.4		Drop	
191738	24 48.6	86 23.7	24	224	21.8	1529	1623	17.4	13.3	1014.9	842.4		CTD 14	(48)
192459	25 10	86 04	51	228	22	1529	1625	17.3	13.5	1015.2	842.6		CTD 16	(49)
193221	25 29	85 39	50	224	25	1530	1625	17.2	12.5	1015	842		CP 4	(50)
193943	25 46	85 14	67	222	23	1529	1628	17.3	12.7	1015.7	842.5		CTD 2	(51)
194535	25 57	84 53	32	228	25.5	1533	1632	17.7	12.1	1015.2	843.3		BT 12	(52)
195730	26 39	84 20	↑ 7K	11K										
2027	27 48	82 28	49	243	20	777	828	21.1	20.4	1013.9	823			
2045	27 51	8229.6				-2.		27.2	23.0		1013.5		BLOCK IN	

On-Board Lead Project Scientist Check List

Date 6 Aug '99 Aircraft 42RF Flight ID 990806H

A. Participants:

HRD		AOC	
Function	Participant	Function	Participant
Lead Project Scientist	P. Black / N. Shay	Flight Director	Jack Parrish
Cloud Physics	—	Pilots	Philippsborne, McKim
Radar	—	Navigator	D. Rothbun
Workstation	—	Systems Engineer	J. Roles / A. Goldstein
~~Photographer~~/Observer	E. Van Coverden	Data Technician	George Delgado
Omegasonde		Electronics Technician	
AXBT/AXCP/Guest	Cione / Jacob / Goni	Other	

Take-Off: 1207Z Location: MAC Dill

Landing: 2036Z Location: MAC Dill

Number of Eye Penetrations: ____

B. Past and Forecast Storm Locations:

Date/Time	Latitude	Longitude	MSLP	Maximum Wind

C. Mission Briefing:

Gulf Loop Current / Eddy Air-Sea Interaction flight

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.

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	✓		
Omegasondes	—		
AXBT/AXCP/AXCTD	✓ ✓ ✓		
Workstation	—		
Videography			

REMARKS:

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

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

Lead Project Scientist Event Log

Date _____ Flight 990806H LPS P. BLACK/N. SHAY

Time	Event	Position	Comments
124933	FP, BT2, #1	26K 8437	at 5K ft
5104	SST 30.0C		
125214	20C		
125312	15C		
130333	CTD2, #2	2544 8513	good
131331	CP4, #3	2524 8540	ok data only, died 30sec
132322	BT6, #4	2500 8603	
2505	SST 29.2		
48	20C		
	15C		
133056	CP2, #5	2449 8627	carrier only, no modulation
		IAS = ~~195~~ 193	IAS too high on last 2 CPS will launch at 185 ~~kt~~ IAS
134015	BT6, #6	2429 8651	
134200	SST 29.2		
4505	20C		
4648	15		
134945	CTD4, #7	2409 8714	dropped in convective cell
	signal noisey		~~93~~ 4 on sfc
135533	CP6, #8	2407 8737	MK10 (VM) failed
140143	BT2, #9	2408 8756	
140315	SST 28.8		

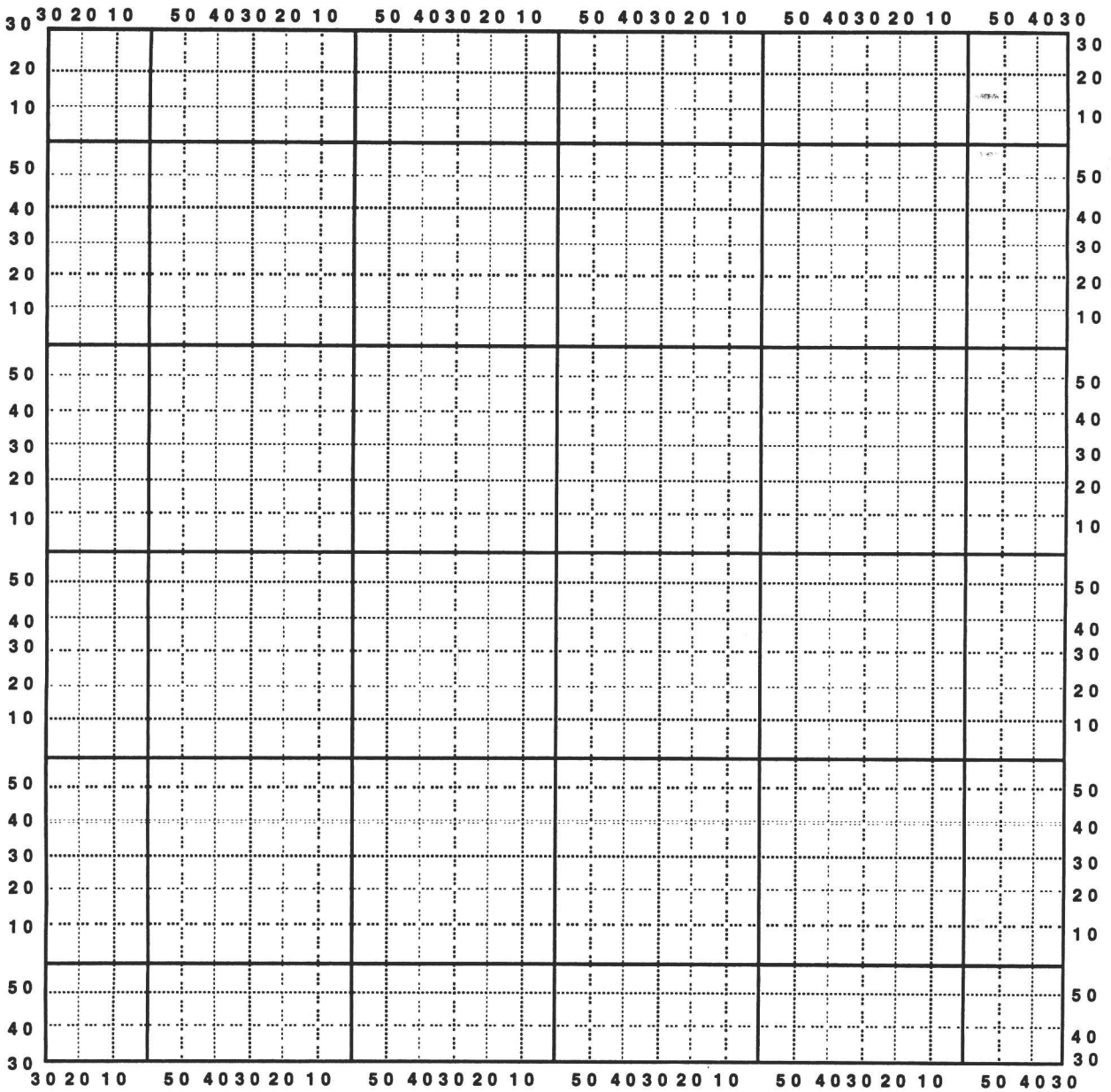
lock IAS ~~195~~ → NG

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.

(2)

Lead Project Scientist Event Log

Date _____ Flight 9F 080 6H LPS P BLACK, N. SHAY

Time	Event	Position	Comments
	20 C		
140458	15 C		
141400	BT16, #10	2426 8835	
141347		TA,	LF down
~~141400~~	~~B 28.~~		
141547	SST 28.1		
141632	20C		
141719	15C		
142120	~~CTD4, #11~~ turn (2)		
142140	CTD4, #11	2435 8900	GPS drop #1
142240			clear of rain bands
	~~CTD signal started late~~		OK
	CTD noisy below 500m		
142735	BT2, #12	2435 8850	
142909	SST 29.0		
	20C		
	15 C		
143216	CP6, #13	2511 8843	MK10 on wrong CH
	IAS = 185		but recorded fine
1440	orbiting, IB 770 crash		
	replaced TA R/T unit		
	LF back up		

pt (2)

Lead Project Scientist Event Log

Date ______________________ Flight ______________________ LPS ______________________

Time	Event	Position	Comments

Lead Project Scientist Event Log

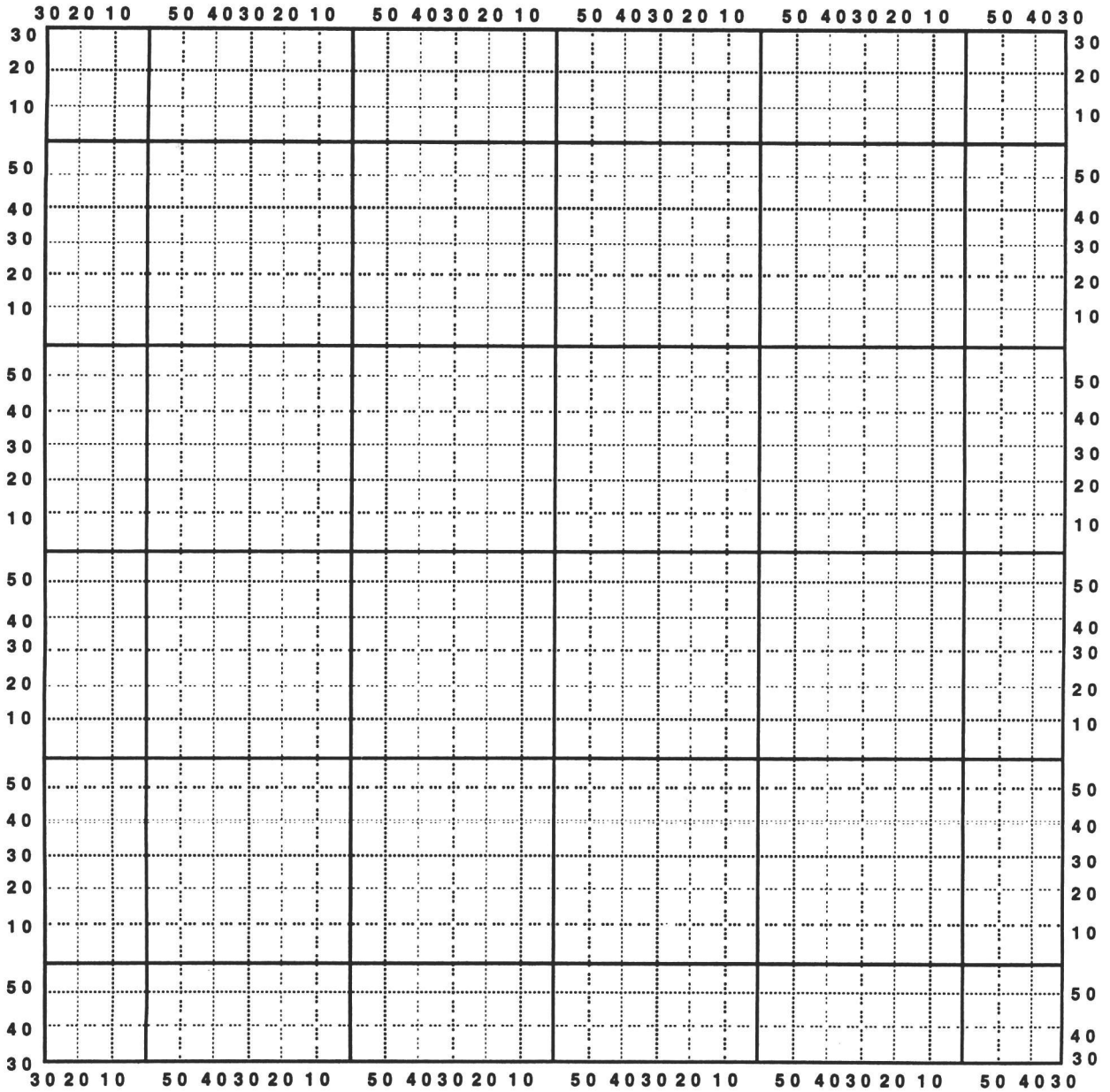
Date _____ Flight 990806 LPS P BLACK

Time	Event	Position	Comments
144506	CP4, #14	2526 8836	resume ~~course~~
144610	bit of r quieting after		1:05
4700	modulation	signal noisy below 400m	
145135	BT2, #15	2547 8825	
5242	SST 29.9		
	20		
	15		
145850	BT6, #16	2610 8814	
150000Z	29.5		
1503-1511	orbit while exchange MK10 -		
151530	CP2, #17	2639 8802	new MK10; HRD MK10
1715	modulation		UM's MK10 BAD
152429	BT6, #18	2706 8747	
	SST 29.4		
	20C		
	15C		
pt#3 153435	CTD6, #19	2736 8733	NG, DUD
154718	CTD2, #20	2716 8821	
155635	CP6, #21	2704 8857	good signal, IAS - 190
5915	modulation		no display after 10m
160140	BT2, #22	2657 8916	
	SST 29.8		

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.

Lead Project Scientist Event Log

Date _____ Flight 990806H LPS P BLACK

Time	Event	Position	Comments
160745	GPS sonde #2	2648 8940	
161202	BT 6 #23	2643 8956	
1345	SST 28.8		
	20		
	15		
161720	CP4, #24	2637 9017	MK10 setup wrong for (2nd time) but
			digital recorded ok
162223	CP2, #25	2630 9036	into weak convection
pt 4 162820	pt 4		
162919	CTD 4, #26	2625 9100	
163828	CP6, #27	2651 9042	
164313	BT 12, #28	2705 9033	
4435	SST 29.3		
164956	CTD 4, #29	2724 9021	
165819	BT 6, #30	2750 9006	
170001	SST 29.6		
	20 C		
	15 C		
turn pt 5 170508	turn		
170519	CTD 6, #31	2758 8945	

(5)

Lead Project Scientist Event Log

Date _____ Flight 990306I LPS P. BLACK

Time	Event	Position	Comments
170932	CP2, #32	2743 8943	
171453	BT16, #33	2722 8941	
	SST 29.7		
1726	CTD4 #34	2649 3938	NG, NUD
173230	CP6, #35	2624 8935	
173644	CP4, #36	2609 8932	
174211	pt 6	2551 8932	
174316	CTD2, #37	2553 8923	
174721	CP14, #38	2559 8909	
175015	CP2, #39	2603 8859	
180150	CTD6, #40	2620 8818	
181650	CP2, #41	2639 8724	
182354	BT6, #42	2647 8658	
	29.7		
182643	20C		
183300	pt 7	2701 8626	
183411	CTD2, #43	2658 8626	
184442	CP6, #44	2624 8639	
185048	BT2, #45	2604 8642	
185210	SST 30.0		

pt (6)

pt (7)

Lead Project Scientist Event Log

Date _____ Flight 9908064 LPS P. BLACK

Time	Event	Position	Comments
185651	BT 2, #46	2544 8647	
	SST 29.9		
190255	CTD6, #47	2524 8652	
190340	pt 8	2521 8653	
190613		2514 8649	~~dropped~~ GPS drop #3
	sonde hung temporarily		~~no launch~~ good
	~~CTD4, #48~~	of wind	~ 25-30 kt (SW)
191521	pt 9	2447 8631	
191740	CTD4, #48	2449 8624	noisy below 500m
192456	CTD6, #49	2510 8604	
193230	CP4, #50	2529 8539	died at 300m
193944	CTD2, #51	2546 8514	
194538	BT2, #52	2558 8453	
	SST 30.0		

pt 8

pt 9