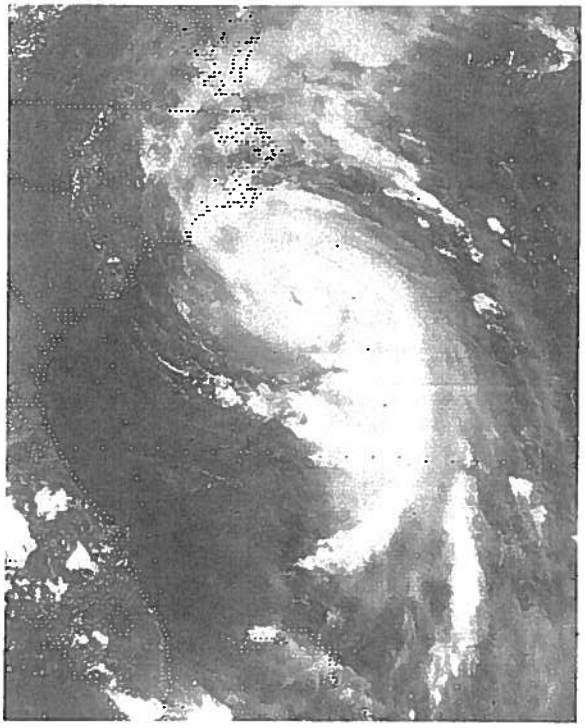
U.S. DEPARTMENT OF COMMERCE/ National Oceanic and Atmospheric Administration

OFCM

OFFICE OF THE FEDERAL COORDINATOR FOR
METEOROLOGICAL SERVICES AND SUPPORTING RESEARCH

National Hurricane Operations Plan

FCM-P12-1992



Hurricane Bob - Aug 18, 1991

Washington, DC
April 1992

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NATIONAL HURRICANE OPERATIONS PLAN

FCM-P12-1992

Washington, D.C.
April 1992

CHANGE AND REVIEW LOG

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FOREWORD

This publication is the 30th edition of the National Hurricane Operations Plan (NHOP). It is a compilation of the procedures and agreements reached at the 46th Interdepartmental Hurricane Conference (IHC), which was held at the United States Air Force Conference Center, Homestead Air Force Base, Florida, January 14-17, 1992. Details of the conference can be found in the minutes published by this office.

The conference is sponsored annually by the Working Group for Hurricanes and Winter Storms Operations, Committee for Basic Services of the Interdepartmental Committee for Meteorological Services and Supporting Research. It brings together the cognizant Federal agencies to reach agreement on items of mutual interest and concern related to hurricane forecasting and warning services. The host for the conference this year was Headquarters, Air Force Reserve, Warner Robins Air Force Base, Georgia.

Although the 1991 hurricane season was relatively inactive in the Atlantic and Gulf of Mexico, Hurricane Bob caused much damage and some deaths and injuries as the hurricane approached and moved across New England coastal areas. Reconnaissance flights, satellites, radars, ships, buoys and computer numerical models all contributed valuable data for the National Hurricane Center to advise and warn the appropriate areas about Hurricane Bob and other storms.

All of the chapters in this edition have minor updates or changes. More substantial changes were made to the text, figures and tables in Chapters 5, 6, and 8, which describe aircraft reconnaissance, satellite surveillance, and national data buoy operations.

The effectiveness of the multi-agency storm warning support system that has evolved over the years is a tribute to the dedication and cooperation of public, private and government individuals and concerns. It is gratifying to see their extensive review and planning efforts blended into the updated National Hurricane Operations Plan each year.

James A. Almazan

JAMES A. ALMAZAN
Acting Federal Coordinator for
Meteorological Services and
Supporting Research

NATIONAL HURRICANE OPERATIONS PLAN

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CHAPTER 1

INTRODUCTION

1.1. General. The tropical cyclone warning service is an interdepartmental effort to provide the United States and designated international recipients with forecasts, warnings, and assessments concerning tropical and subtropical weather systems. The National Oceanic and Atmospheric Administration of the Department of Commerce is responsible for providing forecasts and warnings for the Atlantic and Eastern and Central Pacific Oceans while the Department of Defense provides the same services for the Western Pacific and Indian Ocean (see Figure 1-1). Interdepartmental cooperation achieves economy and efficiency in the operation of the tropical cyclone warning service. This plan provides the basis for implementing agreements of the Department of Commerce, Department of Defense, and the Department of Transportation reached at the annual Interdepartmental Hurricane Conference. The Interdepartmental Hurricane Conference is sponsored by the Committee for Basic Services of the Interdepartmental Committee for Meteorological Services and Supporting Research to bring together cognizant Federal agencies and achieve agreement on items of mutual concern related to the Atlantic and Eastern Pacific tropical cyclone warning services.

1.2. Scope. The procedures and agreements contained herein apply to the Atlantic Ocean, Gulf of Mexico, Caribbean Sea, and North Pacific Ocean east of the 180th meridian. This plan is intended to define the role of the individual agencies participating in the tropical cyclone warning service when more than one agency is involved in the delivery of service in any specific area. When a single agency is involved in any specific area, that agency's procedures should be contained in internal documents and, to the extent possible, be consistent with National Hurricane Operations Plan practices and procedures.

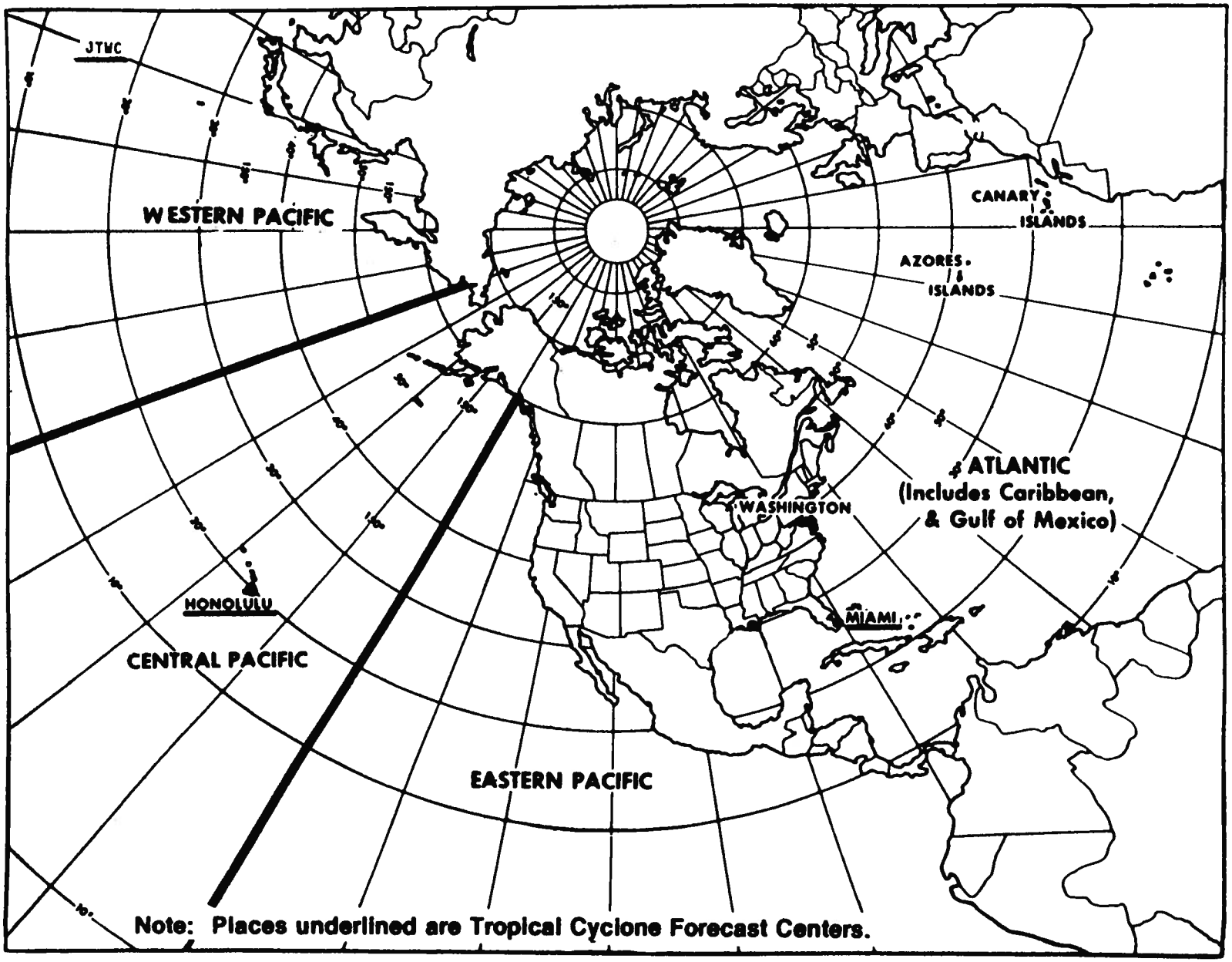

Figure 1-1. Tropical cyclone forecast centers' areas of responsibility.

CHAPTER 2

RESPONSIBILITIES OF COOPERATING FEDERAL AGENCIES

2.1. General. The Department of Commerce (DOC) is charged with the overall responsibility to implement a responsive, effective national tropical cyclone warning service. Many local, state, and Federal agencies play a vital role in this system--their cooperative efforts help ensure that necessary preparedness actions are undertaken to minimize loss of life and destruction of property. The joint participation by the Department of Defense (DOD) and the Department of Transportation (DOT) with the Department of Commerce brings to bear those limited and expensive Federal resources considered essential for storm detection and accurate forecasting. This cooperative effort has proven to be a cost effective, highly responsive endeavor to meet national requirements for tropical cyclone warning information.

2.2. DOC Responsibilities.

2.2.1. Forecast and Warning Services. The DOC will provide timely dissemination of forecasts, warnings, and all significant information regarding tropical and subtropical cyclones to appropriate agencies, general public, and marine and aviation interests.

2.2.2. Support to DOD. Through the National Weather Service (NWS), the DOC will

- consult, as necessary, with DOD regarding their day-to-day requirements for cyclone assessments and attempt to meet these requirements within the capabilities of the tropical cyclone warning service;

- prepare, through the National Hurricane Center (NHC), and distribute to DOD, the coordinated DOC reconnaissance and other meteorological data requirements to be provided by DOD on tropical or subtropical cyclones and disturbances;

- provide facilities, administrative support, and dissemination of weather observation data for Chief, Aerial Reconnaissance Coordination, All Hurricanes (CARCAH) as agreed to by DOC and DOD; and

- provide DOD with basic meteorological information, warnings, forecasts, and associated prognostic reasoning concerning location, intensity, and forecast movement of tropical and subtropical cyclones in the following maritime areas and adjacent states and possessions of the United States:

- Atlantic Ocean (north of the equator including the Caribbean Sea and Gulf of Mexico)--advisories are the responsibility of the Director, NHC, Miami, FL. The NHC will consult with the Naval Eastern Oceanography Center (NAVEASTOCEANCEN), Norfolk, VA, prior to issuing initial and final advisories and prior to issuing any advisory that indicates a significant change in forecast of intensity or track from the previous advisory. Exchange of information is encouraged on subsequent warnings when significant changes are made or otherwise required.

- Eastern Pacific Ocean (north of the equator and east of 140°W)--advisories are the responsibility of the Director, NHC, Miami, FL. The NHC will consult with the Naval Western Oceanography Center (NAVWESTOCEANCEN), Pearl Harbor, HI, prior to issuing initial and final advisories and prior to issuing any advisory that indicates a significant change in forecast of intensity or track from the previous advisory. Exchange of information is encouraged on subsequent warnings when significant changes are made or otherwise required.

- Central Pacific Ocean (north of the equator between 140°W and 180°)--advisories are the responsibility of the Director, Central Pacific Hurricane Center (CPHC), Honolulu, HI. The CPHC will consult with the NAVWESTOCEANCEN and Detachment 4, 20th Weather Squadron, Hickam AFB, HI, prior to issuing initial and final advisories and prior to issuing any advisory that indicates a significant change in forecast of intensity or track from the previous advisory. Exchange of information is encouraged on subsequent warnings when significant changes are made or otherwise required.

2.2.3. Post-Analysis of Tropical Cyclones. The DOC, through the NWS, will conduct an annual post-analysis for all tropical cyclones in the Atlantic and the Pacific regions east of 180° and prepare an annual hurricane report for issue to interested agencies.

2.2.4. Environmental Satellite Systems. The National Environmental Satellite, Data, and Information Service will operate DOC environmental satellite systems capable of providing coverage of meteorological conditions in the tropics during the tropical cyclone season (see Figure 2-1) and monitor and interpret DOC satellite imagery. The DOC will obtain, as necessary, National Aeronautics and Space Administration (NASA) research and development satellite data and DOD operational satellite data for NWS operational use and comply with NHC and CPHC satellite data requirements.

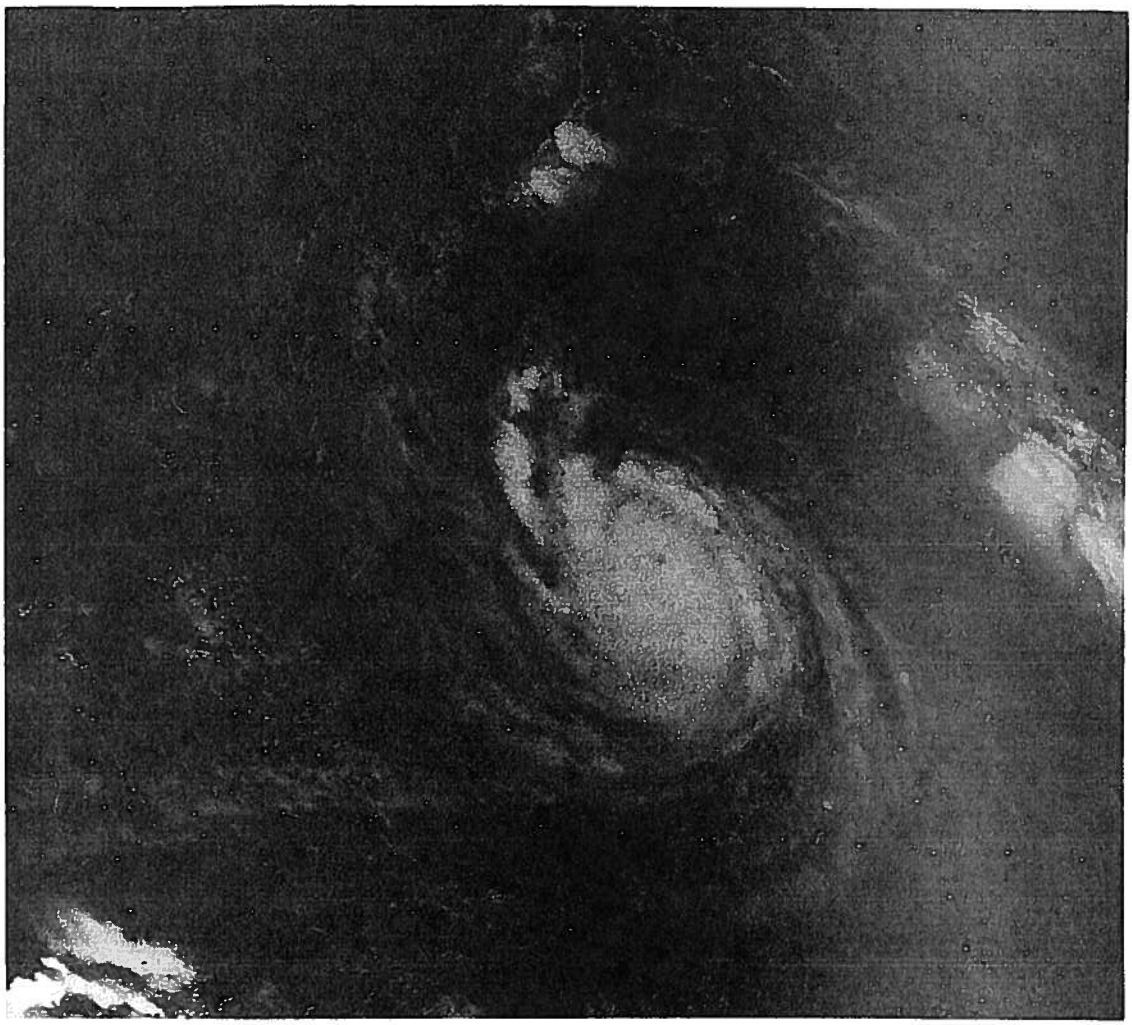

Figure 2-1. Hurricane Claudette, September 7, 1991

2.2.5. Data Buoy Systems. Through the National Data Buoy Center (NDBC), the DOC will develop, deploy, and operate environmental data buoy systems and automated coastal stations to support data requirements of the NHC and CPHC.

2.2.6. Weather Reconnaissance. Through the National Oceanic and Atmospheric Administration (NOAA) Aircraft Operations Center (AOC), the DOC will provide weather reconnaissance flights as specified in Chapter 5, unless relieved of these responsibilities by the Administrator of NOAA.

2.3. DOD Responsibilities. The DOD will

- provide NWS with timely dissemination of significant information received regarding tropical and subtropical cyclones;
- provide NHC and CPHC current DOD requirements for tropical and subtropical cyclone advisories;
- meet DOC requirements for aircraft reconnaissance and other special observations as agreed to by DOD and DOC (see Appendix C);
- provide at NHC a 24-hr aircraft operation interface--Chief, Aerial Reconnaissance Coordination, All Hurricanes (CARCAH);
- designate CARCAH as the liaison to NHC and the military point of contact for NHC to request special DOD observations in support of this plan, i.e., Defense Meteorological Satellite Program (DMSP) fixes, additional upper air observations, etc.;
- provide broadcast facilities of radio station NAM for tropical storm and hurricane forecasts and warnings;
- provide access to North American Aerospace Defense Command long-range radar sites (see Chapter 7);
- provide weather reconnaissance data monitor services to evaluate and disseminate reconnaissance reports; and
- provide, through Air Force Global Weather Central, Offutt AFB, NE, surveillance support and fixes and/or intensity estimates to all United States tropical cyclone warning agencies through analysis of satellite imagery obtained primarily from the DMSP system.

2.4. DOT Responsibilities.

2.4.1. Information Dissemination. The DOT will provide NWS with timely dissemination of significant information received regarding tropical and subtropical cyclones.

2.4.2. Flight Assistance. Through the Federal Aviation Administration, the DOT will provide air traffic control, communications and flight assistance services.

2.4.3. U. S. Coast Guard. The DOT will provide the following through the U.S. Coast Guard:

- personnel, vessel, and communication support to the NDBC for development, deployment, and operation of moored environmental data buoy systems;
- surface observations to NWS from its coastal facilities and vessels;
- communications circuits for relay of weather observations to NWS in selected areas;
- primary guard Automated Digital Network support to CARCAH; and
- coastal broadcast facilities at selected locations for tropical storm or hurricane forecasts and warnings.

2.5. Annual Liaison with Other Nations. The DOD, DOC, and DOT will cooperate in arranging an annual trip to the Caribbean and the Gulf of Mexico area to carry out a continuing and effective liaison of the warning service with the directors of meteorological services, air traffic control agencies, and disaster preparedness agencies of nations in those areas.

2.6. Air Traffic Control/Flight Operations Coordination. The operations officers of the principal flying units, the Assistant Manager, Operations, Air Traffic Control System Command Center, Central Flow Control Facility, Washington, D.C., and the assistant managers for traffic management or assistant manager for military operations, as appropriate, at key Air Route Traffic Control Centers (ARTCC) will maintain a close working relationship on a continuing basis to ensure mission success under actual tropical storm conditions. This will involve visits to each other's facilities, familiarization flights, and telephone and teletype communications to improve the understanding of each other's requirements and capabilities.

2.6.1. Gulf of Mexico Weather Reconnaissance. The 815th Weather Operations Flight, and AOC operations officers will maintain a close working relationship with the Air Traffic Control System Command Center, Central Flow Control Facility, the ARTCCs, and the Fleet Aerial Control and Surveillance Facility (FACSFAC) for the coordination of weather reconnaissance flights in the Gulf of Mexico and over the Caribbean Sea in particular, and in the United States in general. The operations officers will

- request the assistance of the appropriate ARTCC/FACSFAC in support of the National Hurricane Operations Plan;

- provide the current operations officer's name and telephone number to the appropriate ARTCC and FACSFAC; and

- publish the unit's telephone numbers [Federal Telephone System (FTS)/Defense Switched Network (DSN) (formerly known as Automated Voice Network (AUTOVON (AV))/ Commercial] and teletype address code for Service B (Appendix H).

2.6.2. Air Traffic Control Assistance. The Air Traffic Control System Command Center, appropriate ARTCCs, and FACSFAC will maintain a close working relationship with the weather reconnaissance units and provide airspace and air traffic control assistance to the extent possible. Those organizations will

- provide the current names and telephone numbers of points of contact to the flying units and

- publish telephone numbers (FTS/DSN/Commercial) and teletype code for Service B (Appendix H).

CHAPTER 3

GENERAL OPERATIONS AND PROCEDURES OF THE NATIONAL WEATHER SERVICE HURRICANE CENTERS

3.1. General. This chapter describes the products, procedures, and communications headers used by the National Hurricane Center (NHC) and the Central Pacific Hurricane Center (CPHC).

3.2. Products.

3.2.1. Tropical Weather Outlook (TWO). Tropical weather outlooks are issued by the NHC and CPHC during their respective hurricane seasons. The NHC writes TWOs in both the Atlantic and Eastern Pacific. They are transmitted at 0530, 1130, 1730, and 2230 Eastern Local Time in the Atlantic and at 0400, 1000, 1600, and 2200 UTC in the Eastern Pacific. In the Central Pacific, TWOs are transmitted by the CPHC at 1000 and 2200 UTC. The outlook briefly describes both stable and potentially unstable areas out to 48 hr. A tropical weather summary of Atlantic and eastern Pacific tropical cyclone activity will be prepared and issued at the end of each month during the hurricane season.

3.2.2. Tropical Cyclone Discussion.

3.2.2.1. Atlantic and Eastern Pacific. The NHC will issue a tropical cyclone discussion on Atlantic tropical cyclones at 0330, 0930, 1530, and 2130 UTC, and on Eastern Pacific tropical cyclones at 0230, 0830, 1430, and 2030 UTC. Discussions will be disseminated for inter-governmental use only and will contain preliminary prognostic positions and maximum wind speed forecasts up to 72 hr; will describe objective techniques, synoptic features, and climatology used; and will provide reasons for track changes.

3.2.2.2. Central Pacific. The CPHC will issue a tropical cyclone discussion twice daily not later than 0330 and 1530 UTC. The discussions will describe objective techniques, synoptic features, and climatology used and will provide reasons for track changes.

3.2.3. Public Advisories. Public advisories are issued by the NHC for all tropical cyclones in the Atlantic. In the Eastern Pacific, public advisories are issued by NHC for tropical cyclones that are expected to affect land within 48 hr. In the Central Pacific, public advisories are issued by CPHC for all tropical cyclones within the area of responsibility. Scheduled public advisories are issued at the same time scheduled marine advisories are issued. However, when NHC is issuing advisories every 3 hours in the Atlantic, the 0400 UTC public advisory will be issued at 0230 UTC to ensure that the latest information is available for the heavily-watched evening local news shows. Watch and warning break points are listed in Table 3-1.

[NOTE: Public advisories use statute miles for distance and miles per hour for speed. Nautical miles and knots may be added at the discretion of the centers.]

Table 3-1. Watch and warning break points

1. Brownsville, TX
2. Port Mansfield, TX
3. Baffin Bay, TX
4. Corpus Christi, TX
5. Port Aransas, TX
6. Port O'Connor, TX
7. Matagorda, TX
8. Freeport, TX
9. High Island, TX
10. Port Arthur, TX
11. Sabine Pass, TX
12. Cameron, LA
13. Morgan City, LA
14. Grand Isle, LA
15. Mouth of Mississippi River, LA
16. Mouth of Pearl River, LA
17. Gulfport, MS
18. Mobile, AL
19. Pensacola, FL
20. Fort Walton Beach, FL
21. Panama City, FL
22. Apalachicola, FL
23. Ochlockonee River, FL
24. St. Marks, FL
25. Aucilla River, FL
26. Steinhatchee River, FL
27. Suwannee River, FL
28. Cedar Key, FL
29. Yankeetown, FL
30. Bay Port, FL
31. Anclote Key, FL
32. Longboat Key, FL
33. Venice, FL
33. Boca Grande, FL
35. Fort Myers Beach, FL
36. Bonita Beach, FL
37. Everglades City, FL
38. Flamingo, FL
39. Seven Mile Bridge, FL
40. Craig Key, FL
41. Key Largo, FL
42. Hallandale, FL
43. Deerfield Beach, FL
44. Boynton Beach, FL
45. Lake Worth, FL
46. Jupiter Inlet, FL
47. Stuart, FL
48. Fort Pierce, FL
49. Vero Beach, FL
50. Sebastian Inlet, FL
51. Cocoa Beach, FL
52. Titusville, FL
53. New Smyrna Beach, FL
54. St. Augustine, Fl
55. Fernandina Beach, FL
56. Brunswick, GA (Atlamaha Sound)
57. Savannah, GA [GA/SC Border and Southern Extent of Coastal Waters Forecast (CWF)]
58. Edisto Beach, SC
59. Cape Romain, SC
60. Little River Inlet, SC (Northern Extent of Columbia CWF and Southern Extent of Raleigh CWF)
61. Cape Fear, NC
62. Topsail Beach, NC
63. Bogue Inlet, NC
64. Cape Lookout, NC
65. Ocracoke Inlet, NC
66. Cape Hatteras, NC
67. Oregon Inlet, NC (The inclusion of Pamlico and Albemarle Sounds should be on a case-by-case basis.)
68. Virginia Beach, VA (Northern Extent of Raleigh CWF and Southern Extent of Washington CWF)
69. Chicoteague, VA
70. Cape Henlopen, DE (Northern Extent of Washington CWF and Southern Extent of Philadelphia CWF)
(The inclusion of Chesapeake Bay and the Tidal Potomac should be on a case-by-case basis.)
71. Manasquan, NJ (Northern Extent of Philadelphia CWF and Southern Extent of New York CWF)
(The inclusion of Delaware Bay should be on a case-by-case basis.)
72. Fire Island Inlet, Long Island, NY
73. Shinnecock Inlet, Long Island, NY
74. Montauk Point, Long Island, NY
75. Port Jefferson Harbor, Long Island, NY
76. New Haven, CT
77. Watch Hill, RI (Northeastern Extent of New York CWF and Southwestern Extent of Boston CWF)
78. Point Judith, RI
79. Woods Hole, MA
80. Chatham, MA
81. Plymouth, MA
82. Gloucester, MA
83. Merrimack River, MA (Northern Extent of Boston CWF and Southern Extent of Portland CWF)
84. Portsmouth, NH
85. Portland, ME
86. Rockland, ME
87. Bar Harbor, ME
88. Eastport, ME

3.2.4. Marine Advisories. Marine advisories are issued by the NHC and the CPHC. See Section 4.3 for content and format of the advisories. Marine advisories will be transmitted to high-seas shipping according to the details found in Worldwide Marine Weather Broadcasts, jointly published by the U.S. Navy and National Weather Service. In the Atlantic, these advisories should be distributed 30 min before their effective times of 0400, 1000, 1600, and 2200 UTC. In the Pacific the advisories are scheduled for 0300, 0900, 1500, and 2100 UTC for position times of 0000, 0600, 1200, and 1800 UTC, respectively. Pacific advisories should be transmitted 15 min before the effective time.

3.2.5. Probability of Hurricane/Tropical Storm Conditions.

3.2.5.1. When Included. The probability of the storm center passing within 50 mi to the right or 75 mi to the left of specific forecast points within 24, 36, 48, and 72 hr is included in the public and, on a trial basis, marine advisories for all named storms in the Atlantic, Caribbean, and the Gulf of Mexico. Probabilities may also be included for yet to be named storms that are developing rapidly near a coastline, dependent upon NHC assessment. Probabilities will not be included on intermediate public advisories. The probabilities, which are based on the official forecast track, will be issued when the 72-hr forecast position approaches the coast and will continue until the hurricane or tropical storm has made landfall and is not expected to reemerge over water. For storms forecast to parallel the coast, the maximum value over water points will be included. The NHC retains the right to discontinue issuance of probabilities earlier if other factors arise, such as difficulties with evacuation orders.

3.2.5.2. When Computed. The probabilities will be computed shortly after synoptic times for the periods 0-24, 24-36, 36-48, and 48-72 hr. A total probability for the next 72 hr will be shown in the last column and represents a total of all forecast periods. If the probability of a storm hitting a coastal location within 48 hr is needed, add the 0-24, 24-36, and the 36-48 hr probabilities. If the probability for a location is less than one percent, an "X" will be indicated in the table.

3.2.5.3. Locations. When appropriate, specific probabilities will be computed for the following locations:

Brownsville, TX
Corpus Christi, TX
Port O'Connor, TX
Galveston, TX
Port Arthur, TX
New Iberia, LA
New Orleans, LA
Buras, LA
Gulfport, MS
West Palm Beach, FL
Fort Pierce, FL
Cocoa Beach, FL
Daytona Beach, FL
Jacksonville, FL
Savannah, GA
Myrtle Beach, SC
Charleston, SC
Wilmington, NC

Mobile, AL	Cape Hatteras, NC
Pensacola, FL	Ocean City, MD
Panama City, FL	Atlantic City, NJ
Apalachicola, FL	Norfolk, VA
St. Marks, FL	New York City, NY
Cedar Key, FL	Montauk Point, NY
Tampa, FL	Providence, RI
Venice, FL	Nantucket, MA
Fort Myers, FL	Hyannis, MA
Marco Island, FL	Boston, MA
Key West, FL	Portland, ME
Marathon, FL	Bar Harbor, ME
Miami, FL	Eastport, ME
29°N85°W	28°N93°W
29°N87°W	28°N95°W
28°N89°W	27°N96°W
28°N91°W	25°N97°W

3.2.6. Tropical Cyclone Updates. Tropical cyclone updates are brief statements in lieu of or preceding special advisories to inform of significant changes in a tropical cyclone or the posting or cancelling of watches and warnings.

3.2.7. Atlantic and Gulf of Mexico Tropical Cyclone Position Estimates. The NHC may also issue hourly tropical cyclone position estimates when the tropical cyclone is under effective surveillance and within 200 nmi of land-based radar. These estimates, when issued, will be prepared a short time before each hour except at hours when advisories are issued. Position estimates disseminated to the public, DOD, and other Federal agencies will provide geographical positions in latitude and longitude and also by distance and direction from a well-known point.

3.2.8. Special Tropical Disturbance Statement. Special tropical disturbance statements may be issued to furnish information on strong formative, non-depression systems.

3.2.9. Storm Summaries. Storm summaries are written by the National Meteorological Center after subtropical and tropical cyclones have moved inland and public advisories have been discontinued. Storm summaries will continue to be numbered in sequence with public advisories on named storms. Also, these summaries will reference the former storm's name and be issued as long as the remnants of the storm remain a serious flooding threat. Storm summaries will be transmitted at 0500, 1100, 1700, and 2300 UTC.

3.2.10. Satellite Interpretation Message. These are issued four times a day by the NHC and the National Meteorological Center in Washington to describe synoptic features and significant weather areas. Federal Aviation Administration contractions are used.

3.2.12. Tropical Weather Discussion. These are issued four times a day by the NHC. They describe significant features from the latest surface analysis and significant weather areas for the Gulf of Mexico, the Caribbean, and between the equator and 32°N in both the Atlantic and Eastern Pacific east of 140°W. Plain language is used.

3.2.13. Tropical Disturbance Rainfall Estimates. As required, the NHC issues satellite based rainfall estimates for tropical disturbances and tropical cyclones within 36 hr of expected landfall for the Caribbean, the Bahamas and both coasts of Mexico.

3.3. Designation of Tropical and Subtropical Cyclones.

3.3.1. Numbering of Tropical Depressions.

3.3.1.1. Atlantic, Caribbean, and Gulf of Mexico. Depression numbers, ONE, TWO, THREE, will be assigned by the NHC after advising the Navy Eastern Oceanography Center, Norfolk.

3.3.1.2. Pacific East of 140°W. Depression numbers, with the suffix E, e.g., ONE-E, TWO-E, THREE-E, will be assigned by the NHC after advising the Navy Western Oceanography Center (NAVWESTOCEANCEN), Pearl Harbor.

3.3.1.3. Pacific West of 140°W and East of 180°. Depression numbers, with suffix C, e.g., ONE-C, TWO-C, THREE-C, will be assigned after advising the NAVWESTOCEANCEN, Pearl Harbor.

3.3.2. Naming of Tropical Storms and Hurricanes.

3.3.2.1. Atlantic and Eastern Pacific. A different set of names will be used each year. After a set is used, it will drop to the end of the list to be used again in 6 years. Names of significant hurricanes will be retired and replaced. Lists of Atlantic and Eastern Pacific names are provided in Tables 3-2 and 3-3, respectively.

Table 3-2. Atlantic tropical cyclone names

1992		1993		1994	
ANDREW		ARLENE		ALBERTO	al-BAIR-toe
BONNIE		BRET		BERYL	BURL
CHARLEY		CINDY		CHRIS	
DANIELLE	dan-YELL	DENNIS		DEBBY	
EARL		EMILY		ERNESTO	er-NES-to
FRANCES		FLOYD		FLORENCE	
GEORGES	ZHORZH	GERT		GORDON	
HERMINE	her-MEEN	HARVEY		HELENE	he-LEEN
IVAN	I-van	IRENE		ISAAC	EYE-sak
JEANNE	JEEN	JOSE	ho-ZAY	JOYCE	
KARL		KATRINA	ka-TREE-na	KEITH	
LISA	LEE-sa	LENNY		LESLIE	
MITCH		MARIA	ma-REEH-ah	MICHAEL	MIKE-el
NICOLE	ni-COLE	NATE		NADINE	nay-DEEN
OTTO		OPHELIA	oh-FEEL-ya	OSCAR	
PAULA		PHILIPPE	fe-LEEP-pay	PATTY	
RICHARD	RICH-erd	RITA		RAFAEL	ra-fe-EL
SHARY	SHA-ree	STAN		SANDY	
TOMAS	to-MAS	TAMMY		TONY	
VIRGINIE	vir-JIN-ee	VINCE		VALERIE	
WALTER		WILMA		WILLIAM	

1995		1996		1997	
ALLISON		ARTHUR		ANA	
BARRY		BERTHA	BUR-tha	BOB[1]	
CHANTAL	shan-TAL	CESAR	say-ZAR	CLAUDETTE	claw-DET
DEAN		DOLLY[1]		DANNY	
ERIN	AIR-in	EDOUARD	eh-DWARD	ERIKA	ERR-re-ka
FELIX	FEEL-ix	FRAN		FABIAN	FAY-bee-in
GABRIELLE	gay-bree-EL	GUSTAV	GOO-stahv	GRACE	
HUMBERTO	oom-BAIR-toe	HORTENSE	HOR-tense	HENRI	ahn-REE
IRIS	EYE-ris	ISIDORE	IS-i-door	ISABELL	IS-a-bel
JERRY		JOSEPHINE	JO-ze-feen	JUAN	WAN
KAREN		KLAUS	KLOUSE	KATE	
LUIS	loo-EES	LILI	LIL-ee	LARRY	
MARILYN		MARCO		MINDY	
NOEL		NANA	NAN-uh	NICHOLAS	NIK-o-las
OPAL		OMAR		ODETTE	o-DET
PABLO	PA-blow	PALOMA	pa-LOW-ma	PETER	
ROXANNE	rocks-ANN	RENE	re-NAY	ROSE	
SEBASTIEN	say-BAS-tyan	SALLY		SAM	
TANYA	TAHN-ya	TEDDY		TERESA	te-REE-sa
VAN		VICKY		VICTOR	VIC-ter
WENDY		WILFRED		WANDA	

[1] Regional Association IV, WMO, retired the names BOB and DIANA in 1992 and substituted BILL and DOLLY.

Table 3-3. Eastern Pacific tropical cyclone names

1992		1993		1994	
AGATHA		ADRIAN		ALETTA	ah LET ah
BLAS		BEATRIZ	BEE a triz	BUD	
CELIA		CALVIN		CARLOTTA	
DARBY		DORA		DANIEL	
ESTELLE		EUGENE		EMILIA	ee MIL ya
FRANK		FERNANDA	fer NAN dah	FABIO	FAH bee o
GEORGETTE		GREG		GILMA	GIL mah
HOWARD		HILARY		HECTOR	
ISIS	EYE sis	IRWIN		ILEANA	ill ee AHN ah
JAVIER	ha VEEAIR	JOVA	JOE vah	JOHN	
KAY		KENNETH		KRISTY	
LESTER		LIDIA		LANE	
MADELINE		MAX		MIRIAM	
NEWTON		NORMA		NORMAN	
ORLENE	or LEAN	OTIS		OLIVIA	
PAINE		PILAR		PAUL	
ROSLYN		RAMON	rah MON	ROSA	
SEYMOUR		SELMA		SERGIO	SIR gee oh
TINA		TODD		TARA	
VIRGIL		VERONICA		VICENTE	vee CEN tay
WINIFRED		WILEY		WILLA	
XAVIER	ZAY vier	XINA	ZEE nah	XAVIER	ZAY vier
YOLANDA	yo LAHN da	YORK		YOLANDA	yo LAHN da
ZEKE		ZELDA	ZEL dah	ZEKE	

1995		1996		1997	
ADOLPH		ALMA	AL mah	ANDRES	ahn DRASE
BARBARA		BORIS		BLANCA	BLAHN kah
COSME	COS may	CRISTINA		CARLOS	
DALILA	da LEE luh	DOUGLAS		DOLORES	
ERICK		ELIDA	ELL ee dah	ENRIQUE	anh REE kay
FLOSSIE		FAUSTO	FOU sto	FELICIA	Fay LISH ee ya
GIL		GENEVIEVE		GUILLERMO	gee YER mo
HENRIETTE	hen ree ETT	HERNAN	her NAHN	HILDA	
ISMAEL	eee mah EL	ISELLE	ee SELL	IGNACIO	eeg NAH cio
JULIETTE		JULIO	HOO lee o	JIMENA	he MAY na
KIKO	KEE ko	KENNA		KEVIN	
LORENA	low RAY na	LOWELL		LINDA	
MANUEL	mahn WELL	MARIE		MARTY	
NARDA		NORBERT		NORA	
OCTAVE	AHK tave	ODILE	oh DEAL	OLAF	OH lahf
PRISILLA		POLO		PAULINE	
RAYMOND		RACHEL		RICK	
SONIA	SONE yah	SIMON		SANDRA	
TICO	TEE koh	TRUDY		TERRY	
VELMA		VANCE		VIVIAN	
WALLIS		WINNIE		WALDO	
XINA	ZEE nah	XAVIER	ZAY vier	XINA	ZEE nah
YORK		YOLANDA	yo LAHN da	YORK	
ZELDA	ZEL dah	ZEKE		ZELDA	ZEL dah

If over 24 tropical cyclones occur in a year, the Greek alphabet will be used following ZEKE or ZELDA.

3.3.2.2. Central Pacific. When a tropical depression intensifies into a tropical storm or hurricane between 140°W and 180°, the depression number will be discontinued and replaced by an appropriate name. The CPHC will select the name from the list of Central Pacific names in Table 3-4. All of the names listed in each column, beginning with column 1, will be used before going on to the next column.

3.3.2.3. Western Pacific. For the Pacific west of 180°, tropical storms and typhoons are named by the Joint Typhoon Warning Center (JTWC), Guam. The names listed in Table 3-5 are for information only.

3.4. Transfer of Warning Responsibility.

3.4.1. NHC to CPHC. When a tropical or subtropical cyclone approaches 140°W, the coordinated transfer of warning responsibility from the NHC to the CPHC will be made and the appropriate advisory issued.

3.4.2. CPHC to JTWC. When a tropical or subtropical cyclone crosses 180°from east to west, the coordinated transfer of warning responsibility from CPHC to JTWC through NAVWESTOCEANCEN, Pearl Harbor, will be made and the appropriate advisory issued.

3.4.3. JTWC to CPHC. When a tropical or subtropical cyclone crosses 180° from west to east, the coordinated transfer of warning responsibility from JTWC to CPHC will be made through NAVWESTOCEANCEN, Pearl Harbor. The JTWC will append the statement, "Next advisory by CPHC-HNL" to their last advisory.

3.5. Alternate Warning Responsibilities. In the event of impending or actual operational failure of a hurricane forecast center, tropical warning responsibilities will be transferred to an alternate facility in accordance with existing directives and retained there until resumption of responsibility can be made. The NAVEASTOCEANCEN, Norfolk, will be advised by the NHC and Chief, Aerial Reconnaissance Coordinator, All Hurricanes (CARCAH) of impending or actual transfer of responsibility by the most rapid means available. Alternate facilities are as follows:

PRIMARY	ALTERNATE
NHC	National Meteorological Center, Meteorological Operations Division Washington, DC
CPHC	NHC
CARCAH[1]	34th Air Weather Flight (34 AWF)

[1] In the event of the operational failure of CARCAH, direct communication is authorized between 34 AWF and the forecast facility. Contact 34 AWF at Defense Switch Network (DSN) (formerly AUTOVON) 597-2409/Commercial (COM) 601-377-2409 or through the Keesler AFB Command Post at DSN 597-4330/COM 601-377-4330 (ask for the 815TAS).

Table 3-4. Central Pacific tropical cyclone names

COLUMN 1		COLUMN 2		COLUMN 3		COLUMN 4	
Name	Pronunciation	Name	Pronunciation	Name	Pronunciation	Name	Pronunciation
AKONI	ah-KOH-nee	AKA	AH-kah	ALIKA	ah-LEE-kah	ANA	AH-nah
EMA	EH-mah	EKEKA	eh-KEH-kak	ELE	EH-leh	ELA	EH-lah
HANA	HAH-nah	HALI	HAH-lee	HUKO	HOO-koh	HALOLA	hah-LOH-lah
IO	EE-oo	INIKI	ee-NEE-kee	IOKE	ee-OH-keh	IUNE	ee-OO-neh
KELI	KEH-lee	KEONI	keh-OH-nee	KIKA	KEE-kah	KIMO	KEE-mo
LALA	LAH-lah	LI	LEE	LANA	LAH-na	LOKE	LOH-keh
MOKE	MOH-keh	MELE	MEH-leh	MAKA	MAH-kah	MALIA	mah-LEE-ah
NELE	NEH-leh	NONA	NOH-nah	NEKI	NEH-kee	NIALA	nee-AH-lah
OKA	OH-kah	OLIWA	oh-LEE-vah	OLEKA	oh-LEH-kah	OKO	OH-koh
PEKE	PEH-keh	PAKA	PAH-kah	PENI	PEH-nee	PALI	PAH-lee
ULEKI	oo-LEH-kee	UPANA	oo-PAH-nah	ULIA	oo-LEE-ah	ULIKA	oo-LEE-kah
WILA	VEE-lah	WENE	WEH-neh	WALI	WAH-lee	WALAKA	wah-LAH-kah

NOTE: Use Column 1 list of names until exhausted before going to Column 2, etc., All letters in the Hawaiian language are pronounced, including double or triple vowels.

Table 3-5. Western Pacific tropical cyclone names

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
ANGELA	ABE	AMY	AXEL
BRIAN	BECKY	BRENDAN	BOBBIE
COLLEEN	CECIL	CAITLIN	CHUCK
DAN	DOT	DOUG	DEANNA
ELSIE	ED	ELLIE	ELI
FORREST	FLO	FRED	FAYE
GAY	GENE	GLADYS	GARY
HUNT	HATTIE	HARRY	HELEN
IRMA	IRA	IVY	IRVING
JACK	JEANA	JOEL	JANIS
KORYN	KYLE	KINNA	KENT
LEWIS	LOLA	LUKE	LOIS
MARIAN	MANNY	MELISSA	MARK
NATHAN	NELL	NAT	NINA
OFELIA	OWEN	ORCHID	OMAR
PERCY	PAGE	PAT	POLLY
ROBYN	RUSS	RUTH	RYAN
STEVE	SHARON	SEITH	SIBYL
TASHA	TIM	TERESA	TED
VERNON	VANESSA	VERNE	VAL
WINONA	WALT	WILDA	WARD
YANCY	YUNYA	YURI	YVETTE
ZOLA	ZEKE	ZELDA	ZACK

NOTE: Names will be assigned in rotation, alphabetically. When the last name, ZACK, has been used the sequence will begin again with ANGELA. This entire list was updated at the 1992 Tropical Cyclone Conference.

3.6. Abbreviated Communications Headings. Abbreviated communications headings are assigned to advisories on tropical and subtropical cyclones and other advisories based on depression numbers or storm name and standard communication procedures.

[NOTE: An abbreviated heading consists of three groups with ONE space between the second and third groups. The first group contains a data type indicator (e.g., WT for hurricane), a geographical indicator (e.g., NT for North Atlantic and Caribbean), and a number. The second group contains a location identifier of the message originator (e.g., KMIA for Miami). The third group is a date-time group in UTC. An example of a complete header is WTNT31 KMIA 180400.]

Abbreviated communication headers for the areas of responsibility follow:

3.6.1. Atlantic.

ABNT20 KMIA	Tropical Weather Outlook
ABNT30 KMIA	Tropical Weather Summary (monthly)
WTNT41-45 KMIA	Tropical Cyclone Discussion
WTNT31-35 KMIA	Public Advisory
WTNT21-25 KMIA	Marine Advisory
WTNT61 KMIA	Tropical Cyclone Update
WTNT51 KMIA	Tropical Cyclone Position Estimate
WONT41 KMIA	Special Tropical Disturbance Statement
WTXX90 KMIA	Tropical Cyclone Discussion for WMO Region IV Stations

3.6.2. Eastern and Central Pacific.

3.6.2.1. Advisories. All advisories on hurricanes, tropical storms, and depressions are under WT abbreviated headings, as follows:

ABPZ30 KMIA	Tropical Weather Summary
ABPA30 PHNL	Tropical Weather Summary
WTPZ21-25 KMIA	Marine Advisory
WTPA21-25 PHNL	Marine Advisory
WTPZ31-35 KMIA	Public Advisory
WTPA31-35 PHNL	Public Advisory

3.6.2.2. Numbering. Depressions are numbered internally and storms are named internally, but the number in the abbreviated headings does not relate to either the internal number of the depression or the name of the storm. The first cyclone would have 21 and 31 in the abbreviated headings, the second cyclone would have 22 and 32, the sixth cyclone would have 21 and 31, etc. The abbreviated heading would not change when a depression was upgraded to storm status.

ABPA20 PHNL	Tropical Weather Outlook
ABPZ20 KMIA	Tropical Weather Outlook
WTPZ41-45 KMIA	Tropical Cyclone Discussion
WTPA41-45 PHNL	Tropical Cyclone Discussion
WTPZ51 KMIA	Tropical Cyclone Position Estimate
WTPA51 PHNL	Tropical Cyclone Position Estimate
WTPZ61 KMIA	Tropical Cyclone Update
WTPA61 PHNL	Tropical Cyclone Update
WOPZ41 KMIA	Special Tropical Disturbance Statement
WOPA41 PHNL	Special Tropical Disturbance Statement

CHAPTER 4

NATIONAL WEATHER SERVICE PRODUCTS FOR THE DEPARTMENT OF DEFENSE

4.1. General. The Department of Defense (DOD) and the Department of Commerce (DOC) weather forecasting, reconnaissance, and distribution agencies share technical information and some responsibilities. Mutually supportive relationships have developed over the years and have resulted in a mutual dependency. Due to the nature and distribution of DOD resources and operations, the DOD requires certain meteorological information beyond that available to the general public. Accordingly, the DOC provides DOD with special observations and advisories on tropical and subtropical storms threatening DOD resources or operations.

4.2. Observations. The National Hurricane Center (NHC) and Central Pacific Hurricane Center (CPHC) will make available to DOD all significant tropical and subtropical cyclone observations that they receive.

4.3. Marine Advisories.

4.3.1. General. The NHC and CPHC will provide to DOD forecasts and related information for tropical and subtropical weather disturbances of depression intensity or greater. Forecasts will include advice as to location, movement, intensity, and dimension of the disturbances. Marine advisories will be disseminated through the National Weather Service (NWS) communications facility at Suitland, MD, to the Automated Digital Weather System hub at Carswell AFB, TX, for further relay to DOD agencies. The DOD forecasters, who must give advice concerning an imminent operational decision, may contact the appropriate hurricane center forecaster (see Chapter 2) when published marine advisories require elaboration. Telephone numbers for the hurricane centers are in Appendix H.

4.3.2. Marine Advisory Issue Frequency. The first marine advisory will normally be issued when meteorological data indicate that a tropical or subtropical cyclone has formed. Subsequent advisories will be issued at 0300, 0900, 1500, and 2100 UTC from the NHC and CPHC. Advisories will continue to be issued until the system degenerates below depression level. In addition, special advisories will be issued whenever the following criteria are met:

- conditions require a hurricane or tropical storm watch or warning to be issued;
- a tropical depression becomes a tropical storm or vice versa;
- a tropical storm changes to a hurricane or vice versa;
- conditions require initiation or upgrading of an existing coastal warning;
- a tornado threat develops or ends; or
- any other circumstances causing the hurricane forecaster to believe other significant changes have occurred.

Remarks stating the reason for the special advisory or the relocation will be mandatory in all special advisories or advisories that include a relocated position.

[NOTE: Tropical cyclone updates are permitted without the requirement of a special advisory, including when coastal warnings are cancelled. However, in some cases a special advisory may follow.]

4.3.3. Marine Advisory Content. Marine advisories will contain appropriate information as shown in Figure 4-1. Advisories will contain 12-hr and 24-hr forecasts and 36-hr, 48-hr, and 72-hr outlooks valid from times based on the latest 6-hourly synoptic time.

4.3.4. Numbering of Advisories. All advisories will be numbered sequentially; e.g.,

Advisory Number 1 on Tropical Depression ONE
Advisory Number 2 on Tropical Depression ONE
Advisory Number 3 on Tropical Storm Anita
Advisory Number 4 on Hurricane Anita
Advisory Number 5 on Tropical Depression Anita.

The NHC and CPHC will append an alphabetic designator for intermediate advisories (e.g., 20A).

ZCZC MIATCMAT3 ALL
TTAAOO KNHC DDHHMM
HURRICANE BOB MARINE ADVISORY NUMBER 12
NATIONAL WEATHER SERVICE MIAMI FL
2200Z SUN AUG 18 1991

AT 6 PM EDT...HURRICANE WARNINGS ARE EXTENDED NORTH AND EASTWARD FROM CAPE HENLOPEN DELAWARE THROUGH PLYMOUTH MASSACHUSETTS. THE WARNING AREA INCLUDES LONG ISLAND...LONG ISLAND SOUND...CONNECTICUT EAST OF NEW HAVEN...AND CAPE COD. HURRICANE WARNINGS NOW EXTEND FROM LITTLE RIVER INLET NORTH CAROLINA TO PLYMOUTH MASSACHUSETTS.

TROPICAL STORM WARNINGS ARE EXTENDED TO INCLUDE DELAWARE BAY...AND CONTINUE FOR THE LOWER CHESAPEAKE BAY SOUTH OF THE MOUTH OF PATUXENT RIVER INCLUDING THE GREATER NORFOLK AREA. A HURRICANE WATCH IS ALSO ISSUED NORTHWARD FROM PLYMOUTH MASSACHUSETTS THROUGH EASTPORT MAINE.

CENTER LOCATED NEAR 33.9N 76.0W AT 18/2200Z
POSITION ACCURATE WITHIN 20NM

CURRENT MOTION TOWARD THE NORTH OR 10 DEGREES AT 16 KT

SYNOPTIC CENTER LOCATED NEAR 33.6N 75.9W AT 18/1800Z

DIAMETER OF EYE 20NM
MAX WNDS 100KT...GUSTS 120 KT
64 KT.....100NE 100SE 25SW 25NW WIND RADII IN NM
50 KT.....125NE 125SE 50SW 50NW
34 KT.....150NE 150SE 75SW 75NW
12 FT SEAS 150NE 150SE 75SW 75NW

FORECAST VALID 19/0600Z 36.5N 74.5W
MAX WND 100 KT...GUSTS 120 KT
50 KT...125NE 125SE 50SW 50NW
34 KT...150NE 150SE 75SW 75NW

FORECAST VALID 19/1800Z 41.0N 71.0W
MAX WND 100 KT...GUSTS 120 KT
50 KT...125NE 125SE 50SW 50NW
34 KT...150NE 150SE 75SW 75NW

FORECAST VALID 20/0600Z 46.0N 66.0W
MAX WND 90 KT...GUSTS 105 KT
50 KT...125NE 125SE 50SW 50NW
34 KT...150NE 150SE 75SW 75NW

STORM SURGE OF 4 TO 7 FEET ABOVE NORMAL TIDE IS POSSIBLE IN THE WARNED AREA OF NORTH CAROLINA AND 3 TO 5 FEET IN THE REMAINDER OF THE WARNED AREA. IN ADDITION...LARGE WAVES WITH BEACH EROSION WILL BE EXPERIENCED IN THE WARNED AREAS.

REQUEST FOR 3 HOURLY SHIP REPORTS WITHIN 300 MILES OF 33.9N 76.0W
EXTENDED OUTLOOK...USE FOR GUIDANCE ONLY...ERRORS MAY BE LARGE
OUTLOOK VALID 20/180Z 50.5N 60.0W
MAX WNDS 70 KT...GUSTS 85 KT
50 KT...125NE 125SE 50SW 50NW

OUTLOOK VALID 21/1800Z 56.0N 47.0W
MAX WNDS 60 KT...GUSTS 75 KT
50 KT...125NE 125SE 50SW 50NW

NEXT ADVISORY AT 19/0400Z

Figure 4-1. Marine advisory format

CHAPTER 5

AIRCRAFT RECONNAISSANCE

5.1. General. All Department of Commerce (DOC) tropical and subtropical cyclone aircraft reconnaissance needs will be requested and provided in accordance with the procedures of this chapter. As outlined in the Air Force Reserves (AFRES)/National Oceanic and Atmospheric Administration (NOAA) draft Memorandum of Agreement (see Appendix C), DOC has identified a requirement for, and the Department of Defense (DOD) maintains aircraft to support, up to five sorties per day (see Figure 5-1). Requirements exceeding five sorties will be accomplished on a "resources permitting" basis. Congress has directed the DOD to maintain a reserve Air Force flying hour program of 1600 hours in support of hurricane reconnaissance coverage. In times of national emergency or war, some or all DOD reconnaissance resources may not be available to fulfill DOC needs.

5.2. Responsibilities.

5.2.1. DOD. The DOD is responsible for

- providing operational aircraft for vortex fixes and data, synoptic tracks, and investigative flights in response to DOC needs and
- developing operational procedures to deploy data buoys to satisfy DOC needs.

5.2.2. DOC. The DOC is responsible for aircraft operations that may be requested to

- augment AFRES aircraft reconnaissance when DOC needs exceed the capabilities of DOD resources. This includes the provision of quick response to National Hurricane Center (NHC) requests for reconnaissance on developing tropical cyclones (normally east of 80°W) from August 1 through September 30 on a resources permitting basis;
- assume responsibility for hurricane reconnaissance over foreign airspace that may be restricted for military operations and
- conduct research flights that assume an operational responsibility to the hurricane centers.

Figure 5-1. WC-130 Weather Reconnaissance Aircraft

5.3. Control of Aircraft. Operational control of aircraft flying tropical and subtropical cyclone reconnaissance will remain with the operating agencies of DOD or DOC as appropriate.

5.4. Reconnaissance Requirements.

5.4.1. Meteorological Parameters. Data needs in priority order are as follows:

- Geographical position of the flight level vortex center (vortex fix) and relative position of the surface center, if known
- Center sea-level pressure determined by dropsonde or extrapolation from within 1,500 ft of the sea surface or from the computed 850-hPa height
- Minimum 700 or 850-hPa height, if available
- Wind profile data for surface and flight level
- Temperature at flight level
- Sea-surface temperature
- Dew-point temperature at flight level

5.4.2. Required Meteorological Reconnaissance Data, Ranges and Accuracies. The following are the required reconnaissance data accuracies.

5.4.2.1. Geographic Position.

- Aircraft position: within 3 nmi
- Storm surface center (wind/pressure): within 6 nmi
- Flight level storm center (wind/pressure): within 6 nmi

5.4.2.2. Wind Direction.

- Surface: within 10 deg
- Flight level for winds greater than 20 kt: within 5 deg

5.4.2.3. Wind Speed.

- Surface: within 10 kt
- Flight level: within 4 kt

5.4.2.4. Pressure Height.

- Surface: within 2 hPa
- Flight level above 500 hPa: within 20 m
- Flight level at or below 500 hPa: within 10 m

5.4.2.5. Temperature.

- Sea surface: within 1°C
- Flight level: within 1°C

5.4.2.6. Dew-Point Temperature.

- Range from -20°C to +40°C: within 1°C
- Less than -20°C: within 3°C

5.4.2.7. Absolute Altitude: Within 10 m

5.4.2.8. Vertical Sounding.

- Pressure: within 2 hPa
- Temperature: within 1°C
- Dew-point temperature:
  Range of -20°C to +40°C: within 1°C
  Less than -20°C: within 3°C
- Wind direction: within 10 deg
  Wind speed: within 5 kt

[NOTE: Present weather reconnaissance capabilities do not completely satisfy these requirements; data will be collected as close to stated requirements as possible.]

5.4.3. Required Frequency and Content of Observations. Requirements are summarized in Table 5-1.

5.4.3.1. Horizontal Observations. Standard RECCO Section 1, plus 4ddff and 9VTTT, if applicable, (9-groups are not required for WC-130s). Section 3 RECCO will not be used if HD/HA data are not available. The format is as specified in Appendix G of the National Hurricane Operations Plan (NHOP).

A. Enroute. Horizontal observations will be taken and transmitted every 200 nmi over water enroute to and from the storm area. Data from the 500-hPa level are preferred, if possible, otherwise other levels are acceptable. If an automated system is not in use, encode observations every 15 min when over water within 15 degrees of the tasked coordinates, and transmit hourly.

Table 5-1. Requirement for aircraft reconnaissance data

	RECCO (HD/HA)	RECCO (Non HD/HA)	VORTEX	SVD[1] (Non HD/HA)	VERTICAL
ENROUTE	Section 1 Every 200 nm	Section 1 & 3 Every 200 nm (When within 15 degrees, every 15 minutes) Xmt: Hourly	NA	NA	400 nm
INVEST	Every 15 min and major turn points	Every 15 min and at major turn points, Xmt: 30 min	After closing the circulation	Outbound leg	NA
FIX	At the end points of Alpha pattern legs	Midway between outbound and inbound legs	Tasked: DVDM Intermediate: AVDM or DVDM	One after each fix	Each scheduled fix and as tasked. Others at crew discretion

[1] SVD = Supplementary Vortex Data

B. Fix Missions. A horizontal observation is required at each end point of an Alpha pattern leg. If High Density/High Accuracy (HD/HA) data are not available, then additionally one horizontal observation is required midway between the outbound leg and inbound leg of the Alpha and modified Alpha flight patterns. This is not required if HD/HA data are available.

C. Invest Missions. See para 5.8.2.

5.4.3.2. High Density/High Accuracy Data. The HD/HA data include time, latitude, longitude, pressure altitude, D-value, and flight-level wind speed and direction, temperature and dew-point temperature. Minobs also include radar altitude and peak winds. These observations are collected every minute (MINOBS) and transmitted to National Hurricane Center (NHC) every 20 min (WC-130) or 30 min (WP-3). See Appendix G for the format of the MINOBS or para 5.9.4.1. for the ASDL data format.

5.4.3.3. Vortex and Supplemental Vortex Observations. Vortex and supplemental vortex observations are collected, encoded, and transmitted in accordance with NHOP pattern requirements (see para 5.7.). Supplementary vortex observations are not required when HD/HA data are transmitted. See Figures 5-2 and 5-3 and Table 5-2 for data formats.

[NOTE: Non-automated systems are marginal in satisfying these requirements. Data will be collected as close to stated requirements as possible, and will be considered satisfactory as long as observations are accomplished every 30 min.]

5.4.3.4. Vertical Observations. The frequency of vertical observations enroute to and from the storm or invest area will be approximately every 400 nmi over water, unless otherwise specified. The frequency will be as specified (NHOP flight patterns or TCPOD) within the tasked area. The format for all vertical observations is WMO TEMP DROP code (FM 37-VII). See Appendix G for the format.

5.4.4. High Density/High Accuracy Requirements. The DOC requires rapid acquisition and transmission of tropical cyclone data, especially within the last 24-hr period prior to landfall. If HD/HA capability is lost on an operational mission, the airborne meteorologist will contact CARCAH immediately to determine whether a backup aircraft is required and available.

5.4.5. High Level Synoptic Track Profile Data Requirements. When required, the NHC will request mid-tropospheric reconnaissance data on the periphery of systems approaching the United States. The NHC will provide a specific track profile including control point and control time to Chief, Aerial Reconnaissance Coordination, All Hurricanes (CARCAH) for coordination with the reconnaissance units.

VORTEX DATA MESSAGE

MANOP HEADING (PRECEDENCE IMMEDIATE)

MISSION IDENTIFIER AND OBSERVATION NUMBER

(ABBREVIATED) (DETAILED) VORTEX DATA MESSAGE

A	Z	DATE AND TIME OF FIX
B	DEG MIN N S	LATITUDE OF VORTEX FIX
	DEG MIN E W	LONGITUDE OF VORTEX FIX
C	MB M	MINIMUM HEIGHT AT STANDARD LEVEL
D	KT	ESTIMATE OF MAXIMUM SURFACE WIND OBSERVED
E	DEG NM	BEARING AND RANGE FROM CENTER OF MAXIMUM SURFACE WIND
F	DEG KT	MAXIMUM FLIGHT LEVEL WIND NEAR CENTER
G	DEG NM	BEARING AND RANGE FROM CENTER OF MAXIMUM FLIGHT LEVEL WIND
H	MB	MINIMUM SEA LEVEL PRESSURE COMPUTED FROM DROPSONDE OR EXTRAPOLATED FROM WITHIN 1500 FT OF SEA SURFACE
I	C/ M	MAX FLT LVL TEMP/PRESSURE ALT OUTSIDE EYE
J	C/ M	MAX FLT LVL TEMP/PRESSURE ALT INSIDE EYE
K	C/ C	DEWPOINT TEMP/SEA SURFACE TEMP INSIDE EYE
L		EYE CHARACTER: Closed wall, poorly defined, open SW, etc.
M		EYE SHAPE/ORIENTATION/DIAMETER. Code eye shape as: C - circular; CO - Concentric; E-Elliptical. Transmit orientation of major axis in tens of degree, i.e., 01-010 to 190; 17-170 to 350. Transmit diameter in nautical miles. *Examples*: C8 - Circular eye 8 miles in diameter. EO9/15/6 - Elliptical eye, major axis 090-270, length of major axis 15 NM, length of minor axis 6NM. CO8-14 - Concentric eye, diameter inner eye 8 NM, outer eye 14 NM.
N	DEG MIN N S	CONFIRMATION OF FIX: Coordinates and time
	DEG MIN E W	
	Z	
O	/	FIX DETERMINED BY/FIX LEVEL FIX DETERMINED BY: 1 - Penetration; 2 - Radar; 3 - Wind; 4 - Pressure; 5 - Temperature. FIX LEVEL (Indicate surface center if visible; indicate both surface and flight level centers only when same): 0 - Surface; 1 - 1500ft; 8 - 850 mb; 7 - 700 mb; 5 - 500 mb; 4 - 400 mb; 3 - 300 mb; 2 - 200 mb; 9 - Other.
P	/ NM	NAVIGATION FIX ACCURACY/METEOROLOGICAL ACCURACY
Q		REMARKS

INSTRUCTIONS: Items A through G (and H when extrapolated) are transmitted from the aircraft immediately following the fix. The remainder of the message is transmitted as soon as available for scheduled fixes and at the ARWO's discretion for unscheduled (intermediate) fixes.

Figure 5-2. Vortex data message

SUPPLEMENTARY VORTEX DATA MESSAGE

MANOP HEADING *(completed by monitors only)*

UR___ ___ 14 ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

MISSION IDENTIFIER AND OBSERVATION NUMBER *(completed by flight meteorologist and monitor)*

AF___ ___ ___

SUPPLEMENTARY VORTEX DATA MESSAGE

($L_aL_aL_a$)	($L_aL_aL_aL_a$)	(,HHH)	(TTT_aT_a)	(ddfff)
01	1	1	1	
02	2	2	2	
03	3	3	3	
04	4	4	4	
05	5	5	5	
06	6	8	8	
07	7	7	7	
($L_aL_aL_a$)	($L_aL_aL_aL_a$)	(fff)		
MF	M	MF		

OBS 01 AT: ___ Z OBS ___ AT ___ Z OBS 01 SFC WND:

LEGEND

01 INDICATOR FOR DATA COLLECTED APPROXIMATELY 105 NM FROM STORM CENTER (INBOUND) OR APPROXIMATELY 15 NM FROM CENTER (OUTBOUND)

OTHER INDICATORS (02/2, 03/3...) FOR DATA AT APPROXIMATELY 15 NM INTERVALS INBOUND OR OUTBOUND FROM STORM CENTER. INDICATORS MAY BE EXPANDED BEYOND 07(08,09...) AS NECESSARY AT APPROXIMATELY 15NM INTERVALS.

MF = INDICATOR FOR MAXIMUM FLIGHT LEVEL WIND OBSERVED

fff = SPEED OF WIND IN KNOTS

dd = TRUE DIRECTION OF FLIGHT LEVEL WIND SPEED IN TERMS OF DEGREES

TTT_aT_a = TEMP/DEWPOINT IN DEGREES CELSIUS: ADD 50 FOR NEGATIVE VALUES

HHH = PRESSURE HEIGHT DATA IN RECCO FORMAT

$L_aL_aL_a$ = LATITUDE IN DEGREES/TENTHS

$L_aL_aL_aL_a$ = LONGITUDE IN DEGREES/TENTHS

/ = DATA UNKNOWN/UNOBTAINABLE

($L_aL_aL_a$)	($L_aL_aL_aL_a$)	(,HHH)	(TTT_aT_a)	(ddfff)
01	1	1	1	
02	2	2	2	
03	3	3	3	
04	4	4	4	
05	5	5	5	
08	8	8	8	
07	7	7	7	
($L_aL_aL_a$)	($L_aL_aL_aL_a$)	(fff)		
MF	M	MF		

OBS 01 AT: ___ Z OBS ___ AT ___ Z OBS 01 SFC WND:

SAMPLE MESSAGE

URNT 12 KMIA 241703
AF 988 0411 FREDERIC OB 14
SUPPLEMENTARY VORTEX DATA MESSAGE
01178 10899 13107 10908 36027
02177 20885 23100 20908 35042
03178 30891 33092 30807 36052
04177 40887 43088 40807 35070
05178 50883 53070 50908 36088
08178 60880 63000 81010 35108
07178 70877 73882 71211 35120
MF178 MO877 MF120
OBS 01 AT 1530Z OBS 07 AT 1800Z
OBS 01 SFC WND 36025
01177 10872 13000 11010 18120
02178 20868 23070 21009 17098
03178 30862 23088 30909 18080
04177 40856 43093 40908 17050
05177 50854 53102 50908 17048
08178 60850 63108 80905 18031
07177 70844 73114 70902 18025
MF177 MO872 MF120
OBS 01 AT 1830Z OBS 07 AT 1700Z
OBS 07 SFC WIND 18025
REMARKS HEAVY RAIN OUTBOUND

REMARKS *(end of message)*

PREPARED BY: TRANSMISSION TIME:

Figure 5-3. Supplementary vortex data messsage

Table 5-2. Vortex data message entry explanation

DATA ITEM	ENTRY
MISSION IDENTIFIER	As determined in Chapter 5, paragraph 5.7.6.
OBSERVATION NUMBER	A two digit number determined by the sequential order in which the observation is transmitted from the aircraft.
(ABBREVIATED) (DETAILED) VORTEX MESSAGE	An abbreviated message has at least item ALPHA through GOLF, item HOTEL (when extrapolated DATA from flight level) and a maximum flight level wind remark in item QUEBEC.
A (ALPHA)	Date and time (UTC) of the flight level center fix. If the flight level center cannot be fixed and the surface center is visible, enter the time of the surface center fix.
B (BRAVO)	The latitude and longitude of the center fix associated with item ALPHA. NOTE: If the surface center is fixable, enter bearing and range from the center in item QUEBEC, e.g., SFC CNTR 270/15 NMI, if the centers are separated by over 5 nmi.
C (CHARLIE)	Indicate the standard atmospheric surface e.g., 850 hPa or 700 hPa. The minimum height of the standard surface observed inside the center. If at 1,500 ft or below or not within 1,500 ft of a standard surface, enter NA.
D (DELTA)	The maximum surface wind observed during the inbound leg associated with this fix.
E (ECHO)	Bearing and range of the maximum surface wind observed (item DELTA) from the coordinates reported in item BRAVO.
F (FOXTROT)	The maximum flight level wind observed during the inbound leg associated with this fix.

Table 5-2. Vortex data message entry explanation (continued)

G (GOLF)	Bearing and range of the maximum flight level wind observed (item FOXTROT) from the coordinates reported in item BRAVO.
H (HOTEL)	The minimum sea level pressure (SLP) to the nearest hectopascal observed at the coordinates reported in item BRAVO. Preface the SLP with "EXTRAP" (extrapolated) when the data are not derived from dropsonde or when the SLP is extrapolated from a dropsonde that terminated early. Clarify the difference in remarks (e.g., SLP EXTRAPOLATED FROM BELOW 1500 FEET/850 HPA/DROPSONDE)
I (INDIA)	MAX FLT LVL TEMP--This temperature is taken just outside the central region of a cyclone (i.e., just outside the eyewall or just beyond the maximum wind band). This temperature may not be the highest recorded on the inbound leg but is representative of the environmental temperature just outside the central region of the storm. PRESSURE ALT--Pressure altitude data (meters) are taken at the same location as the maximum temperature data reported in item INDIA
J (JULIET)	MAX FLT LVL TEMP--The maximum temperature observed within 5 nmi of the center fix coordinates. If a higher temperature is observed at a location more than 5 nmi away from the flight level center (item BRAVO). it is reported in item QUEBEC including bearing and distance from the flight level center. PRESSURE ALT--Pressure altitude data (meters) are taken at the same location as the maximum temperature data reported in item JULIET.
K (KILO)	Dewpoint temperature/sea surface temperature are collected at the same location as the maximum temperature reported in item JULIET. Enter NA if not observed.

Table 5-2. Vortex data message entry explanation (continued)

L (LIMA)	Only report if at least 50 percent of the center has an eyewall, otherwise enter NA. Closed wall--if the center has 100 percent coverage with no eyewall weakness. Open XX--if the center has 50 percent or more but less than 100 percent coverage. State the direction of the eyewall weakness.
M (MIKE)	Self explanatory. Report only if item LIMA is reported, otherwise enter NA.
N (NOVEMBER)	Flight level center coordinates (same as item BRAVO).
O (OSCAR)	Fix determined by: Always report 1. Report 2 if radar indicates curvature or banding consistent with fix location. Report 3 if recorded or observed winds indicate a closed center. Report 4 if the fix pressure is lower than all reported on the inbound leg. Report 5 if the fix temperature is at least higher than any reported on the inbound leg. Fix level: Report 0 alone if fix is made solely on surface winds. Report 0 and the flight-level code if the centers are within 5 nmi of each other.
P (PAPA)	Navigational and meteorological accuracy are reported as the upper limit of probable error. Meteorological accuracy is normally reported as one-half of the diameter of the light and variable wind center.
Q (QUEBEC)	Remarks to enhance the data reported above. The aircraft crew should report the maximum flight level winds observed and the time of observation on their latest pass through any of the four quadrants during the mission in the remarks section of the detailed/ abbreviated vortex message.

5.5. Reconnaissance Planning and Flight Notification.

5.5.1. DOC Requests for Aircraft Reconnaissance Data.

5.5.1.1. Coordination. The National Hurricane Center (NHC) will coordinate with the Central Pacific Hurricane Center (CPHC) to determine a list of the total DOC requirements for data on tropical and subtropical cyclones or disturbances for the next 24-hr period (1100 to 1100 UTC) and an outlook for the succeeding 24-hr period. This coordinated request will be provided to CARCAH as soon as possible, but not later than 1630 UTC each day in the format of Figure 5-4. Amendments will be provided as required.

5.5.1.2. Tropical Cyclone Plan of the Day. From the above coordinated DOC request, CARCAH will publish the Tropical Cyclone Plan of the Day (TCPOD). When DOC reconnaissance needs exceed DOD and DOC resources, CARCAH will coordinate with the NHC to establish priorities of requirements.

5.5.1.3. Anticipated Reconnaissance Requests. The following reconnaissance requests can be anticipated for a forecast or actual storm location.

A. The Atlantic, Gulf of Mexico, Caribbean, Eastern and Central Pacific:

- up to four 6-hourly fixes per day when a storm is within 500 nmi of landfall west of 55°W and north of 08°N
- up to eight 3-hourly fixes per day when a storm is forecast to be within 300 nmi of the U.S. coast, Hawaiian Islands, Puerto Rico, Virgin Islands, DOD installations, and other DOD assets when specified

B. Investigative flights may be requested for disturbances in areas defined in paragraph 5.5.1.3.1., above, i.e., one or two flights per day dependent upon proximity of landfall and upon known or suspected stage of development.

C. Exceptions may be made when additional reconnaissance is essential to carry out warning responsibilities.

5.5.2. DOD Reconnaissance Aircraft Responsiveness.

5.5.2.1. Requirement Notification. Notification of requirements must precede tasked-on-station time by at least 16 hours plus enroute time to the area of concern.

NHOP COORDINATED REQUEST FOR AIRCRAFT RECONNAISSANCE

__ Original
__ Amendment
(Check One)

I. ATLANTIC REQUIREMENTS

STORM NAME DEPRESSION # SUSPECT AREA	FIX OR ON STATION TIME	COORDI-NATES	FLIGHT PATTERN	FCST MVMT	HIGH DENS ACCY REQT	NHC PRI-ORITY

SUCCEEDING DAY OUTLOOK _____

REMARKS _____

II. EASTERN AND CENTRAL PACIFIC REQUIREMENTS

STORM NAME DEPRESSION # SUSPECT AREA	FIX OR ON STATION TIME	COORDI-NATES	FLIGHT PATTERN	FCST MVMT	HIGH DENS ACCY REQT	NHC PRI-ORITY

SUCCEEDING DAY OUTLOOK _____

REMARKS _____

III. DISTRIBUTION

A. TO CARCAH BY 1630Z OR AMEND AT ANY TIME

B. DATE _____ TIME _____ FCSTR INIT _____

Figure 5-4. NHOP coordinated request for aircraft reconnaissance

5.5.2. DOD Reconnaissance Aircraft Responsiveness.

5.5.2.1. Requirement Notification. Notification of requirements must precede tasked-on-station time by at least 16 hours plus enroute time to the area of concern.

5.5.2.2. Prepositioning. The "Succeeding Day Outlook" portion of the TCPOD provides advance notification of requirements and authorizes units to preposition aircraft to forward operating locations. For missions requiring prepositioning, the "Succeeding Day Outlook" may not provide adequate advance notification. In this situation, an "Additional Day Outlook" may be included in the TCPOD to authorize units to preposition aircraft.

5.5.2.3. Resources Permitting. When circumstances preclude the appropriate notification lead time, the requirement will be levied as "resources permitting." When a "resources permitting" requirement is levied in an amendment, the NHC will indicate the priority of all existing or remaining requirements.

5.5.2.4. Emergency Requirement. If a storm develops unexpectedly and could cause a serious threat to lives and property within a shorter time than provided for in the paragraphs above, CARCAH will contact the reconnaissance units, or higher headquarters, as appropriate, and request assistance in implementing emergency procedures not covered in this plan. The NHC and CPHC directors have authority to declare an emergency.

5.5.3. Reconnaissance Tropical Cyclone Plan of the Day.

5.5.3.1. Preparation. The CARCAH will coordinate the TCPOD (Figure 5-5) daily during the period from June 1 to November 30 and at other times during the year as required. Transmitted TCPODs will be serially numbered each season.

A. The CARCAH will coordinate the TCPOD with the NHC, 815th Weather Flight, and the Aircraft Operations Center before publication.

B. The TCPOD will list all DOC and DOD required tropical and subtropical cyclone reconnaissance operational missions. The remarks section of the TCPOD will include appropriate comments whenever research and operational flights overlap.

C. The DOD-required tropical or subtropical cyclone reconnaissance missions in the Atlantic or the Pacific west to 180° will be identified in the TCPOD as USN or USAF requirements.

D. Amendments to the TCPOD will be published only when requirements change. When amended, the impact on each listed flight will be identified (i.e., No Change, Change Added, or Cancel).

TROPICAL CYCLONE PLAN OF THE DAY FORMAT
--ATLANTIC, EASTERN, AND CENTRAL PACIFIC OCEANS--

FM: CARCAH, CORAL GABLES, FL

TO: (AFRES-APPROVED ADDRESSEES)/(NOAA-APPROVED ADDRESSEES)

SUBJECT: TROPICAL CYCLONE
RECON POD FROM _____Z (MONTH) (YEAR) TO _____Z (MONTH) (YEAR) FOLLOWS

I. ATLANTIC

1. (STORM NAME, DEPRESSION, SUSPECT AREA) or (NEGATIVE RECON REQUIREMENTS)

FLIGHT ONE (NHC PRIORITY, if applicable)

A. _____Z FIX TIMES/ON STATION TIMES

(Resources permitting if applicable)
_____Z

B. _____ MISSION IDENTIFIER

C. _____Z ETD

D. _____ DEPARTURE STATION

E. _____ FORECAST POSITION/STORM NAME

F. _____ DESTINATION STATION

G. _____ FLIGHT PATTERN

H. _____ FORECAST MOVEMENT

I. _____ REMARKS

FLIGHT TWO (if applicable, same as FLIGHT ONE)

2. (SECOND SYSTEM, if applicable, same as in 1. above)

3. OUTLOOK FOR SUCCEEDING DAY (NHC PRIORITY, if applicable)

A. POSSIBLE _(Unit)_ ON STATION REQUIREMENT NEAR _(Location)_
AT _(Time)_ Z.

II. EASTERN AND CENTRAL PACIFIC (Same as in ATLANTIC)

Figure 5-5. Tropical cyclone plan of the day format

5.5.3.2. Dissemination. The TCPOD will be made available to appropriate agencies that provide support to or control of reconnaissance aircraft or are a part of the tropical cyclone warning service. Under normal circumstances, the TCPOD will be disseminated by 1800 UTC each day. Amendments will be disseminated as required.

[NOTE: The TCPOD will not be disseminated by message on weekends or holidays if there are no current-day or succeeding-day reconnaissance requirements. The CARCAH, however, will still coordinate with concerned agencies by telephone as in paragraph 5.5.3.1.1., above.]

5.5.4. Air Traffic Control (ATC) Clearances.

5.5.4.1. Air Traffic Control Separation. Air traffic control agencies will provide air traffic control separation between all aircraft operating on storm missions and between storm aircraft and nonparticipating aircraft operating on instrument flight rules within controlled airspace. Mission commanders are reminded that nonparticipating aircraft may be operating near storm areas; thus, adherence to ATC clearances is mandatory for safety.

5.5.4.2. Assigned Altitudes. When storm aircraft cannot maintain assigned altitudes due to turbulence, ATC should be advised. Normal vertical separation of 1,000 ft at flight level (FL) 290 and below and 2,000 ft above FL 290 will be provided by ATC to aircraft operating in the storm area. Unless otherwise coordinated with ATC, the altitudes between storm-mission aircraft may be used by ATC for nonparticipating aircraft. Any procedure desired by storm-mission aircraft commanders that is outside these parameters must be coordinated with the appropriate ATC facility.

5.5.4.3. Release of Dropsondes. Dropsonde releases will be coordinated with the appropriate Air Route Traffic Control Center and participating aircraft if within controlled airspace, and with participating aircraft only, if outside controlled airspace. Contact between participating aircraft will be made using the frequencies listed in paragraph 5.9.3.

5.6. Reconnaissance Effectiveness Criteria.

5.6.1. General. Specified reconnaissance times are established to allow sufficient time for the forecaster to analyze the data before issuing an advisory. Every effort should be made to obtain data at scheduled times. The following criteria will be used to assess reconnaissance mission effectiveness (see Figure 5-6):

5.6.1.1. Tropical Cyclone Fix Mission.

A. ON-TIME. The fix is made not earlier than 1 hr before nor later than 1/2 hr after scheduled fix time.

MISSION EVALUATION FORM

MEMORANDUM FOR: OL-A, 815TAS/CARCAH

FROM: _____(Director, NHC, CPHC)_____

SUBJECT: Mission_____Evaluation
(Mission Identifier)

PUBLISHED REQUIREMENTS:

Premission Coordinates (As Updated Prior to TKO)_____N_____W

Flight Pattern _____

Mission Requirements Times _____

RECONNAISSANCE MISSION PERFORMANCE:

Flight Flown:	____Completely	____Partially	____Other
Horizontal Data Coverage:	____Complete ____Incomplete	____Timely ____Untimely	____Accurate ____Inaccurate
Vertical Data Coverage:	____Complete ____Incomplete	____Timely ____Untimely	____Accurate ____Inaccurate
Requirements Accomplished:	____On Time ____Missed	____Early	____Late

OVERALL MISSION EVALUATION:

OUTSTANDING_____

UNSATISFACTORY_____ FOR:

COMPLETENESS_____ TIMELINESS_____ ACCURACY_____

EQUIPMENT_____ PROCEDURES_____ OTHER_____

REMARKS: (Brief but specific)

_____
FORECASTER's SIGNATURE

Figure 5-6. Mission evaluation form

B. EARLY. The fix is made from 1 hr before scheduled fix time to one-half of the time interval to the preceding scheduled fix, not to exceed 3 hr.

C. LATE. The fix is made within the interval from 1/2 hr after scheduled fix time to one-half of the time interval to the succeeding scheduled fix, not to exceed 3 hr.

D. MISSED. Data are not obtained within the parameters specified for on-time, early, or late.

[NOTE: Appropriate credit will be given when the aircraft arrives in the requested area but is unable to locate a center due to storm dissipation or rapid movement. Credit will also be given for radar fixes if penetration is not possible due to geographic or other flight restrictions.]

5.6.1.2. Tropical Cyclone Investigative Missions.

A. ON-TIME. An observation must be taken within 250 nmi of the specified coordinates by the scheduled time.

B. LATE. An observation is taken within 250 nmi of the specified coordinates after the scheduled time but not later than the scheduled time plus 2 hr.

C. MISSED. When the aircraft fails to be within 250 nmi of the specified coordinates by the scheduled time plus 2 hr.

5.6.2. Mission Assessment. The NHC or CPHC will provide CARCAH a written assessment of the reconnaissance mission anytime its timeliness or quality is outstanding or substandard (see Figure 5-6). Requirements levied as "resources permitting" will not be assessed for timeliness, but may be assessed for quality of data gathered.

5.6.3. Summaries. The CARCAH will maintain monthly and seasonal reconnaissance summaries detailing missions actually flown to satisfy NHC-levied requirements.

5.7. Aerial Reconnaissance Weather Encoding, Reporting, and Coordination.

5.7.1. Vortex Data. The detailed vortex data message (Figure 5-1) will be prepared with all observed vortex fix information for all scheduled fixes. For intermediate fixes, either an abbreviated or detailed vortex data message may be transmitted, depending upon availability of information and forecaster requirements.

5.7.2. Center Fix Data. When proximity to unfriendly territory, air traffic control restriction, or other factors prevent actual penetration of the vortex by the reconnaissance aircraft, it is permissible to fix the cyclone by radar. All aircraft radar fix reports will be made in plain text and appended to a RECCO observation taken at fix time or to a supplementary vortex data message completed up to the time of the radar fix, e.g., RADAR CENTER FIX 21.5N 83.0W, POOR RADAR PRESENTATION, NAV ACCURACY 5NMI. The remark stating the type of radar fix and quality of the radar presentation is in accordance with Chapter 7, paragraph 7.2.2.

5.7.3. Supplementary Vortex Data. Penetration and collection of supplementary vortex data will normally begin at a radius of approximately 105 nmi from the center as determined by the flight meteorologist. The required supplementary vortex data are as shown in Figure 5-2. Supplementary vortex data are not required when HD/HA data are received or available at CARCAH or NHC. If a fix is not possible and supplementary vortex data have been collected, transmit the inbound leg as a complete observation and add clarifying remarks, e.g., "FIX NOT MADE, CLOSED CIRCULATION NOT FOUND, INVESTIGATIVE PROFILE BEGUN AT 23/1522Z."

5.7.4. Mission Coordination. Mission coordination for all missions will be accomplished through CARCAH. Meteorological discussions for Central Pacific missions may be accomplished directly with the CPHC; however, any changes to tasking will be accomplished through CARCAH.

5.7.5. Post-flight Debriefing. Unless otherwise directed, the flight meteorologist will provide either an airborne or post-flight debriefing to the appropriate hurricane center to ensure all observations were received and understood.

5.7.6. Mission Identifier. Each reconnaissance report will include the mission identifier as the opening text of the message. Regular weather and hurricane reconnaissance messages will include the five-digit agency/aircraft indicator followed by the CARCAH assigned mission-storm system indicator. Elements of the mission identifier follow:

Agency/Aircraft	Mission Storm System Indicator			
Agency + Aircraft Number[1, 2]	Number of missions this storm system	Depression number or XX if not a depression or greater	Location A,C,E [3]	Storm name or words CYCLONE or INVEST

[1] AF plus last 3 digits of tail number

[2] NOAA, plus last digit of aircraft registration number 6

[3] A = Atlantic, C = Central Pacific, E = Eastern Pacific

-EXAMPLES-

AF985 01XXA INVEST	(USAF aircraft 985 on the first mission to investigate a suspect area.)
AF987 0503C CYCLONE	(USAF aircraft 987 on the fifth mission on depression number 3. Invest or fix as specified in TCPOD.)
NOAA2 0701A AGNES	(NOAA aircraft 42RF on the seventh mission to fix depression number 1, which has acquired the name AGNES.)

5.7.7. Observation Numbering and Content.

5.7.7.1. First Weather Observation. The first weather observation will have appended as remarks the International Civil Aviation Organization (ICAO) four-letter identifier for the departure station, time of departure, and estimated time of arrival (ETA) at the coordinates or storm.

-EXAMPLE-

AF966 0308A EMMY OB 01 KMIA
97779 TEXT TEXT... DPTD KBIX AT 10/2100Z ETA 31.5N 75.0W AT 11/0015Z

5.7.7.2. Numbering Scheme. All observations (RECCO, vortex, supplemental, and dropsonde) from the first to the last will be numbered sequentially. The Improved Weather Reconnaissance System (IWRS) will automatically number MINOBS sequentially, but separately from other observations. When an aircraft is diverted from its original mission to fulfill NHC requirements, conclude the original mission by using the last report remark. The next observation from the diverted aircraft will be labeled OB 01, will use the CARCAH-assigned mission identifier, and will include time of diversion and ETA of coordinates of interest.

-EXAMPLE-

AF968 OlXXA INVEST OB 01 KMIA
97779 TEXT ...
DPTD AF968 1005A CINDY MISSION AT 05/1235Z ETA 18N 85W AT 05/1630Z

5.7.7.3. Final Weather Observation. Append to the final weather observation a remark that includes ETA, destination, number of observations (excluding MINOBS), and monitor(s) that copied the observations.

-EXAMPLE-

AF913 0317A JOAN OB 16 KMIA
97779 TEXT TEXT... ETA KBIX 15/2030Z, LAST REPORT, OBS 01 THRU 16 TO KMIA.

5.8. Operational Flight Patterns. This section includes operational flight patterns that provide vortex and peripheral data on tropical and subtropical cyclones including two 6-hourly and intermediate fixes.

5.8.1. Flight Pattern ALPHA Operational Details.

5.8.1.1. Flight Levels and Sequence. Flight levels will normally be at 1,500 ft, 850 hPa, or 700 hPa, depending on data requirements and flight safety. The flight sequence is shown in the figure. The pattern sequence can be entered at any point and then repeated for the mission duration. See Figure 5-7.

5.8.1.2. Reconnaissance Code. When HD/HA is not used, reconnaissance code (section 1 plus 4ddff) is required for each transit of a triangle (▲) position in Figures 5-7 and 5-8. These data are transmitted immediately. Groups with the indicator 4 are included in observations only when surface winds are discernible. Open circle (O) positions indicate the beginning or ending of supplementary vortex data on inbound or outbound radials.

5.8.1.3. Supplementary Vortex Data. Supplementary vortex data are required for each radial flown inbound or outbound. Transmit data to the appropriate monitor at the end of each pair of inbound or outbound legs flown. When HD/HA data are available at CARCAH or NHC, the supplementary vortex data message is not required from the aircraft. The CARCAH or NHC will prepare and disseminate the supplementary vortex data message, as appropriate.

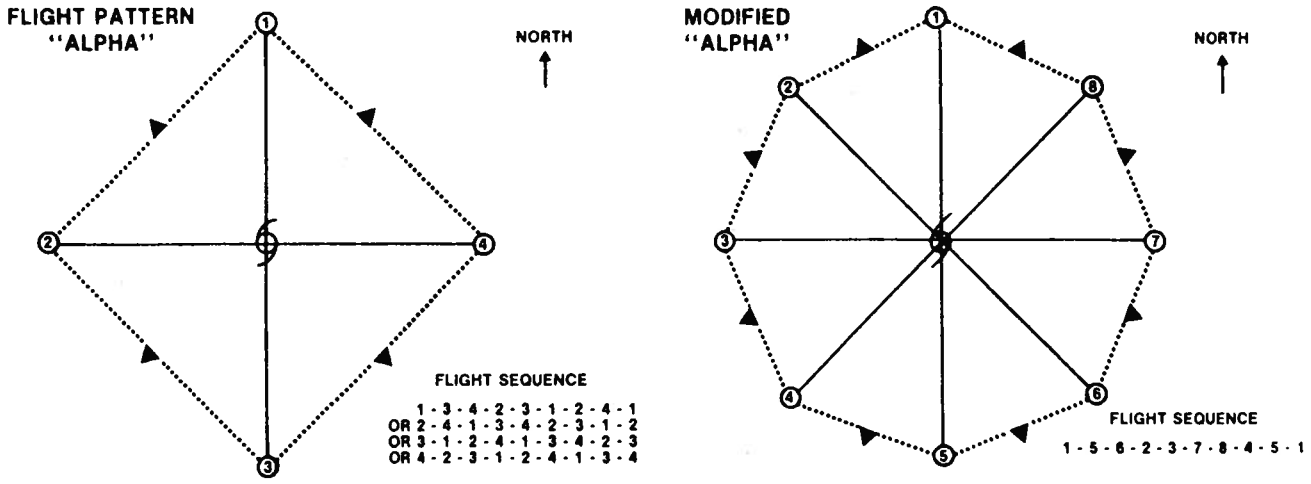

Figure 5-7. Flight patterns ALPHA and modified ALPHA

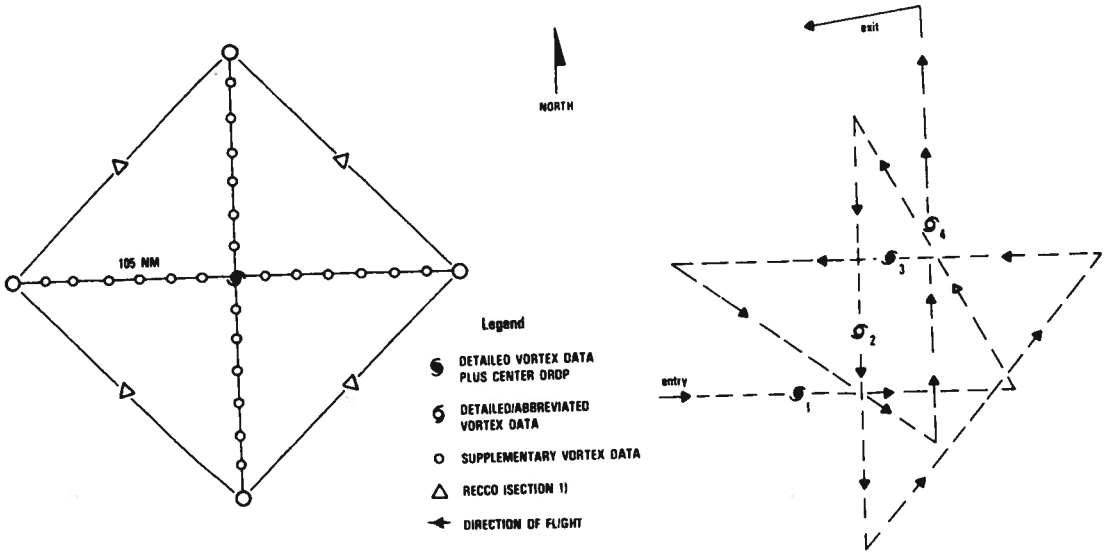

Figure 5-8. Recommended pattern ALPHA execution

5.8.1.4. Center Fix Data. On each transit of the center a fix will be made and a vortex data message completed. If it is a scheduled fix, the detailed vortex data message will be completed using data gathered on the inbound track since the previous fix and will be transmitted immediately. If it is an intermediate (nonscheduled) fix, an abbreviated vortex data message using data gathered on the inbound track since the previous fix may be prepared in lieu of the detailed message and transmitted immediately. Center dropsonde data will also be provided for scheduled fixes made at 700 hPa or above. The dropsonde will be released at the flight-level center coordinates (item BRAVO of the vortex data message). When making a fix from 850 hPa or 700 hPa extrapolate sea-level pressure using Table 5-3 or Table 5-4, respectively, or use an approved computer program.

Table 5-3. Surface pressure as a function of 850 hPa heights and temperatures

Heights	850 hPa Temperature (°C)								
	14	16	18	20	22	24	26	28	30
1560	1020	1018	1017	1016	1014	1013	1012	1010	1009
1540	1017	1016	1015	1014	1012	1011	1010	1008	1007
1520	1015	1014	1013	1011	1010	1009	1007	1006	1005
1500	1013	1012	1010	1009	1008	1006	1005	1004	1003
1480	1010	1009	1008	1007	1005	1004	1003	1002	1000
1459	1008	1007	1006	1004	1003	1002	1001	999	998
1440	1006	1005	1003	1002	1001	1000	999	997	996
1420	1004	1002	1001	1000	999	998	996	995	994
1400	1001	1000	999	998	996	995	994	993	992
1380	999	998	997	995	994	993	992	991	990
1360	997	995	994	993	992	991	990	989	987
1340	994	993	992	991	990	989	988	986	985
1320	992	991	990	989	988	986	985	984	983
1300	990	989	988	986	985	984	983	982	981
1280	987	986	985	984	983	982	981	980	979
1260	985	984	983	982	981	980	979	978	977
1240	983	982	981	980	979	978	977	976	975
1220	981	980	979	978	977	976	975	974	972
1200	978	977	976	975	974	973	972	971	970
1180	976	975	974	973	972	971	970	969	968
1160	974	973	972	971	970	969	968	967	966
1140	972	971	970	969	968	967	966	965	964
1120	969	968	967	967	966	965	964	963	962
1100	967	966	965	964	963	963	962	961	960
1080	965	964	963	962	961	960	960	959	958
1060	963	962	961	960	959	958	957	957	956
1040	960	959	959	958	957	956	955	954	954
1020	958	957	957	956	955	954	953	952	951
1000	956	955	954	953	953	952	951	950	949

Lapse Rate Used: -6.5 Deg c/km. Assumed dew point depression of 10 deg C.

This table is based on the identical computations used by IWRS to extrapolate SLP from aircraft platform data.

Table 5-4. Surface pressure as a function of 700 hPa heights and temperatures

Heights	700 hPa Temperature (°C) 12	14	16	18	20	22	24	26	28
3000	990	987	985	982	980	978	975	973	970
2980	988	985	983	980	978	976	973	971	968
2960	985	983	981	978	976	973	971	969	966
2940	983	981	978	976	974	971	969	967	964
2920	981	979	976	974	972	969	967	965	962
2900	979	976	974	972	969	967	965	962	960
2880	977	974	972	970	967	965	963	960	958
2860	974	972	970	968	965	963	961	958	956
2840	972	970	968	965	963	961	959	956	954
2820	970	968	966	963	961	959	957	954	952
2800	968	966	963	961	959	957	954	952	950
2780	966	964	961	959	957	955	952	950	948
2760	964	961	959	957	955	953	950	948	946
2740	961	959	957	955	953	951	948	946	944
2720	959	957	955	953	951	948	946	944	942
2700	957	955	953	951	949	946	944	942	940
2680	955	953	951	949	946	944	942	940	938
2660	953	951	949	946	944	942	940	938	936
2640	951	949	946	944	942	940	938	936	934
2620	949	946	944	942	940	938	936	934	932
2600	946	944	942	940	938	936	934	932	930
2580	944	942	940	938	936	934	932	930	928
2560	942	940	938	936	934	932	930	928	926
2540	940	938	936	934	932	930	928	926	924
2520	938	936	934	932	930	928	926	924	922
2500	936	934	932	930	928	926	924	922	920
2480	934	932	930	928	926	924	922	920	918
2460	932	930	928	926	924	922	920	918	916
2440	929	928	926	924	922	920	918	916	914
2420	927	925	924	922	920	918	916	914	912
2400	925	923	922	920	918	916	914	912	910
2380	923	921	919	918	916	914	912	910	908
2360	921	919	917	916	914	912	910	908	907
2340	919	917	915	914	912	910	908	906	905
2320	917	915	913	912	910	908	906	904	903
2300	915	913	911	910	908	906	904	903	901
2280	913	911	909	908	906	904	902	901	899
2260	911	909	907	905	904	902	900	899	897
2240	909	907	905	903	902	900	898	897	895
2220	907	905	903	901	900	898	896	895	893
2200	904	903	901	899	898	896	894	893	891
2180	902	901	899	897	896	894	893	891	889
2160	900	899	897	895	894	892	891	889	887
2140	898	897	895	893	892	890	889	887	885
2120	896	895	893	891	890	888	887	885	884
2100	894	893	891	890	888	886	885	883	882

Lapse rate used: -6.5 deg C/km. Assumed dew point depression of 10 deg C.

This table is based on the identical computations used by IWRS to extrapolate SLP from aircraft platform data.

5.8.1.5. Dropsonde Data. The requirement for dropsonde data in the periphery of the storm will be determined on a case-by-case basis and coordinated through the TCPOD.

5.8.1.6. Entry and Exit Track. The entry and exit track should be on one of the cardinal directions (see recommended pattern "A" execution, Figure 5-8). Prior to starting an inbound or an outbound track, the aircrew should evaluate all available data, e.g., radar presentation, satellite photo, and select a course within plus or minus 20 deg of the cardinal direction. Once started on the course, every effort should be made to maintain a straight track and the tasked altitude unless flight safety becomes a factor.

5.8.2. Investigative Missions. An investigative mission is tasked on tropical disturbances to determine the existence or non-existence of a closed circulation, supply reconnaissance observations in required areas, and locate the vortex center, if any.

5.8.2.1. Flight Levels. Flight level will normally be at or below 1,500 ft absolute altitude but may be adjusted as dictated by data requirements, meteorological conditions, or flying safety factors. During day or night operations when flying safety conditions dictate, an 850 hPa or higher altitude may be flown.

5.8.2.2. Required Reconnaissance Observations. Reconnaissance observations (Section 1, plus 4ddff and 9VTTT, if applicable--see para 5.4.3.1.) are required approximately every 15 minutes and at major turn points. If HA/HD data are not available, a Section 3 observation may be appended to the next RECCO Section 1 observation and data will be transmitted at least every 30 minutes. The 4-or-9 group will not be reported if data are unavailable.

5.8.2.3. Vortex Fix. A detailed vortex data message is required if a vortex fix is made.

5.8.2.4. Closed Circulation. A closed circulation is supported by at least one sustained wind reported in each quadrant of the cyclone. Surface winds are preferred.

5.8.2.5. Flight Pattern. Suggested patterns are the X, Box, or Delta patterns, but the flight meteorologist may choose any approach. See Figure 5-9. Turns are usually made to take advantage of tailwinds whenever possible.

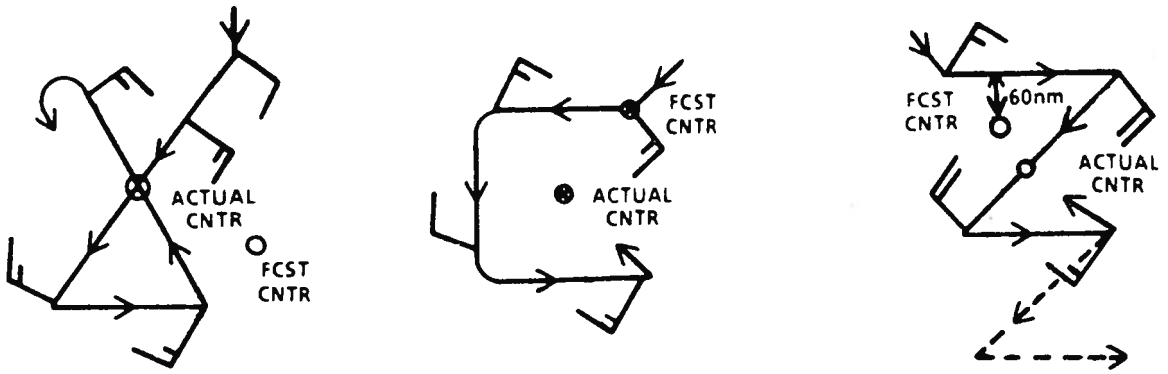

Figure 5-9. Suggested patterns for investigative missions

A. On the X pattern, the aircraft is turned to head directly towards the center, as indicated by the surface or flight level winds. The aircraft is flown through the calm center until winds from the opposite direction occur (second quadrant). The aircraft is then turned to a cardinal heading until a wind shift occurs (third quadrant). Finally, the aircraft is turned towards the center and flown straight through the center to the last quadrant.

B. On the Box pattern, the aircraft is flown on cardinal headings around the suspected center. The track resembles three sides of a square.

C. On the Delta pattern, the aircraft is flown on a cardinal heading to pass 60 nmi from the forecasted center. After observing a wind shift (second quadrant) the aircraft is turned to pass through the center until winds from the opposite direction occur (third quadrant). Finally, the aircraft is turned on a cardinal heading (parallel to the initial heading) to pick up the fourth quadrant winds. If data indicate that the aircraft is far north of any existing circulation, the pattern is extended as shown by the dashed lines.

[NOTE: The depicted pattern may be converted to a mirror image if entry is made from a different direction.]

5.9. Aircraft Reconnaissance Communications.

5.9.1. General. The U.S. Air Force and NOAA aircraft will normally transmit reconnaissance observations via the Air Force Satellite Communications System (AFSATCOM), Aircraft-to-Satellite Data Link, or high frequency (HF) radio phone patch. Flight meteorologists should contact CARCAH following the first fix, and periodically through the mission.

5.9.2. Air-to-Ground Communications (HF Radio). The weather reconnaissance crew will relay weather data via direct telephone patch to the weather data monitor. Monitors will evaluate these reports and disseminate them to either the Automated Digital Weather Switch or the weather communications facility at Suitland, Maryland. When requested, aeronautical stations will provide a discrete frequency for misson use, if possible. Specific radio procedures and terminology will comply with Allied Communications Publication 125, Standard Telephone and Radio Procedures. Because of the perishable nature and potential operational impact of weather data, USAF has authorized the use of IMMEDIATE precedence for transmission of hurricane reconnaissance data. Data will be routed by direct phone patch between the aircraft and Miami Weather Monitor (CARCAH). In the central Pacific, Hickam Weather Monitor (Letterman) is available if communications with Miami Weather Monitor are difficult.

5.9.3. Air-to-Air Communications. When more than one reconnaissance aircraft is known to be operating in a particular area of interest, the following frequencies will be used for airplane-to-airplane communications and coordination unless otherwise directed by air traffic control:

- Primary: VHF 123.05 MHz
- Secondary: UHF 304.8 MHz
- Back-up: HF 4701 KHz USB

5.9.4. Aircraft-to-Satellite Data Link (ASDL) Equipped Aircraft. Aircraft equipped with ASDL have the option to utilize the ASDL system using the following procedures (See Figure 5-10):

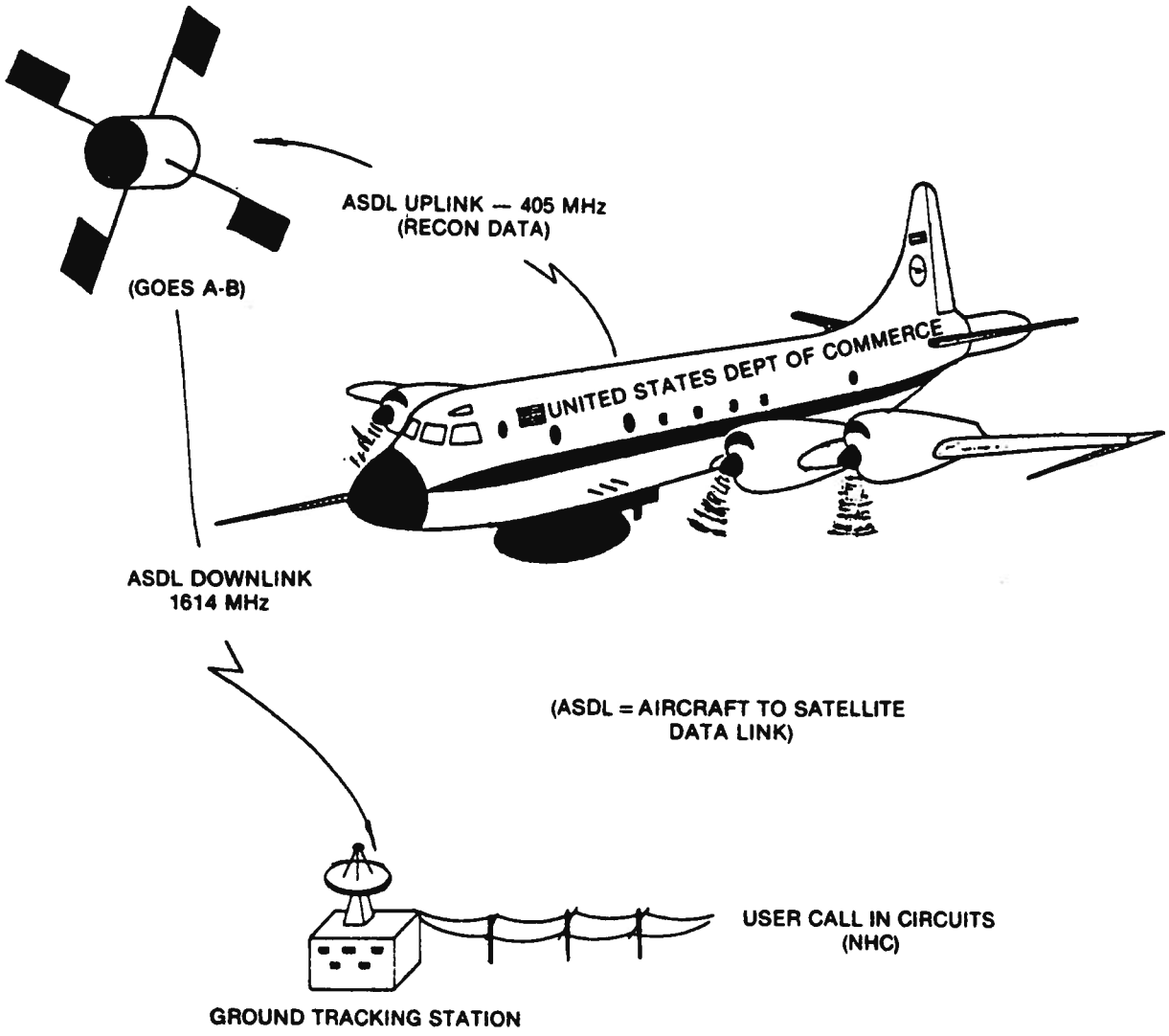

Figure 5-10. Schematic of aircraft to satellite data link for NOAA P-3 aircraft

5.9.4.1. Data Format. The following format will be used for data transmission by the ASDL system.

- One minute observation--all locations

(Platform Identifier)
15C9419C
(Message Header) (Date/Time)
URNT40 KMIA 291630
(Mission Identifier)
NOAA3 1002 ALLEN

(Time)(Hr/Min/Sec)	(Latitude)(Deg/Min)	(Longitude)(Deg/Min)	(Press Alt)(ft)	(D Value)(ft)
123300	2803	08037	0617	0436

(Wind)(Dir/Speed) (Temperature)(°C/Tenths) (Dew Point)(°C/Tenths)
213010 ±138 ±096
(End of Message)
NNNN

- RECCO Observation--Atlantic Area

(Platform Identifier)
15C9419C
(Message Header) (Date/Time)
URNT40 KMIA 291630
(Observation MANOP Heading)
URNT11 KMIA
(Mission Identifier)
NOAA31002 ALLEN OB 03
(RECCO Text)
97779 12427... 93275
(End of Message)
NNNN

- RECCO Observation--Eastern and Central Pacific. This is the same as the one above except that the observation MANOP heading is URPN11 KMIA.

[NOTE: 11 is used for routine tropical cyclone observations; 12 is used for vortex reports, etc.]

(Platform Identifier)
15C9419C
(Message Header) (Date/Time)
URPN11 KMIA 291630
(Observation MANOP Heading)
URPN11 KMIA
(Mission Identifier)
NOAA3 1002 ALLEN 0B 03
(RECCO Text)
97779 12427... 93275
(End of Message)
NNNN

5.9.4.2. Data Transmission Schedule. To aid the transmission of data from several aircraft through one circuit, each aircraft will be assigned a specific block of time within the 30-minute interval for transmission of its data. The schedule is shown in Table 5-5.

Table 5-5. ASDL data transmission schedule

TIME PERIOD	TRANSMITTER
0 - + 5	
+ 5 - +10	AOC 42RF P-3(A)
+10 - +15	AOC 43RF P-3(B)
+15 - +20	
+20 - +25	
+25 - +30	
+30 - +35	
+35 - +40	AOC 42RF P-3(A)
+40 - +45	AOC 43RF P-3(B)
+45 - +50	
+50 - +55	Radar
+55 - +60	Radar

[NOTE: Because only 4 min 28 sec of each 5-min time block can be used for data transmission, roughly 1/2 min is left in each transmission block. This schedule is designed to eliminate diagnostic statements that would appear at the NESDIS computer if data from specific sources arrived at the computer at unscheduled times.]

5.9.4.3. Data Transmission Test. Prior to the beginning of the hurricane season, each ASDL-equipped aircraft will perform a ground or airborne test of the equipment and data ground handling procedures to determine the equipment reliability, transmission errors, and time lapse between transmission of the data from the aircraft and receipt of the data by the hurricane forecaster. Test data will be forwarded to the Chairman, Working Group for Hurricane and Winter Storms Operations.

5.9.5. Improved Weather Reconnaissance System (IWRS) Equipped Aircraft. The AFRES aircraft equipped with IWRS will use the AFSATCOM data link with ground stations at NHC and at Keesler AFB, MS to relay data to the NHC and the AWN. Figure 5-11 depicts these communication links.

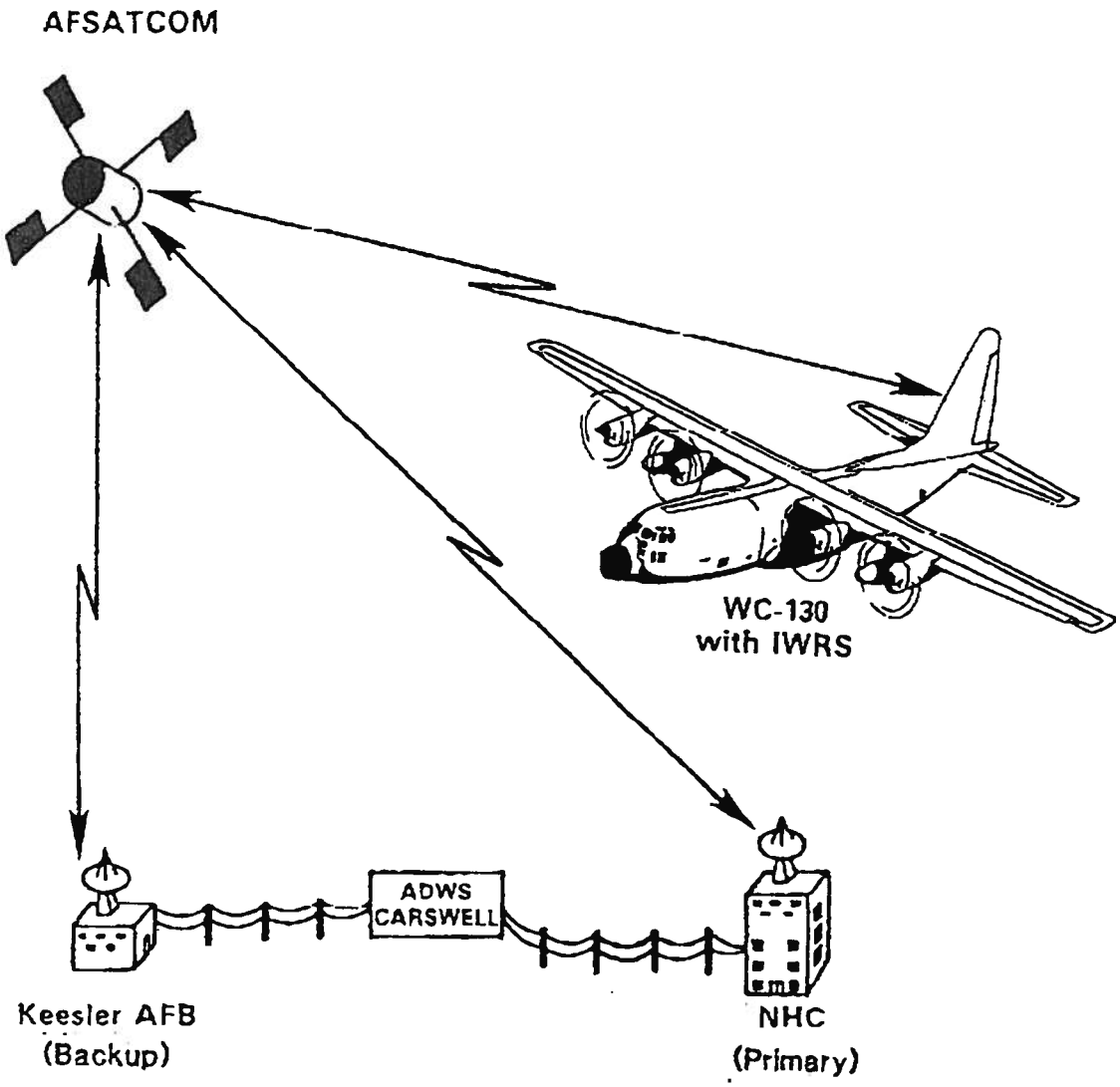

Figure 5-11. Schematic of aircraft to satellite data link for AFRES WC-130 aircraft

CHAPTER 6

SATELLITE SURVEILLANCE OF TROPICAL AND SUBTROPICAL CYCLONES

6.1. Satellites.

6.1.1. Geostationary Operational Environmental Satellite (GOES). The GOES system currently consists of ONE operational spacecraft, GOES-7, due to arrive at its new designated station, 112°W, by late April 1992. The principal GOES products are one-half hourly pictures with implanted grids automatically applied to all sectors. During daylight hours, approximately 1-, 2-, and 4-km resolution fixed standard sectors are produced (see Figure 6-1). During the night (and during daylight) the same geographical coverage standard sectors are produced with 7-km resolution in infrared (IR). The IR data may be enhanced to emphasize various features. Also, 14-km resolution sectors of water vapor are available half-hourly. All products are delivered in near real time to the National Environmental Satellite, Data, and Information Service's (NESDIS) Synoptic Analysis Branch (SAB), the Satellite Field Distribution Facilities (SFDFs) and Weather Service Forecast Offices (WSFOs)(see Table 6-1).

6.1.2. National Oceanic and Atmospheric Administration (NOAA) Polar-Orbiting Satellites. These Advanced Television Infrared Observation Satellites (NOAA Series) cross the United States twice daily near the equatorial crossing times indicated in Table 6-1. Data are available via direct readout--high resolution picture transmission (HRPT) or automatic picture transmission (APT)--or central processing. Data from the Advanced Very High Resolution Radiometer (AVHRR) are available on a limited basis through the GOES distribution system (Figure 6-2). The Air Force Global Weather Central (AFGWC), Offutt AFB, NE, receives global NOAA imagery data direct from central readout sites on a pass-by-pass basis. Data are processed in mapped and unmapped form for use internally.

6.1.3. European Space Agency (ESA) Geostationary Meteorological Satellite (METEOSAT). Two operational METEOSAT satellites, METEOSAT-4 and METEOSAT-3, stationed at 0°W and at 50°W respectively, provide extensive coverage of the Atlantic Ocean from Africa to the Caribbean. METEOSAT data, including applied grid information, are generated and transmitted every half hour. The IR and water vapor data have a 5 km resolution whereas the VIS data have a 2.5 km resolution. The digital data are transmitted to the National Hurricane Center (NHC) in Miami, Florida, and the National Environmental Satellite, Data and Information Service (NESDIS) and National Meteorological Center (NMC) at the NOAA Science Center (NSC) in Camp Springs, Maryland. METEOSAT WEFAX data are also available and distributed on GOES-Tap circuits.

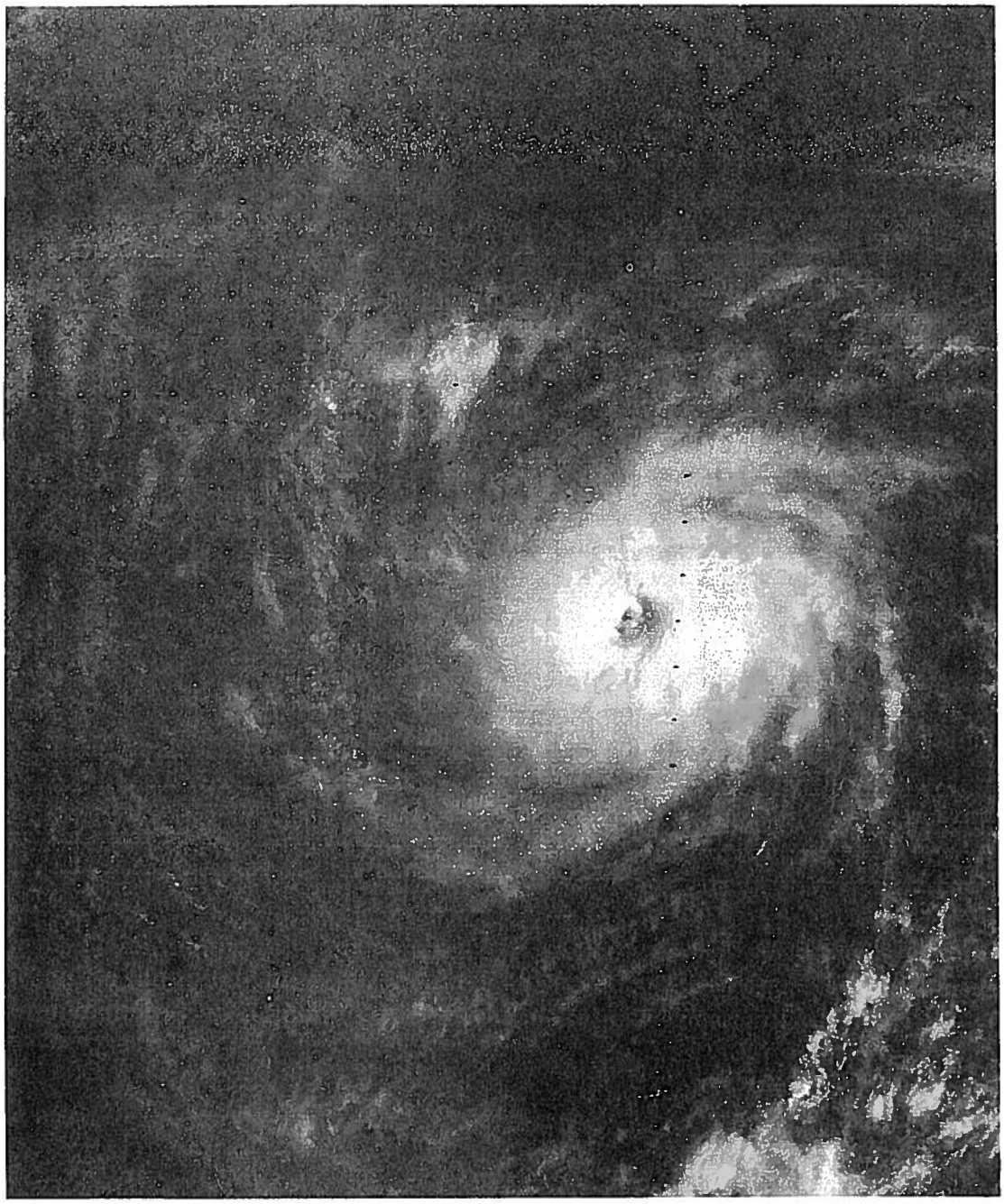

Figure 6-1. Hurricane Kevin, September 30, 1991

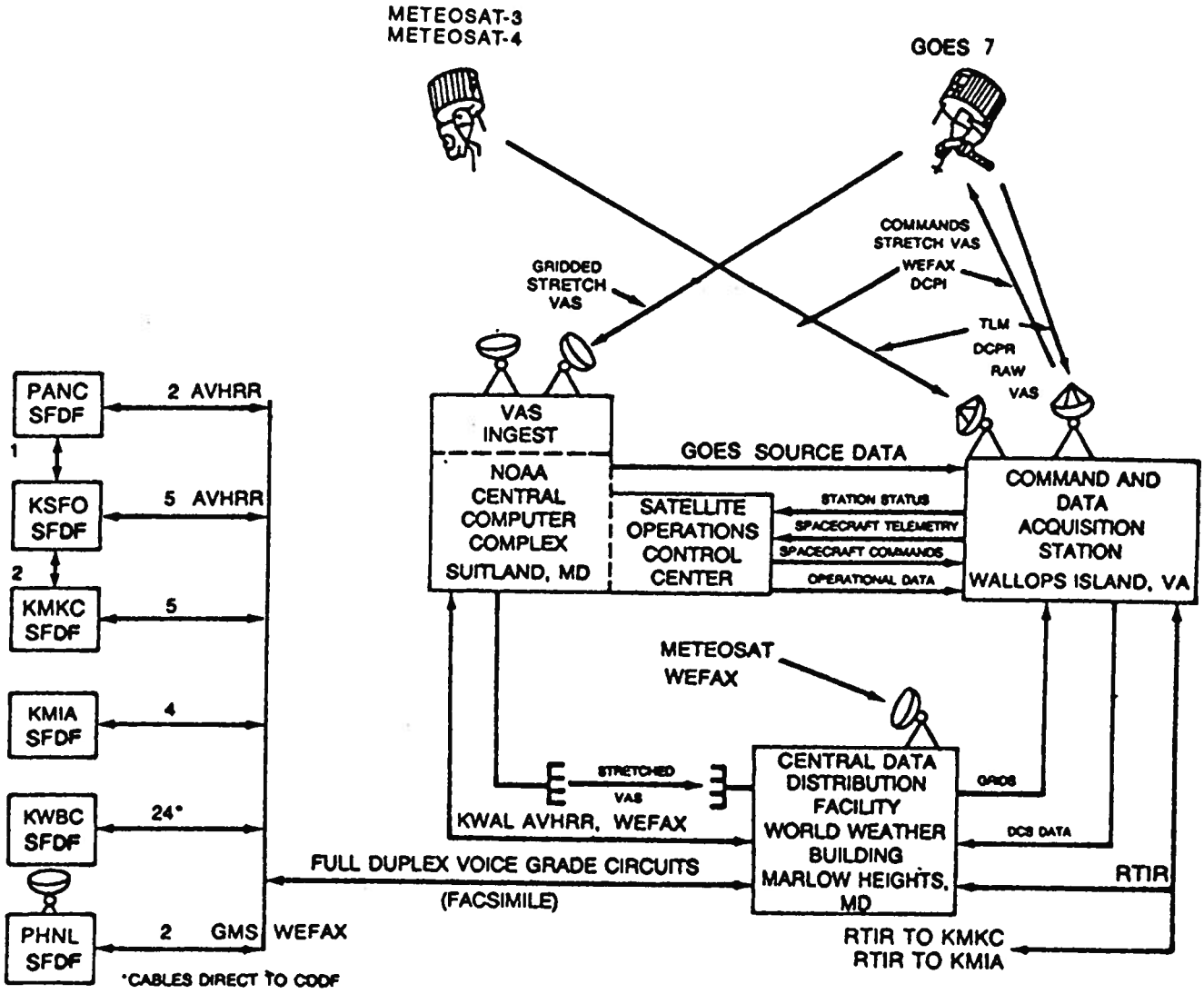

Figure 6-2. GOES central data distribution system

Table 6-1. Satellite and satellite data availability for the current hurricane season

SATELLITE	TYPE OF DATA	LOCAL TIME	PRODUCTS
GOES-7	VAS	Every 30 min (24 hr/day) (Limited scan for short-interval viewing available.)	1. 1-, 2-, and 4-km resolution visible standard sectors covering Western, Midwest, and Eastern United States. 2. 7-km resolution equivalent IR standard sectors for U.S. (night) 3. Equivalent IR-enhanced imagery. 4. Full disc IR (day and night) 5. 14-km resolution water vapor sectors (day and night) 6. VDUC interactive/manual products: deep layer mean wind package: satellite derived winds; moisture analysis; quantitative precipitation estimates; and cloud top heights. 7. Tropical storm monitoring, including intensity analysis.
NOAA-12	AVHRR GAC and LAC (recorded) HRPT and APT (direct) TOVS	0731D[1]/1931A[2]	1. Mapped imagery 2. Unmapped imagery (all data types) at DMSP sites. 3. Sea-surface temperature analysis 4. Soundings
NOAA-11	GAC and LAC (recorded) HRPT and APT (direct) TOVS	0240/1440A	5. Moisture analysis 6. Remapped GAC sectors

[1] D - descending
[2] A - ascending

Table 6-1. Satellite and satellite data availability for the current hurricane season (continued)

SATELLITE	TYPE OF DATA	LOCAL TIME	PRODUCTS
METEOSAT-3 METEOSAT-4	Multi-spectral Spin-Scan Radiometer	Every 30 min (24 hr/day)	1. 2.5 km resolution digital VIS imagery; 5 km resolution digital IR imagery. 2. 5 km resolution VIS and IR WEFAX imagery. 3. 5 km water vapor imagery 4. Proposed METEOSAT-3 operational products: cloud motion wind vectors; deep layer mean wind package; cloud top heights; upper troposphere humidity; precipitation index (5-day accumulation); and moisture analysis.
DMSP F-8	Operational Linescan System (OLS) (recorded and direct) Microwave temperature sounder (SSM/T) (recorded) Microwave imager (SSM/I) (recorded)	0625D/1825D	1. AFGWC 1.5 nmi resolution visual and infrared imagery. 2. Hickam Direct Readout 0.3 and 1.5 nmi resolution visual and infrared imagery. 3. SSM/T data transmitted to NESDIS via shared processing. 4. SSM/I data validation ongoing.
DMSP F-9	OLS imagery (recorded and direct) SSM/T (recorded)	0930A/2130D	
DMSP F-10	OLS Imagery (recorded and direct) SSM/I, SSM/T (recorded)	0810/2010A	
DMSP F-11	OLS Imagery (recorded and direct) SSM/I, SSM/T, SSM/T2--moisture sounder (recorded)	0500D/1700A	

6.2. National Weather Service (NWS) Support.

6.2.1. Station Contacts. The GOES imagery is available in support of the surveillance of tropical and subtropical cyclones at specific NWS offices. Satellite meteorologists can be contacted at these offices; telephone numbers are in Appendix H.

6.2.2. Products. There are four types of satellite products issued by the centers and their alternates. Chapter 3 describes these products, their communications headings, and their schedules. The products are

- satellite tropical weather discussions
- satellite interpretation messages
- tropical weather discussions
- tropical disturbance rainfall estimates

6.2.3. Satellite Tropical Weather Discussion. The Miami and Honolulu WSFOs distribute satellite discussions (see Figure 6-3 for an example) for prescribed oceanic regions at the times indicated in Table 6-2. The Miami WSFO is responsible for the tropical regions of the Atlantic and Eastern Pacific; Honolulu WSFO monitors the tropical regions of the Central and Western Pacific. These satellite discussions describe significant weather in tropical regions of the Atlantic, Eastern Pacific, and Central Pacific (north and south between 140°W and 100°W), respectively.

6.3. NESDIS Synoptic Analysis Branch (SAB). The SAB operates 24 hrs a day to provide satellite support to the National Meteorological Center (NMC), National Hurricane Center (NHC), and other worldwide users. The development, current intensity (CI) and movement of tropical cyclones are monitored worldwide and disseminated via bulletins to the appropriate users. A tropical weather discussion for the Indian Ocean is also disseminated twice per day. For numerical model input and forecasting applications, data from cloud motion wind vectors, moisture analyses, cloud top heights, and tropical rainfall estimates are provided to NMC and NHC. Telephone numbers for the SAB are located in Appendix H.

6.4. AFGWC Support and the Defense Meteorological Satellite Program (DMSP). The AFGWC uses all available meteorological satellite data when providing fix information. The DMSP will provide coverage of tropical and subtropical cyclones whenever possible. Data covering the National Hurricane Operations Plan areas of interest are received centrally at AFGWC and locally at the direct readout site at Detachment 4, 20th Weather Squadron, Hickam AFB, Hawaii.

AXNT20 KMIA 210800Z

TROPICAL WEATHER DISCUSSION

ALL MOVEMENTS AND TRENDS 24 HOURS UNLESS OTHERWISE STATED

EAST PACIFIC GOES WEST IR NITE 210745Z
TROPICAL STORM SUSAN. SEE LATEST NHC ADVISORY.[1]

ITC 2 TO 4 DEGS WIDE EXTNDG FM 6N 80W TO 11N 116W IS BRKN TO OCNLY OVC WITH HVST ACTIVITY ARND 11N 116W. SCTD ACTV ITC FROM 9N 116W TO 12N 134W 2 DEG WIDE WAS BKN YDA. BRKN TO OVC AREA 3 TO 5 DEG IN DIA IS MDTLY ACTV CNTRD NEAR 11N 116W HAS MVD W 5 DEG WITH LTL CHG.

ATLANTIC GOES EAST IR NOTE 210630Z

NO TROPICAL STORMS OBSERVED

ITC 3 TO 5 DEG WIDE FRM 10N 20W TO 14N 50W IS MSTLY BRKN AND MDTLY ACTV WITH LTL CHG. BRKN ACTV ITC FM 14N 50W TO 17N 57W 4 DEG WIDE HAS INCREASED IN WIDTH.

Figure 6-3. Sample satellite tropical weather discussion

[1] Whenever a tropical system is located in the Atlantic, Caribbean, Eastern or Central Pacific, Part 1, will carry the following statement: "See latest (NHC or CPHC) advisory(ies)."

Table 6-2. Communications headings for satellite tropical discussion summaries

HEADING	TIME ISSUED	OCEANIC AREA	TYPE OF DATA
TCIO10 KWBC	1800 UTC	Indian Ocean	VIS/IR Day
TCIO11 KWBC	0800 UTC	Indian Ocean	IR Night
TCPW11 PHNL	1000 UTC	Western Pacific (north and south) from 100°E to 180°W	IR Night
TCPW10 PHNL	2200 UTC	Western Pacific (north and south) from 100°E to 180°W	VIS/IR Day
TCPA11 PHNL	1000 UTC	Central Pacific (north and south) from 180°W to 140°W	IR Night
TCPA10 PHNL	2200 UTC	Central Pacific (north and south) from 180°W to 140°W	VIS/IR Day
AXNT20 KMIA	00,06,12,18 UTC	Atlantic Ocean South of 32°N to Equator.... Caribbean, Gulf of Mexico	VIS/IR
AXPZ20 KMIA	0135, 0735 1335, 1035 UTC	Eastern Pacific South of 32°N to the Equator.... east of 140° W	VIS/IR

6.4.1. North Atlantic and Central Pacific Surveillance. The AFGWC readouts will augment NESDIS surveillance for the North Atlantic and Central Pacific. The AFGWC will transmit teletype bulletins describing the location and intensity classification of the system, in the format shown in Figure 6-4, to the National Hurricane Center or Central Pacific Hurricane Center, as appropriate, on organized disturbances evident at the tropical classification one (T-1) or higher.

6.4.2. Eastern Pacific Surveillance. If the NHC determines the coverage from available NESDIS satellites should be supplemented, it will request data from AFGWC.

6.5. Satellites and Satellite Data Availability for the Current Hurricane Season. Table 6-1 lists satellite capabilities for the current hurricane season.

6.6. Current Intensity and Tropical Classification Number. The current intensity (C.I.) number relates directly to the intensity of the storm. The empirical relationship between the C.I. number and a storm's wind speed is shown in Table 6-3. The C.I. number is same as the tropical classification number (T-number) during the development stages of a tropical cyclone, but is held higher than the T-number while a cyclone is weakening. This is done because a lag is often observed between the time a storm pattern indicates weakening has begun and the time when the storm's intensity decreases. An added benefit from this rule is the stability it adds to the analysis when short-period fluctuations in the cloud pattern occur. In practice, the C.I. number is not lowered until the T-number has shown weakening for 12 hours or more.

MESSAGE HEADING:
TPNT CCCC

A CYCLONE DESIGNATOR	A. Designator of tropical cyclone category including name/number. When a cloud system has not yet been designated by name/number enter TROPICAL DISTURBANCE. Sample entry: TROPICAL STORM AMY (15)
B DATE/TIME (Z) OF FIX	B. Date and nodal crossing time in Zulu; round time to nearest minute. Sample entry: 252303z.
C LATITUDE OF POSITION	C. Latitude to nearest tenth of degree (N or S), followed by checksum. Sample entry: 29.9N/O
D LONGITUDE OF POSITION	D. Longitude to nearest tenth of degree followed by checksum. Sample entry: 56.7 W/8
E POSITION CODE NUMBER	E. Enter Position Code number (PCN) and source of data (DMSP, NOAA 2, etc.). Spell out PCN number. Select PCN number from code below: GEOGRAPHICAL GRIDDING ONE: eye fix THREE: well defined circulation center FIVE: poorly defined circulation center EPHEMERIS GRIDDING TWO: eye fix FOUR: well defined circulation center SIX: poorly defined circulation center Sample entry: ONE/DMSP
F DVORAK CLASSIFICATION	F. Dvorak classification for storm intensity as described in NOAA technical Memorandum NESS 45 and 1WW/TN-81/001. Dvorak classification will be made once each day and must be based on visual data. If a new Dvorak classification number cannot be derived, use the last reported number. Include in parentheses the date and nodal time of the data on which the Dvorak analysis is based. Sample entry: T 4.5/4.5/D1.0/25HRS (252305Z)
G REMARKS	G. Include information, as appropriate, on data type, eye characteristics, spiral rainbands, unexpected changes in storm movement, departures from Dvorak (modeled) intensities, etc.

Figure 6-4. Center fix data form and message format (satellite)

Table 6-3. The empirical relationship* between the C.I. number and the maximum wind speed and the relationship between the T-number and the minimum sea-level pressure.

C.I. NUMBER	MAXIMUM WIND SPEED	T-NUMBER	MINIMUM SEA-LEVEL PRESSURE (Atlantic)	(NW Pacific)
1	25 kt	1		
1.5	25	1.5		
2	30	2	1009 hPa	1000 hPa
2.5	35	2.5	1005	997
3	45	3	1000	991
3.5	55	3.5	994	984
4	65	4	987	976
4.5	77	4.5	979	966
5	90	5	970	954
5.5	102	5.5	960	941
6	115	6	948	927
6.5	127	6.5	935	914
7	140	7	921	898
7.5	155	7.5	906	879
8	170	8	890	858

*Dvorak, V, 1984: Tropical Cyclone Intensity Analysis Using Satellite Data. NOAA Tech Report NESDIS 11, Washington, D.C.

CHAPTER 7

SURFACE RADAR REPORTING

7.1. General. Radar observations of tropical cyclones will be made at Department of Defense (DOD), National Weather Service (NWS), and Federal Aviation Administration (FAA) radar facilities and at other cooperating radar facilities according to established agreements with NWS.

7.2. Procedures.

7.2.1. Radar Observation Requirements. Radar observations of tropical cyclones will be made in accordance with the Federal Meteorological Handbook (FMH)-7, Part A, Weather Radar Observations. Stations that normally transmit hourly radar weather observations (network stations) will include tropical cyclone features in routine reports at 35 minutes past the hour (H+35) and will make and transmit special observations at H+10 whenever an eye or center is observed. It is highly desirable for stations that do not normally transmit hourly reports (local warning radars) to make and transmit a radar observation whenever an eye, center, or spiral band is observed. The local warning radar sites may transmit only abbreviated special observations, defined in FMH-7, at H+10 and H+35. The Air Force units at MacDill AFB and Tyndall AFB, Florida, will take and transmit radar reports, to include tropical cyclone features, at H+10 and H+35 whenever an eye or center is observed. All other AWS radar units will take and transmit such reports at H+35.

7.2.2. Central Region Report. If the central region of a storm is defined by an identifiable wall cloud, the radar fix is reported as an EYE. If the central region is recognizable, but not well-defined by a wall cloud, it is reported as a "center." When the eye or center is only occasionally recognizable or some other central region uncertainty exists, the eye or center is reported as "psbl eye" or "psbl center." Remarks stating the degree of confidence will be included with eye fixes only and will be classified as either "good," "fair," or "poor." A "good" fix is reported when the eye is symmetrical--virtually surrounded by wall cloud; a "poor" fix is reported when the eye is asymmetrical--less than 50 percent surrounded by wall cloud; a "fair" fix is reported to express a degree of confidence between "good" and "poor."

7.2.3. Transmission of Radar Reports. Timely transmission of tropical cyclone radar reports is essential. Normally, radar reports are transmitted over the Automation of Field Operations and Service System or the CONUS Meteorological Data System circuit equipment. Radar facilities not having weather transmission capability may call the nearest National Weather Service Office collect.

7.3. Special Provisions.

7.3.1. Collocation of Radars. If NWS network radars (WSR-57s and selected WSR-74s) and DOD weather radar facilities are collocated (within 25 nmi), the NWS radar will have the primary responsibility for making and transmitting tropical cyclone radar reports; DOD will provide backup service. If a radar facility is less powerful than the WSR-57 and is collocated with a North American Aerospace Defense Command (NORAD) long-range radar facility, the NORAD long-range radar facility will have the primary responsibility for making and transmitting tropical cyclone radar reports provided it is manned by a qualified weather radar operator. The less powerful radar facility will provide backup service. Any backup radar facility, however, may transmit radar reports as desired.

7.3.2. Use of NORAD Long-Range Radar Facilities. If radar reports are needed from NORAD long-range radar facilities, NWS will dispatch weather radar specialists to those facilities to make and transmit tropical cyclone radar observations. The DOD has authorized the Director, NWS, to dispatch NWS radar specialists to NORAD sites during critical hurricane threats to make and transmit hurricane radar observations. Specific procedures regarding notification, access to sites, clearances, etc., as agreed to by DOD and NWS will be the responsibility of the Warning and Forecast Branch, Office of Meteorology, NWS Headquarters, and will be strictly adhered to.

7.3.3. Visits to NORAD. The Air Force staff weather officers providing support to NORAD long-range radar units act as coordinators for visits. These coordinators are the listed below. Telephone numbers are in Appendix H. Participating radar sites are listed in Table 7-1.

- Commander, 325 Operations Support Squadron (0SS), for the Southeast Air Defense Sector, Tyndall AFB, Florida 32403-5000

- Commander, 416 Operations Support Squadron, for the Northeast Air Defense Sector, Griffiss AFB, New York 13441-5000

- Commander, Det 4, 20 WS, Hawaii Regional Operations Control Center (ROCC). Hickam AFB, Hawaii 96853-5000

7.3.4. Radar in Use. The radar used depends upon the location of the hurricane; the one in use will be properly identified.

Table 7-1. Participating radar stations

LOCATION	TYPE RADAR	LATITUDE	LONGITUDE
	NATIONAL WEATHER SERVICE RADARS		
Apalachicola, FL	WSR-57	29°44'N	84°59'W
Atlantic City, NJ	WSR-57	39°27'N	74°35'W
Baton Rouge, LA[1]	WSR-74C	30°32'N	91°90'W
Brownsville, TX	WSR-57	25°54'N	97°26'W
Cape Hatteras, NC	WSR-57	35°16'N	75°33'W
Charleston, SC	WSR-57	32°54'N	80°02'W
Chatham, MA	WSR-74S	41°39'N	69°57'W
Corpus Christi, TX	WSR-74C	27°46'N	97°30'W
Daytona Beach, FL	WSR-57	29°11,N	81°03'W
Galveston, TX	WSR-57	29°18'N	94°48'W
Jackson, MS	WSR-57	32°19'N	90°05'W
Key West, FL	WSR-57	24°33'N	81°45'W
Lake Charles, LA	WSR-57	30°07'N	93°13'W
Los Angeles, CA[1]	WSR-74C	34°03'N	118°27'W
Miami, FL	WSR-57	25°43'N	80°17'W
Mobile, AL[1]	WSR-74C	30°41'N	88°15'W
Mt Laguna, CA	FPS-7	32°53'N	116°25'W
New York City, NY	WSR-57	40°46'N	73°59'W
Patuxent, MD	WSR-74S	38°17'N	76°25'W
Pensacola, FL	WSR-57	30°21'N	87°19'W
Portland, ME	WSR-57	43°39'N	70°18'W
San Juan, PR	WSR-74S[2]	18°16'N	65°46'W
San Pedro, CA	ARSR	33°45'N	118°20'W
Savannah, GA	WSR-74C	32°08'N	81°12'W
Slidell, LA	WSR-57	30°17'N	89°49'W
Tampa, FL	WSR-57	27°42'N	82°24'W
Victoria, TX[1]	WR-100-5	28°51'N	96°55'W
Volens, VA	WSR-74S	36°57'N	79°00'W
Waycross, GA	WSR-57	31°15'N	82°24'W
West Palm Beach, FL[1]	WSR-74S	26°41'N	80°06'W
Wilmington, NC	WSR-57	34°16'N	77°55'W

[1] Local Warning Radar
[2] FAA-USN joint-use radar

Table 7-1. Participating radars stations (continued)

DEPARTMENT OF DEFENSE			
Andrews AFB, MD	FPS-77	38°48'N	76°53'W
Barksdale AFB, LA	FPS-77	32°30'N	93°40'W
Bermuda NAS	FPS-106	32°22'N	64°41'W
Cape Canaveral AFS, FL	FPS-74C	28°28'N	80°33'W
Chase Field NAS, TX	FPS-106	28°22'N	97°40'W
Cherry Point MCAS, NC	FPS-106	34°54'N	76°53'W
Corpus Christi NAS, TX	FPS-106	27°42'N	97°16'W
Eglin AFB, FL	FPS-77	30°29'N	86°31'W
Homestead AFB, FL	FPS-77	25°29'N	80°23'W
Howard AFB, CZ	FPQ-21	08°55'N	79°36'W
Hurlburt Field, FL	FPQ-21	30°26'N	86°41'W
Jacksonville NAS, FL	FPS-106	30°14'N	81°41'W
Keesler AFB, MS	FPS-77	30°24'N	88°55'W
MacDill AFB, FL	FPS-77	27°51'N	82°30'W
McGuire AFB, NJ	FPS-77	40°00'N	74°36'W
New Orleans NAS, LA	FPS-106	29°50'N	90°01'W
Norfork NAS, VA	FPS-106	36°56'N	76°18'W
Pope AFB, NC	FPQ-21	35°12'N	79°01,W
Randolph AFB, TX	FPS-77	29°32'N	98°17'W
Robins AFB, GA	FPS-77	32°38'N	83°36'W
Seymour Johnson AFB, NC	FPS-77	35°20'N	77°58'W
Guantanamo Bay, Cuba	FPS-106	19°54'N	75°10'W
Roosevelt Roads, PR	FPS-106	18°15'N	65°38'W
Hickam AFB HI	FPQ-21	20°19'N	157°55'W
NORAD SITES			
Southeast Air Defense Sector			
OLAF, 23ADS, Patrick AFB, FL[3]		28°13'N	80°6'W
OLAD, 23ADS, Ft Lonesome, FL[3]		27°36'N	82°6'W
OLAJ, 23ADS, Key West NAS, FL		24°35'N	81°1'W
678 RS, Tyndall, AFB, FL[3]		30°05'N	85°7'W
701 RS, Ft Fisher AFS, NC		33°59'N	77°55'W
OLAC, 23ADS, Jedburg, SC		33°06'N	80°12'W
Northeast Air Defense Sector			
762 RS, North Truro AFS, MA		42°02'N	70°03'W
772 RS, Gibbsboro AFS, NJ		39°49'N	74°57'W
OLAA, 24ADS, Suffolk, NY		40°54'N	72°42'W
OLAE, 24ADS, Bucks Harbor, ME		44°38'N	67°24'W
Hawaii ROCC			
150 AC&WS, Kokee, AFS, HI		22°09'N	159°39'W
169 AC&WS, Mt Kaala AFS, HI		21°30'N	158°08'W

[3] Remoted to FAA ARTCC

Table 7-1. Participating radars stations (continued)

COOPERATING SITES

NASA			
Bay St Louis, MS	CPS-9	30°42'N	89°07'W
Wallops Station, VA	MPS-19	37°50'N	75°29'W
	SPS-12	37°56'N	75°28'W
	FPS-16	37°50'N	75°29'W
	FPQ-6	37°52'N	75°31'W
Universities			
MIT	CPS-9	42°42'N	71°06'W
	M-33	42°42'N	71°06'W
Texas A&M	CPS-9	30°37'N	96°21'W
Univ of Miami	SP-1M	25°43'N	80°17'W
	CPS-68	25°43'N	80°17'W

CHAPTER 8

NATIONAL DATA BUOY CENTER REPORTING STATIONS

8.1. General.

8.1.1. Automated Reporting Stations. The National Data Buoy Center (NDBC) maintains automated reporting stations in the Gulf of Mexico, off the east and west coasts of the United States, at coastal land areas, and in Micronesia. Also, a stockpile of four rapid response drifting data buoys is available for aerial deployment in the event of emergencies. These data acquisition systems obtain measurements of meteorological and oceanographic parameters for operations and research purposes. Moored buoy station locations and configurations are given in Table 8-1. The locations of Coastal Marine Automated Network (C-MAN) stations are listed in Table 8-2. Figures 8-1 through 8-3 show the locations of all moored buoys and C-MAN stations. An example of a drifting data buoy is shown in Figure 8-4. The status and capability of stations can be obtained from the Data Systems Division, NDBC, Bldg. 1100, Stennis Space Center, MS 39529.

8.1.2. Date Acquisition. Moored buoy and C-MAN stations routinely acquire, store, and transmit data every hour. Data obtained operationally include sea-level pressure, wind speed and direction, and air temperature. Sea-surface temperature and wave spectral data are measured by all moored buoys and a limited number of C-MAN stations.

8.1.3. Drifting Buoy Types. Drifting buoys are available in two types called Wind Speed Direction (WSD) and Air Sea Interaction Drifter (ASID). A WSD buoy measures sea-level pressure, wind speed and direction, air temperature, and sea-surface temperature. An ASID buoy measures the same parameters except for wind direction and can be configured with a subsurface thermistor array to measure hydrostatic pressure and subsurface ocean temperature.

8.2. Requests for Drifting Buoy Deployment. The Department of Commerce (DOC) through the National Atmospheric and Oceanic Administration (NOAA) will initiate a request through the Office of the Federal Coordinator for Meteorological Services and Supporting Research to the Air Force Reserve (AFRES) for each desired aerial deployment of drifting data buoys for a pre-storm array in the Atlantic or Pacific Oceans. Normally, AFRES C-130 aircraft are tasked for this mission. Requests for deployment should allow at least a 30-day lead time. For deployments in advance of a U.S. land-threatening hurricane, a 36- to 48-hr notification is required. All requests will include specifics regarding onloading base, accompanying technicians, desired pickup times, offload points, reimbursement funding, and any other pertinent data.

Table 8-1. Data buoy locations and configuration

STATION ID	LOCATION	HULL SIZE	ANEMOMETER HEIGHT
MOORED BUOYS IN THE GULF OF MEXICO			
42001	25.9°N 89.7°W	10 m	10 m
42002	25.9°N 93.6°W	10 m	10 m
42003	25.9°N 85.9W	10 m	10 m
42007	30.1°N 88.8°W	12 m	10 m
42019[1]	27.9°N 95.0°W	3 m	5 m
42020[1]	27.0°N 96.5°W	3 m	5 m
42025[1]	24.9°N 80.4°W	1.8 m	NA
MOORED BUOYS IN THE ATLANTIC OCEAN			
41001	34.9°N 73.0°W	6 m	5 m
41002	32.3°N 75.2°W	6 m	5 m
41006	29.3°N 77.4°W	6 m	5 m
41008[1]	30.7°N 81.1°W	3 m	5 m
41009[1]	28.5°N 80.2°W	3 m	5 m
41010[1]	28.9°N 78.5°W	10 m	10 m
44004	38.5°N 70.6°W	6 m	5 m
44005	42.7°N 68.6°W	6 m	5 m
44007	43.5°N 70.1°W	12 m	14 m
44008	40.5°N 69.4°W	12 m	14 m
44009	38.4°N 74.7°W	12 m	14 m
44011	41.1°N 66.6°W	6 m	5 m
44012	38.8°N 74.6°W	12 m	14 m
44013	42.4°N 70.8°W	12 m	14 m
44014[1]	36.6°N 74.8°W	3 m	5 m
44025[1]	40.3°n 73.2°w	3 m	5 m
MOORED BUOYS IN THE PACIFIC OCEAN (SOUTH of 45°N)			
32302[1]	18.0°S 85.1°W	3 m	5 m
46002	42.5°N 130.4°W	6 m	5 m
46006	40.8°N 137.7°W	12 m	10 m
46011[1]	34.9°N 120.9°W	6 m	5 m
46012[1]	37.4°N 122.7°W	3 m	5 m
46013[1]	38.2°N 123.3°W	10 m	10 m
46014[1]	39.2°N 124.0°W	10 m	10 m
46022[1]	40.7°N 124.5°W	3 m	5 m
46023[1]	34.3°N 120.7°W	10 m	10 m
46025[1]	33.7°N 119.1°W	6 m	5 m
46026	37.7°N 122.7°W	12 m	14 m
46028[1]	35.8°N 121.9°W	6 m	5 m
46040[1]	44.8°N 124.3°W	3 m	5 m
46042[1]	36.8°N 122.4°W	3 m	5 m
46045	33.8°N 118.4°W	3 m	5 m
51001	23.4°N 162.3°W	6 m	5 m
51002	17.2°N 157.8°W	6 m	5 m
51003	19.3°N 160.8°W	6 m	5 m
51004	17.4°N 152.5°W	6 m	5 m
52009[1]	13.2°N 144.5°W	3 m	5 m

[1] Temporary site established in support of other programs

Table 8-2. C-MAN sites

STATION ID	LOCATION	STATION NAME
C-MAN SITES IN THE GULF OF MEXICO		
BURL1	28.9°N 89.4°W	Southwest Pass, LA
BUSL1[1]	27.9°N 90.9°W	Bullwinkle Platform
CSBF1	29.7°N 85.4°W	Cape San Blas, FL
DPIA1	30.2°N 88.1°W	Dauphin Island, AL
GBCL1[1]	27.8°N 93.1°W	Garden Banks Block 236A
GDIL1	29.3°N 90.0°W	Grand Isle, LA
LNEL1	28.2°N 89.1°W	Lena Platform
MPCL1[1]	29.4°N 88.6°W	Main Pass Block 133C
PTAT2	27.8°N 97.1°W	Port Arkansas, TX
SANF1[1]	24.5°N 81.9°W	Sand Key, FL
SRST2	29.7°N 94.1°W	Sabine, TX
VENF1	27.1°N 82.4°W	Venice, FL
C-MAN SITES IN THE ATLANTIC OCEAN		
ALSN6	40.5°N 73.8°W	Ambrose Light, NY
BUZM3	41.4°N 71.0°W	Buzzards Bay, MA
CHLV2	36.9°N 75.7°W	Chesapeake, Light, VA
CLKN7	34.6°N 76.5°W	Cape Lookout, NC
DSLN7	35.2°N 75.3°W	Diamond Shoals, NC
FBIS1	32.7°N 79.9°W	Folly Island, SC
FPSN7	33.5°N 77.6°W	Frying Pan Shoals, NC
FWYF1	25.6°N 80.1°W	Fowey Rocks, FL
IOSN3	43.0°N 70.6°W	Isle of Shoals, NH
LKWF1	26.6°N 80.0°W	Lake Worth, FL
MDRM1	44.0°N 68.1°W	Mt Desert Rock, ME
MISM1	43.8°N 68.9°W	Matinicus Rock, ME
MLRF1	25.0°N 80.4°W	Molasses Reef, FL
SAUF1	29.9°N 81.3°W	St. Augustine, FL
SMKF1	24.6°N 81.2°W	Sombrero Key, FL
SPGF1	26.7°N 79.0°W	Settlement Point, GBI
SVLS1	31.9°N 80.7°W	Savannah Light, GA
TPLM2	38.9°N 76.4°W	Thomas Point, MD
C-MAN SITES IN THE EASTERN PACIFIC OCEAN (SOUTH OF 45°N)		
CARO3	43.3°N 124.4°W	Cape Arago, OR
NWPO3	44.6°N 124.1°W	Newport, OR
PTAC1	39.0°N 123.7°W	Point Arena, CA
PTCG1	34.6°N 120.6°W	Point Arguello, CA

[1] Temporary site established in support of other programs

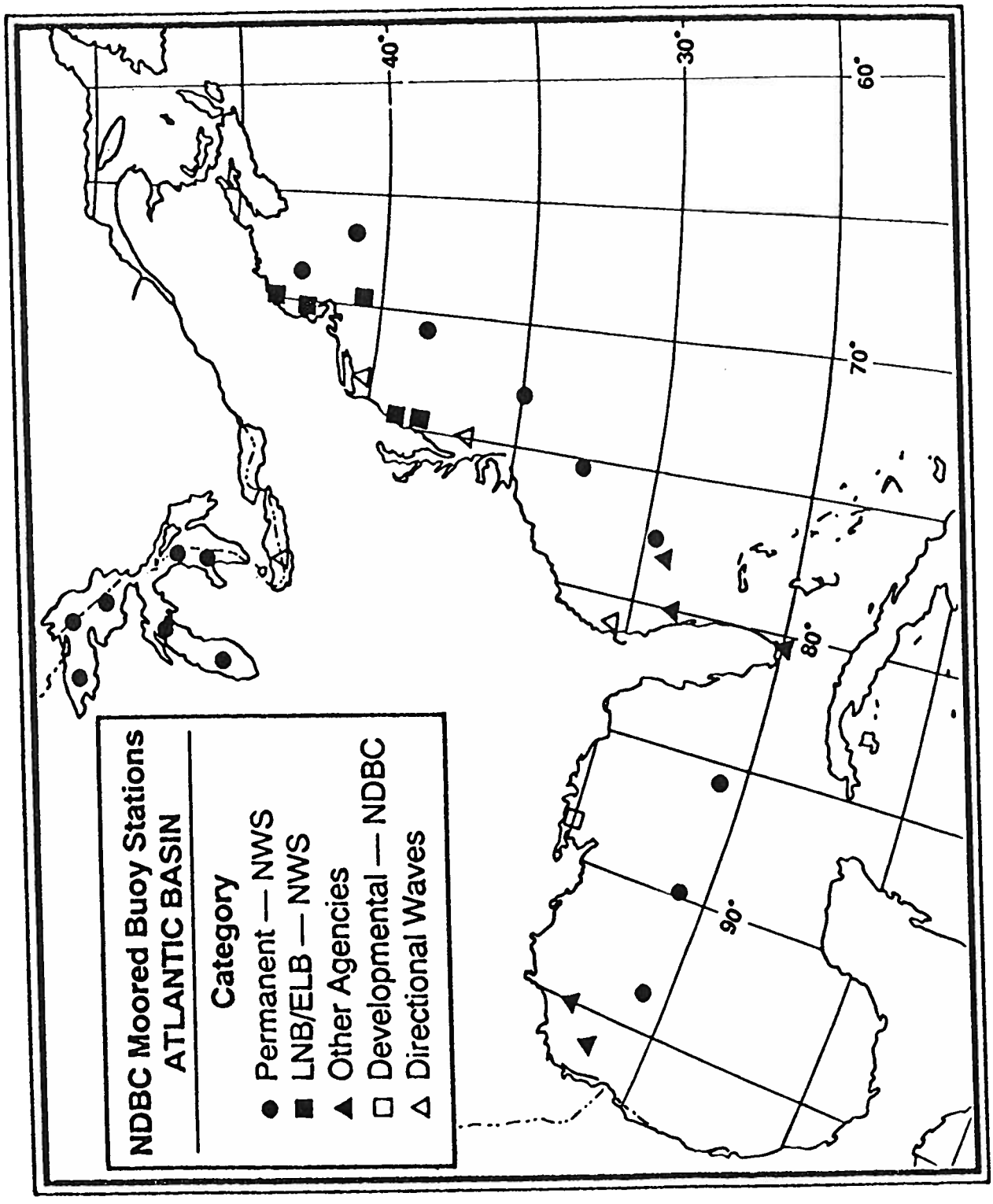

Figure 8-1. NDBC moored buoy locations in the Atlantic Ocean, Gulf of Mexico and Great Lakes

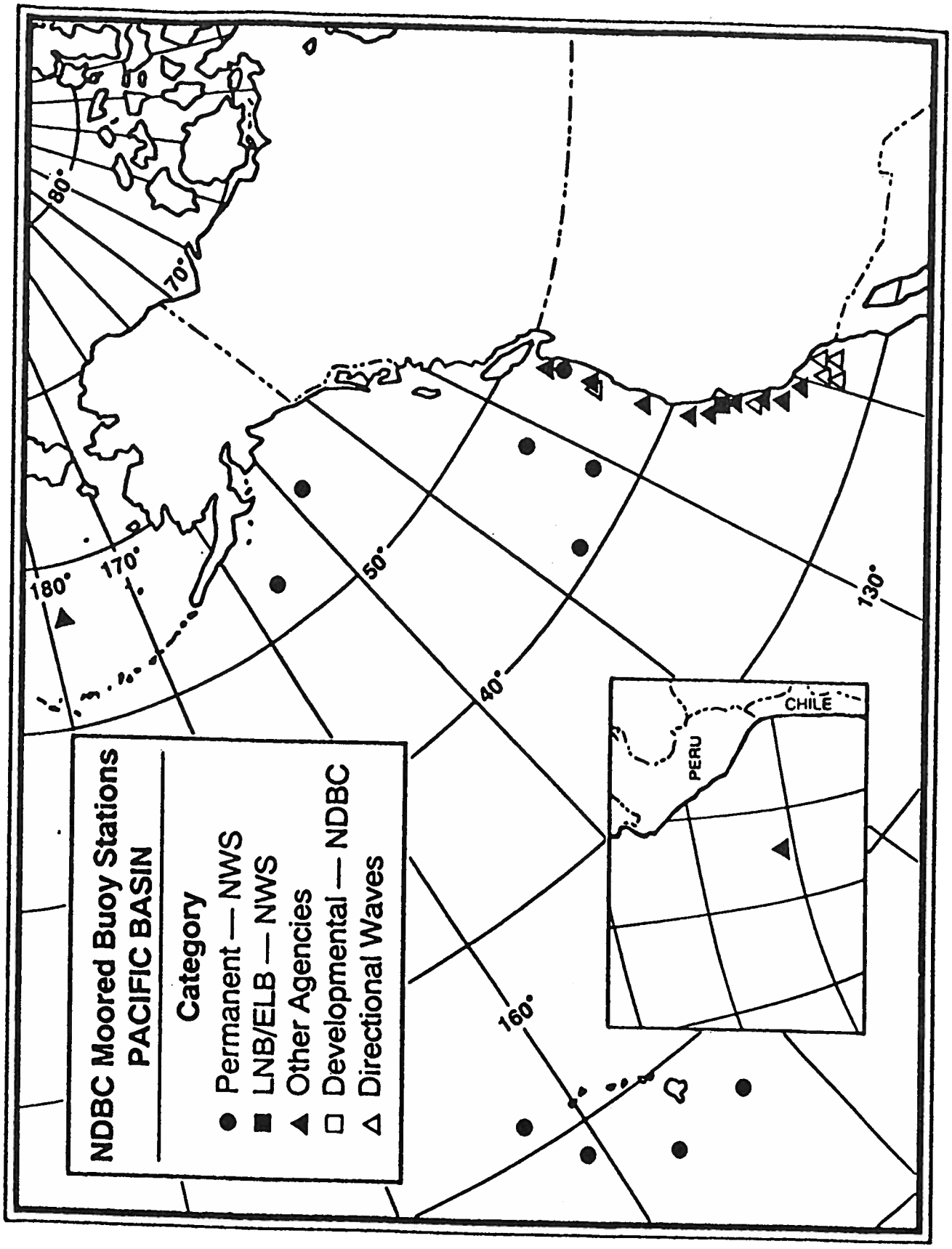

Figure 8-2. NDBC moored buoy locations in the Pacific Ocean

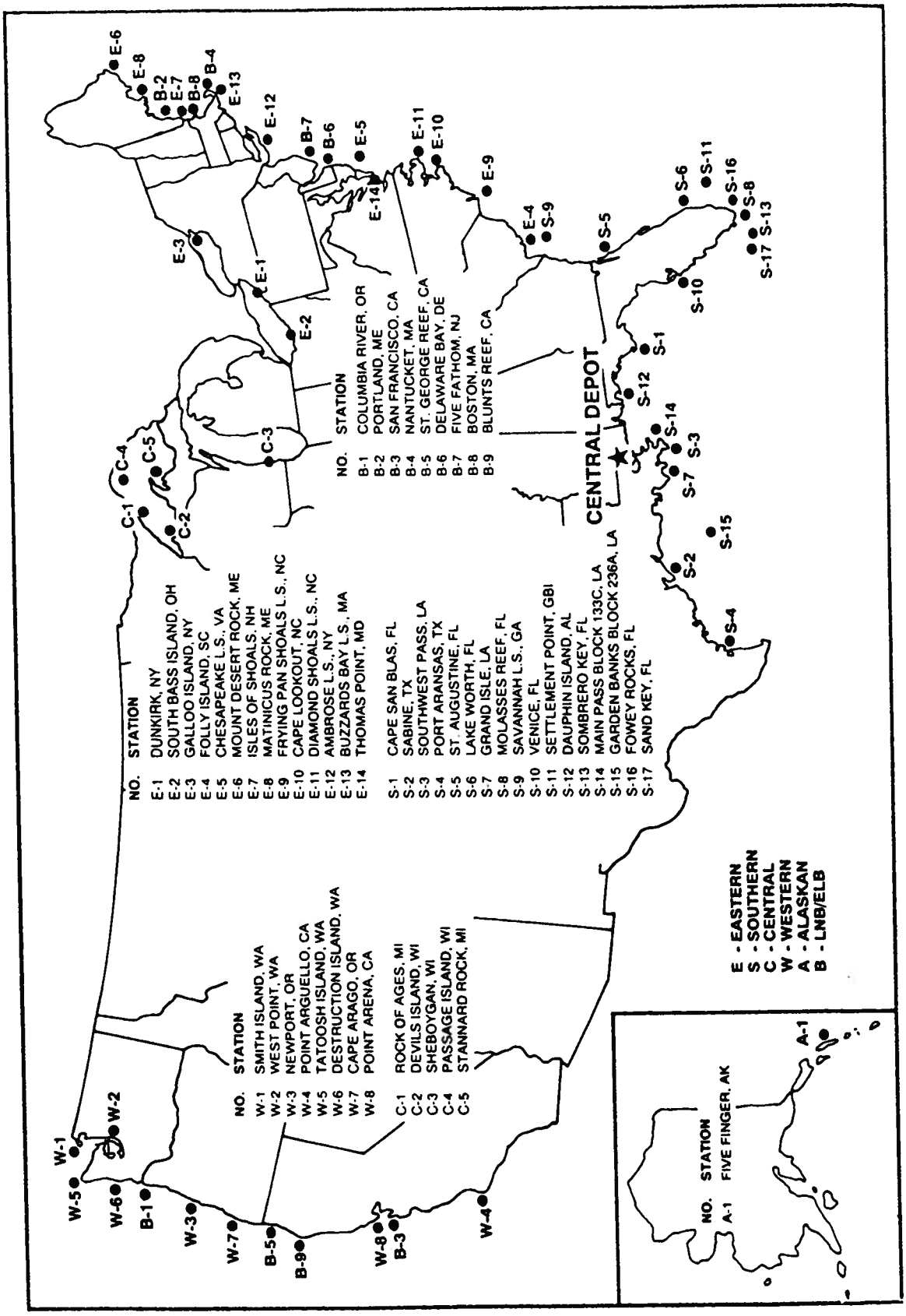

Figure 8-3. C-Man station locations in the Coastal U.S.

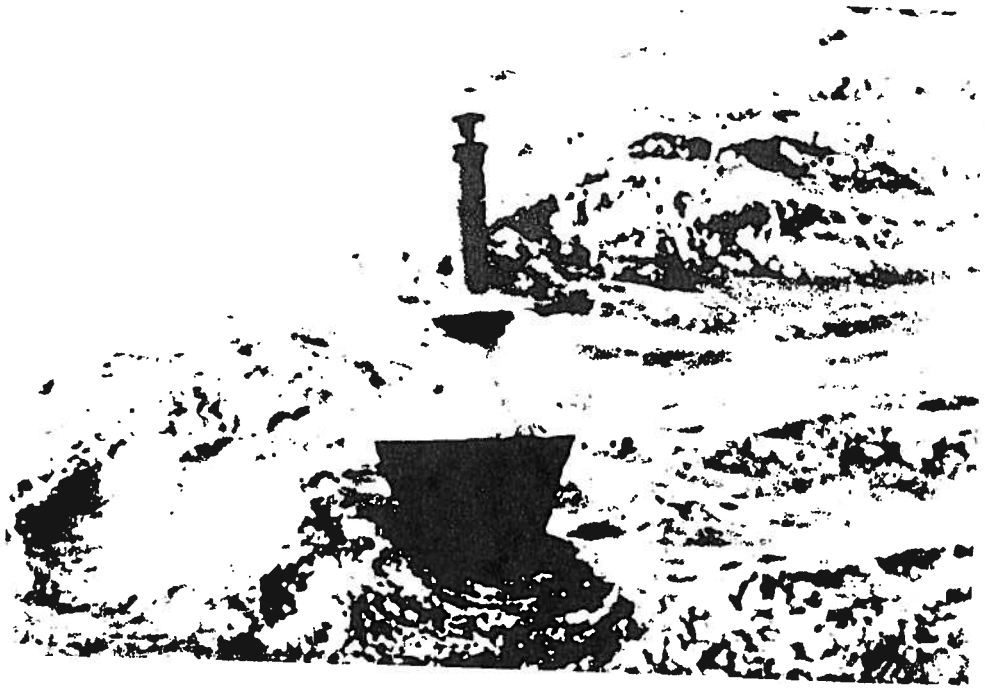

Figure 8-4. A drifting data buoy

8.2.1. National Hurricane Center. The National Hurricane Center forecasters will issue an alert or outlook for a possible request for drifting buoy deployment 48 hr prior to the planned deployment. A formal request for deployment will be issued 24 hr prior to the event. At this point either a cancellation or an extension of the alert will be issued. Decisions will normally be made by 0900 EDT.

8.2.2. Deployment Buoys. The DOC desires the deployment of up to four drifting buoys between 100 and 180 nmi from the storm center, depending on the dynamics of the storm system. The DOC will ensure the buoys and mission-related DOC personnel are available for pickup by Department of Defense aircraft. The specific DOC request for placement of the buoys will depend on several factors, including:

- Characteristics of the storm including size, intensity, and velocity
- Storm position relative to the coast and population centers

8.2.3. Deployment Position. The final deployment position will be provided prior to the flight crew briefing. Two examples of possible buoy deployment patterns are shown in Figure 8-5.

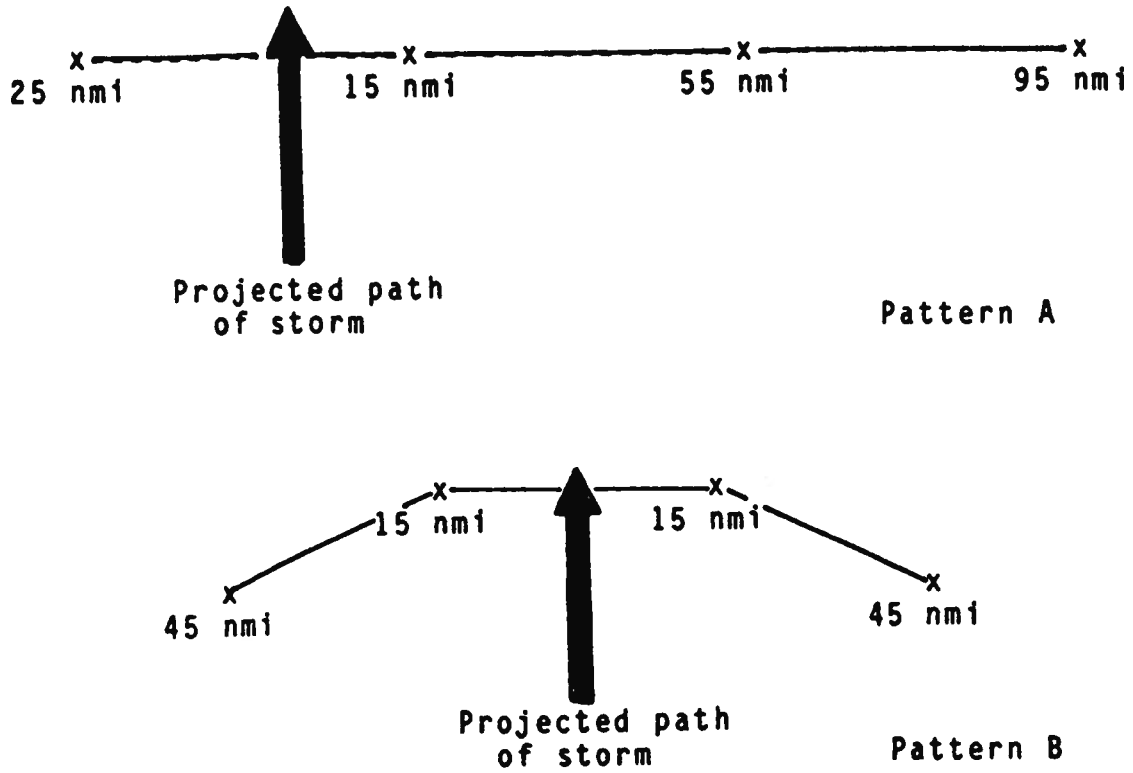

Figure 8-5. Drifting data buoy deployment patterns.

8.3. Communications. Moored buoy and C-MAN data are transmitted by ultra-high frequency communications via the Geostationary Operational Environmental Satellite to the National Environmental Satellite, Data, and Information Service and then are relayed to the National Weather Service Telecommunications Gateway (NWSTG) for processing and dissemination. Moored buoy data are formatted into the World Meteorological Organization (WMO) FM13-IX ship code, and C-MAN data are formatted into C-MAN code, which is very similar to the WMO FM 12-IX synoptic code. The ship code is defined in Federal Meteorological Handbook 2, Surface Synoptic Codes. Code forms are shown in Table 8-3. The C-MAN code is contained in the C-MAN Users' Guide, which is available from NDBC Data Systems. Drifting buoy data are telemetered through the NOAA polar orbiting satellites to the U.S. ARGOS Global Processing Center, Landover, Maryland, for processing. These data are formatted by Service ARGOS into the WMO FM18 (DRIFTER) code defined in the WMO Manual on Codes, Volume I, and then are routed to the NWSTG for distribution and dissemination to users in the United States and overseas over the Global Telecommunications Service.

Table 8-3. Code forms for moored data buoys, C-MAN stations and drifting buoys

CODE FORM FM 13 IX (SHIP) REPORT OF SYNOPTIC
SURFACE OBSERVATION FROM A SEA STATION (AUTOMATIC WEATHER STATION)

$M_iM_iM_jM_j$	$A_1b_wn_bn_bn_b$	YYGGi	$99L_aL_aL_a$		$Q_cL_oL_oL_oL_o$
i_si_s / / /	/ddff	$1s_nTTT$	$(2s_nT_dT_dT_d)$	4PPPP	5appp 9GGgg
22200	$0s_nT_wT_wT_w$	$1P_{ww}P_{ww}H_{ww}H_{ww}$	$70\ H_{ww}H_{ww}H_{ww}$		
333	912ff	(00fff)			
555	11fff	22fff	3GGgg	$4ddf_mf_m$	
6Gegege	$d_1d_1f_1f_1f_1$	$d_2d_2f_2f_2f_2$	$d_3d_3f_3f_3f_3$	$d_4d_4f_4f_4f_4$	$d_5d_5f_5f_5f_5$
	$d_6d_6f_6f_6f_6$				

U.S. NATIONAL CODE FORM (C-MAN LAND STATION CODE)
MODIFIED CODE FORM FM 12-IX

CMAN YYGGi					
$XXXXn_t$	$i_RR\ i_ihVV$	Nddff	(00fff)	$1s_nTTT$	4PPPP 5appp 6RRRt 9GGgg
222 / /	$0s_nT_wT_wT_w$	$1_{ww}P_{ww}H_{ww}H_{ww}$	$70H_{ww}H_{ww}H_{ww}$		
333	912ff	(00fff)			
555	11fff	22fff	(3GGgg)	$(4ddf_mf_mf_m)$	(66666)
6Gegege	$d_1d_1f_1f_1f_1$	$d_2d_2f_2f_2f_2$	$d_3d_3f_3f_3f_3$	$d_4d_4f_4f_4f_4$	$d_5d_5f_5f_5f_5$
	$d_6d_6f_6f_6f_6$	(TIDE1111)			

CODE FORM FM 18 (DRIFTER)
REPORT OF A DRIFTING BUOY OBSERVATION

$M_iM_iM_jM_j$					
DRIFT	$A_1b_wn_bn_bn_b$	YYMMJ	$GGggi_w$	$Q_cL_aL_aL_aL_a$	$L_oL_oL_oL_oL_o$
0ddff	$1s_nTTT$	2PPPP	3appp		
222	$0S_nT_wT_wT_w$	$1P_{ww}P_{ww}H_{ww}H_{ww}$	$20P_{ww}P_{ww}P_{ww}$	$21H_{ww}H_{ww}H_{ww}$	
333	$8887k_2$	$2Z_oZ_oZ_oZ_o$	$3T_oT_oT_oT_o$	$4S_oS_oS_oS_o$	...
	(00000)	$2Z_aZ_aZ_aZ_a$	$3T_aT_aT_aT_a$	$4S_aS_aS_aS_a$	
	$66k_e9k_3$	$2Z_oZ_oZ_oZ_o$ $2Z_aZ_aZ_aZ_a$	$d_od_oC_oC_oC_o$ $d_ad_ac_ac_ac_a$	...	
444	$(1Q_pQ_dQ_{ww}Q_t$	$(2Q_aQ_L$ //)			
	$((Q_cL_aL_aL_aL_aL_a$	$L_oL_oL_oL_oL_oL_o)$ or	$(H_LV_BV_Bd_Bd_B))$		
	$(8V_iV_iV_iV_i)$	$(9i_gZ_dZ_dZ_dZ_d)$			

CHAPTER 9

MARINE WEATHER BROADCASTS

9.1. General. The Department of Defense (DOD) and Department of Transportation (DOT) are responsible for broadcasting marine tropical cyclone advisories issued by the National Hurricane Center and the Central Pacific Hurricane Center. Table 9-1 lists the stations involved. The broadcasts are for the purpose of providing warnings to meet international obligations in the Department of Commerce area of forecast responsibility given in Chapter 2.

9.2. Broadcast Procedures. The DOT and DOD will arrange for broadcast of all marine tropical cyclone advisories immediately upon receipt. The latest tropical cyclone forecast will be transmitted according to the schedule and on the frequencies given in Worldwide Marine Weather Broadcasts. The latest position estimate will be used by DOT and DOD along with the latest forecast for storms on which positions estimates are being issued. The broadcasts will be made in both voice and continuous wave (CW) mode.

Table 9-1. Marine tropical cyclone forecast broadcast stations

STATION CALL LETTERS	AGENCY	LOCATION
NMW	DOT	Astoria, OR
NMF	DOT	Boston, MA
NMO	DOT	Honolulu, HI
NMQ	DOT	Channel Island, CA
NMA	DOT	Miami, FL
NMG	DOT	New Orleans, LA
NAM	DOD	Norfolk, VA
NMN	DOT	Portsmouth, VA
NMC	DOT	San Francisco, CA

CHAPTER 10

PUBLICITY

10.1. News Media Releases. News media releases, other than warnings and advisories, for the purpose of informing the public of the operational and research activities of the Departments of Commerce, Defense, and Transportation should reflect the joint effort of these agencies by giving due credit to the participation of other agencies.

10.2. Distribution. Copies of these releases should be forwarded to the following agencies:

- NOAA Office of Public Affairs
  Herbert C. Hoover Building
  14th and Constitution Avenue, N.W.
  Washington, DC 20230

- Commander, Naval Oceanography Command
  Stennis Space Center, MS 39529

- Hq Air Force Reserve (AFRES/PA)
  Robins AFB, GA 31093

- Chief, Environmental Services Division (J-3)
  The Joint Chiefs of Staff
  Washington, DC 20318-3000

- Federal Aviation Administration (APA-310)
  800 Independence Avenue, S.W.
  Washington, DC 20591

- Federal Coordinator for Meteorological
  Services and Supporting Research
  Suite 900, 6010 Executive Boulevard
  Rockville, MD 20852

APPENDIX A

ABBREVIATIONS

-A-

AB	Data type header for Tropical Weather Outlook
ADWS	Automated Digital Weather System
AES	Atmospheric Environmental Service (Canada)
AFB	Air Force Base
AFGWC	Air Force Global Weather Central
AFOS	Automation of Field Operations and Services
AFRES	Air Force Reserve
AFS	Air Force Station
AFSATCOM	Air Force Satellite Communications System
AFTN	Aeronautical Fixed Telecommuncations Network
AOC	Aircraft Operations Center (NOAA)
APT	Automatic Picture Transmission
ARGOS	ARGOS, Inc., a French data collection system
ARTCC	Air Route Traffic Control Center
ARWO	Aerial Reconnaissance Weather Officer
ASDL	Aircraft-to-Satellite Data Link
ASID	Air-Sea Interaction Drifter
ATC	Air Traffic Control
AUTOVON	Automated Voice Network (DOD)
AV	AUTOVON
AVHRR	Advanced Very High Resolution Radiometer
AWS	Air Weather Service

-C-

CARCAH	Chief, Aerial Reconnaissance Coordination, All Hurricanes
CDDF	Central Data Distribution Facility (NESDIS)
C.I.	Current Intensity
C-MAN	Coastal-Marine Automated Network
COM	Commercial (telephone)
CONUS	Continental United States
COMEDS	CONUS Meteorological Data System (USAF)
CPHC	Central Pacific Hurricane Center
CW	Continuous Wave
°C	degree/degrees Celsius

-D-

DA	Daylight Ascending
DAF	Department of the Air Force
DCS	Data Collection System
deg	degree (latitude or longitude)
Det	Detachment
DMSP	Defense Meteorological Satellite Program
DOC	Department of Commerce
DOD	Department of Defense
DOT	Department of Transportation
DPTD	departed
DRIBU	Drifting Buoy Code
DROP	Dropsonde/dropwindsonde
DSN	Defense Switched Network (formerly AUTOVON)
DTG	Date/Time Group

-E-

EDT	Eastern Daylight Time
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure

-F-

FAA	Federal Aviation Administration
FACSFAC	Fleet Aerial Control and Surveillance Facility
FCM	Federal Coordinator for Meteorological Services and Supporting Research
FCMSSR	Federal Committee for Meteorological Services and Supporting Research
FCST	forecast
FCSTR	forecaster
FL	Flight Level
FLT LVL	Flight Level
FMH	Federal Meterological Handbook
ft	foot/feet
FTS	Federal Telephone System

-G-

GAC	Global Area Coverage
GOES	Geostationary Operational Environmental Satellite
GMS	Geostationary Meteorological Satellite
GTS	Global Telecommunications System

-H-

HA	High Accuracy
HD	High Density
HF	High Frequency
hPa	hectopascal/hectopascals
h	hour/hours
HNL	Honolulu (CPHC)
HRPT	High Resolution Picture Transmission

-I-

ICAO	International Civil Aviation Organization
ICMSSR	Interdepartmental Committee for Meteorological Services and Supporting Research
ID	identification
IFR	Instrument Flight Rules
INIT	initials
IR	Infrared
IWRS	Improved Weather Reconnaissance System

-J-

JTWC	Joint Typhoon Warning Center

-K-

km	kilometer/kilometers
KBIX	ICAO identifier for Keesler AFB, MS
KMHR	ICAO identifier for Mather AFB, CA
KMIA	ICAO identifier for Miami, FL (NHC)
KMKC	ICAO identifier for Kansas City, MO WSFO
KNEW	ICAO identifier for New Orleans, LA WSFO
KSFO	ICAO identifier for San Francisco, CA
kt	knot/knots
KWAL	ICAO identifier for Wallops Island, VA

-L-

LAC	Local Area Coverage
LF	Light Fine (satellite data terminology)
LI	Long Island
LS	Light Smooth (satellite data terminology)

-M-

m	meter/meters
MAC	Military Airlift Command (USAF)
MACR	MAC Regulation
MANOP	communications header
MAX	maximum
MB	millibars
METEOSAT	European Space Agency meteorological satellite
min/MIN	minute
MINOB	Minute Observation (IWRS)
MOU	Memorandum of Understanding
mph	mile/miles per hour
MVMT	movement

-N-

NASA	National Space and Aeronautics Administration
NAVEASTOCEANCEN	Naval Eastern Oceanography Center
NAVOCEANCOM	Naval Oceanography Command
NAVOCEANCOMDET	Naval Oceanography Command Detachment
NAVOCEANCOMFAC	Naval Oceanography Command Facility
NAVWESTOCEANCEN	Naval Western Oceanography Center
NDBC	National Data Buoy Center
NESDIS	National Environmental Satellite, Data, and Information Service
NHC	National Hurricane Center
NHOP	National Hurricane Operations Plan
NLT	Not Later Than
NMC	National Meterological Center
nmi	nautical mile/miles
NOAA	National Oceanic and Atmospheric Administration
NORAD	North American Aerospace Defense Command
NSC	NOAA Science Center
NSSFC	National Severe Storms Forecast Center
NSTL	National Space Technology Laboratories (NASA)
NWS	National Weather Service

-O-

OAC	Oceanic Aircraft Coordinator (USN)
OBS	observation
OFCM	Office of the Federal Coordinator for Meterological Services and Supporting Research
OSS	Operations Support Squadron (USAF)

-P-

PA	Public Affairs
PANC	ICAO identifier for Anchorage, AK
PCN	Position Code Number
PHNL	ICAO identifier for Honolulu, HI
POD	Plan of the Day

-R-

RECCO	Reconnaissance Code
RECON	reconnaissance
REQT	requested
ROCC	Regional Operational Control Center
RTIR	Real-Time Infrared

-S-

SAB	Synoptic Analysis Branch
SFC	surface
SFDF	Satellite Field Distribution Facility
SLP	Sea Level Pressure
SSH	Mission Sensor Infrared Temperature Sounder (DMSP)
SSIR	Mission Sensor Infrared
SSM/I	Mission Sensor Microwave Imager
SSM/T	Mission Senson Microwave Temperature Sounder
SST	Sea Surface Temperature

-T-

TCD	Tropical Cylone Discussion
TCPOD	Tropical Cyclone Plan of the Day
TD	Tropical Depression
TEMP	temperature
TEMP	temporary
TEMP DROP	Dropwindsonde Code
TF	Thermal Fine
TKO	takeoff
T-number	Tropical classification number
TOVS	TIROS-N Operational Vertical Sounder
TS	Thermal Smooth
TWO	Tropical Weather Outlook

-U-

UHF	Ultra High Frequency
US/U.S.	United States
USAF	United States Air Force
USCG	United States Coast Guard
USN	United States Navy
UTC	Universal Coordinated Time

-V-

VAS	VISSR Atmospheric Sounder
VDUC	VAS Data Utilization Center
VIS	Visible
VISSR	Visible and Infrared Spin Scan Radiometer
VTPR	Vertical Temperature Profile Radiometer

-W-

WEFAX	Weather Facsimile
WMO	World Meteorological Organization
WND	wind
WO	Data type header for special tropical disturbance statements
WRS	Weather Reconnaissance Squadron
WS	(National) Weather Service
WS	Weather Squadron
WSD	Wind Speed and Direction (data bouy)
WSFO	Weather Service Forecast Office
WSR	Weather Surveillance Radar
WT	Data type header for hurricane bulletins
WW	Weather Wing (USAF)
WW	Data type header for subtropical storm bulletia

-X-

XMTD	transmitted

-Z-

Z	Zulu (UTC)

APPENDIX B

GLOSSARY

-A-

Agency. Any Federal agency or organization participating in the tropical cyclone warning service.

-C-

Center Fix. The location of the center of a tropical or subtropical cyclone obtained by means other than reconnaissance aircraft penetration. See also Vortex Fix.

Cyclone. An atmospheric closed circulation rotating counter-clockwise in the Northern Hemisphere.

-E-

Eye. The relatively calm center of the tropical cyclone that is more than one half surrounded by wall cloud.

Eye Wall. An organized band of cumuliform clouds immediately surrounding the center of a tropical cyclone. Eye wall and wall cloud are used synonymously.

-H-

High Density/High Accuracy (HD/HA) Data. Those data provided by automated airborne systems--WP-3s or WC-130s equipped with the Improved Weather Reconnaissance System.

Hurricane/Typhoon. A warm-core tropical cyclone in which the maximum sustained surface wind speed (l-min mean) is 64 kt (74 mph) or more.

Hurricane Season. The portion of the year having a relatively high incidence of hurricanes. The seasons for the specific areas are as follows:

• Atlantic, Caribbean, and the Gulf of Mexico	June 1 to November 30
• Eastern Pacific	May 15 To November 30
• Central Pacific	June 1 to November 30

Hurricane Warning Offices. The designated hurricane warning offices follow:

- National Hurricane Center, Miami, Florida
- Central Pacific Hurricane Center, Honolulu, HI

Hurricane Warning. A warning that sustained winds of 64 kt (74 mph) or higher associated with a hurricane are expected in a specified coastal area in 24 hr or less. A hurricane warning can remain in effect when dangerously high water or a combination of dangerously high water and exceptionally high waves continue, even though winds may be less than hurricane force.

Hurricane Watch. An announcement for specific coastal areas that a hurricane or an incipient hurricane condition poses a possible threat, generally within 36 hr.

-M-

Miles. The term "miles" used in this plan refers to nautical miles (nmi) unless otherwise indicated.

Mission Identifier. The nomenclature assigned to tropical and subtropical cyclone aircraft reconnaissance missions for weather data identification. Its an agency-aircraft indicator followed by a Chief, Aerial Reconnaissance Coordination, All Hurricanes (CARCAH) assigned mission-system indicator.

-P-

Present Movement. The best estimate of the movement of the center of a tropical cyclone at a given time and at a given position. This estimate does not reflect the short-period, small-scale oscillations of the cyclone center.

-R-

Reconnaissance Aircraft Sorties. A flight that meets the requirements of the tropical cyclone plan of the day.

Relocated. A term used in an advisory to indicate that a vector drawn from the preceding advisory position to the latest known position is not necessarily a reasonable representation of the cyclone's movement.

-S-

Storm Surge. An abnormal rise in sea level accompanying a hurricane or other intense storm, and whose height is the difference between the observed level of the sea surface and the level

that would have occurred in the absence of the cyclone. Storm surge is usually estimated by subtracting the normal or astronomic tide from the observed storm tide.

Storm Tide. The actual level of sea water resulting from the astronomic tide combined with the storm surge.

Subtropical Cyclone. A low pressure system that develops over subtropical waters that initially has a non-tropical circulation but in which some elements of tropical cyclone cloud structure are present.

Subtropical Depression. A subtropical cyclone in which the maximum sustained surface wind speed (1-min mean) is 33 kt (38 mph) or less.

Subtropical Storm. A subtropical cyclone in which the maximum sustained surface wind speed (1-min mean) is 34 kt (39 mph) or greater.

Synoptic Track. Weather reconnaissance mission flown to provide vital meteorological information in data sparse ocean areas as a supplement to existing surface, radar, and satellite data. Synoptic flights better define the upper atmosphere and aid in the prediction of tropical cyclone development and movement.

-T-

Tropical Cyclone. A warm-core, nonfrontal low pressure system of synoptic scale that develops over tropical or subtropical waters and has a definite organized surface circulation.

Tropical Cyclone Plan of the Day. A coordinated mission plan that tasks operational weather reconnaissance requirements during the next 0500 to 0500 UTC day or as required, describes reconnaissance flights committed to satisfy both operational and research requirements, and identifies possible reconnaissance requirements for the succeeding 24-hr period.

Tropical Depression. A tropical cyclone in which the maximum sustained surface wind speed (1-min mean) is 33 kt (38 mph) or less.

Tropical Disturbance. A discrete tropical weather system of apparently organized convection--generally 100 to 300 mi in diameter--originating in the tropics or subtropics, having a nonfrontal migratory character, and maintaining its identity for 24 hr or more. It may or may not be associated with a detectable perturbation of the wind field.

Tropical Storm. A tropical cyclone in which the maximum sustained surface wind speed (1-min mean) ranges from 34 kt (39 mph) to 63 kt (73 mph).

Tropical Storm Warning. A warning for tropical storm conditions including sustained winds within the range of 39 to 73 mph (34 to 63 kt) that are expected in a specified coastal area within 24 hr or less.

Tropical Storm Watch. An announcement that a tropical storm poses or tropical storm conditions pose a threat to coastal areas generally within 36 hr. A tropical storm watch should normally not be issued if the system is forecast to attain hurricane strength.

Tropical Wave. A trough or cyclonic curvature maximum in the trade-wind easterlies. The wave may reach maximum amplitude in the lower middle troposphere or may be the reflection of an upper tropospheric cold low or equatorial extension of a middle latitude trough.

Tropical Weather System. A designation for one of a series of tropical weather anomalies. As such, it is the basic generic designation, which in successive stages of intensification, may be classified as a tropical disturbance, wave, depression, storm, or hurricane.

Typhoon/Hurricane. A warm-core tropical cyclone in which the maximum sustained surface wind speed (1-min mean) is 64 kt (74 mph) or more.

-V-

Vortex Fix. The location of the surface and/or flight level center of a tropical or subtropical cyclone obtained by reconnaissance aircraft penetration. See Center Fix, also.

-W-

Wall Cloud. An organized band of cumuliform clouds immediately surrounding the center of a tropical cyclone. Wall cloud and eye wall are used synonymously.

APPENDIX C

BIBLIOGRAPHY OF OFFICIAL INTERAGENCY AGREEMENTS

The following reference is pertinent to the agreed interagency responsibilities designated in this plan:

Memorandum of Agreement (MOA) between the Air Force Reserve (AFRES) and the National Oceanic and Atmospheric Administration (NOAA), in draft, April 1992. The purpose of this MOA is to establish policies, principles, and procedures under which the AFRES will provide aircraft weather reconnaissance to NOAA.

APPENDIX D

DISTRIBUTION

DEPARTMENT OF COMMERCE

Regional Office of Audits	1
DOC Budget Office	1

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Asst Administrator for Satellite and Information Services (E)	2
Asst Administrator for Ocean Svcs and Coastal Zone Management	1
Director, Office of Public Affairs, NOAA (PA)	2
Asst Administrator for Weather (W)	1
Director, Office of Meteorology (W/OM)	1
Chief, International Activities Division (W/OM3)	1
Chief, Warning and Forecast Branch (W/OM11)	20
Director, AOML Hurricane Research Division (R/E/AO)	5
Chief, Aviation Services Branch (W/OM13)	1
Chief, Services Development Branch (W/OM23)	1
Director, Office of Hydrology (W/OH)	1
Director, National Climate Program (CP)	1
Director, Office of Climate and Atmospheric Research (R/CAR)	1
Director, Office of NOAA Corps (NC)	1
Director, Program Development and Coordination Staff (R/PDC)	2
NOAA Library (E/AI22)	4
Director, National Meteorological Center (W/NMC)	5
Chief, Meteorological Operations Division (W/NMC3)	2
Chief, Development Division, NMC (W/NMC2)	1
Chief, Satellite Services Division (E/SP2)	1
WFSO, Washington, DC	5
Director, National Data Bouy Center	23
Director, National Hurricane Center	20
Director, NWS Eastern Region	50
Director, NWS Central Region	16
Director, NWS Southern Region	50
Director, NWS Western Region	15
Director, NWS Pacific Region	15
Chief, Library Div MASC (MC5)	2
WFSO, Boston, MA	5
WFSO, San Jaun, PR	5
WFSO, Redwood City, CA	5
WFSO, New Orleans, LA	5
WFSO, Coral Gables, FL	1
Admin Office, Aircraft Operations Center	20
Director, Environmental Research Laboratories (R/E)	4
Chief, Information Services Division, National Climatic Data Center (E/CC4)	2
NOAA Budget Officer, Office of Management and Budget	1
NWS, Melbourne, FL	1
NWS, Eureka, CA	1

DEPARTMENT OF DEFENSE

OFFICE OF THE JOINT CHIEFS OF STAFF

Joint Staff/J3/JOD	1

UNIFIED/SPECIFIED COMMANDS

USCINCCENT/CCJ3-W	1
USCINCEUR/ECJ3-WE	1
USCINCFOR/FCJ2-WE	1
USCINCLANT/J37	1
USCINCPAC/J37 (ENV.GP)	1
USCINCSO/SCJ3-0W	1
USCINCSOC/SOJ3-W	1
USCINCTRANS/TCJ3/JW-OW	1

DEPARTMENT OF THE AIR FORCE

HQ USAF/XOW	3
HQ USAF/XOOCW	1
HQ AFMC/DOW	2
HQ AFSPACOM/XOW	5
HQ AFSC/DOW	3
HQ AFSOC/DOW	1
HQ ANGRC/DOSW	48
HQ ATC/DOW	10
HQ ATC/TTO	2
HQ AU/WE	1
HQ MAC/XOW	10
HQ PACAF/DOW	6
HQ SAC/DOW	19
HQ TAC/DOW	34
HQ USAFE/WE	2
HQ AWS/DO	30
AFGWC/DO	4
ESMC/WE	2
USAFETAC/LD	1
325OSS	1
416OSS/DOW	1
3246 TW/DOW	2
3350 TCHTF/TTGU-W	2
3395 TCHTG/TTKO	2
Phillips Laboratory/GPA	1
SM-ALC/LHFBB	2

AFRES

HQ USAF/REO	3
HQ AFRES/DOO	3
HQ 4AF/DOO	2
HQ 403TAW/DO	3
815 TAS/DO	3
OLA 815TAS (CARCAH)	20
34AWF	35

DEPARTMENT OF THE ARMY

HQ Department of the Army/DAMI- POI	2
Topographic Engineering Center	1

DEPARTMENT OF THE NAVY

Commandant of the Marine Corps (DCS/Aviation)	7
Oceanographer of the Navy	2
Commander, Naval Oceanography Command	100
Commander in Chief (02M) U.S. Pacific Fleet	1
COMTHIRDFLT	1
CINCLANTFLT/(N37,N526)	2
Commander, Naval Air Systems Command	2
COMFITMATAEWWINGLANT, NAS OCEANA, VA	1
Commander, Naval Air Warfare Center, Weapons Division	2
Office of Naval Research (Code 1122MM)	1
NRL, Atmospheric Division, Monterey, CA	2
NRL, Stennis Space Center, MS	1
COMSECOND FLEET	2

DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

Air Traffic Plans and Requirements Service ATR-1	10
Air Traffic Program Management Director ATZ-1	10
Air Traffic Rules and Procedures Service ATP-1	10
Air Traffic Rules and Procedures Service ATP-140	5
Air Traffic System Effectiveness ATH-1	10
Air Traffic System Management ATM-100	10
Air Traffic System Management ATM-200	15
Air Traffic System Management ATM-400	10
Air Traffic System Management ATM-600 (NFDC)	5
Air Traffic System Management Operations Service ATM-1	2
FAA AAC-932 Oklahoma City, OK	3
FAA/AIA-101	3
FAA/AIFSS Houston	3
FAA/AIFSS Miami (QAS)	2
FAA/AIFSS New York	3
FAA AOP-4	3
FAA APA-200	1
FAA ATM-228 (NWS)	5
FAA Regional Air Traffic Division Managers	
ACE-500 Kansas City	5
AEA-500 New York	5
AGL-500 Chicago	5
ANE-500 Boston	5
ANW-500 Seattle	5
ASO-500 Atlanta	5
ASW-500 Dallas/Fort Worth	5
AWP-500 Los Angeles	5
Each FAA Air Route Traffic Control Centers (TMO/NWS/MLS)	3

U.S. COAST GUARD

Commandant, USCG Headquarters (G-OIO)	3
Commandant, USCG (FLAGPLOT)	1
Commander, Atlantic Area, USCG	2
Commander, First Coast Guard District	1
Commander, (OPC) Third Coast Guard District	2
Commander, Fifth Coast Guard District	2
Commander, (RE) Seventh Coast Guard District	3
Commander, Eighth Coast Guard District	3
Commanding Officer, USCG Air Station, Otis AFB, MA	1
Commanding Officer, USCG Air Station, Clearwater, FL	1

Commanding Officer, USCG Air Station, Opa Locka, FL	1
Commanding Officer, USCG Air Station, Corpus Christi, TX	1
Commanding Officer, USCG Air Station, Floyd Bennett Field, Brooklyn, NY	1
Commanding Officer, USCG Air Station, New Orleans, LA	1
Commanding Officer, USCG Air Station, Elizabeth City, NJ	1
Commander, Pacific Area, USCG	2
Commander, Eleventh Coast Guard District	1
Commander, Twelfth Coast Guard District	1
Commander, Fourteeth Coast Guard District	2
Commanding Officer, USCG Air Station, McClellan AFB, CA	1
Commanding Officer, USCG Air Station, Barbers Point, HI	1
Commanding Officer, USCG Air Station, Kodiak, AK	1
Commanding Officer, USCG Reserve Training Center	1

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Bureau of Reclamation, Office of Liaison Engineering and Research	1

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Director, Meteorology Program	1
Director, Atmospheric Sciences Division	1

NATIONAL SPACE AND AERONAUTICS ADMINISTRATION

Goddard Space Flight Center, Code 973	1
Director, Atmospheric Sciences Division, MSFC	1

OTHER U.S.

General Services Administration, Federal Information Center	1
Roddenbery Memorial Library, Cairo, GA	1
Congressional Research Service, Library of Congress	1
CWP Project Office, JPL	1
University of Chicago Library, The Joseph Regenstein Library	1
South Florida Water Management District	1
Natural Hazards Research and Applications Information Center, Institute of Behavioral Science	1
Dr. William Gray, Department of Atmospheric Sciences, Colorado State University	1
Mr. Jerry Hill, CCM	1
Mr. Phil Chan, JPL	1

GOVERNMENT OF CANADA

Director, Canadian Meteorological Centre, (AES) Downsview, ON	1
Meteorological Operations Division, Canadian Meteorological Centre, (AES), Dorval, QU	1
Officer in Charge, METOC Centre, Maritime Command Headquarters, Halifax, NS	1
Base Meteorological Officer, CFB Greenwood, NS	1
Base Meteorological Officer, CFB Summerside, PEI	1
Maritime Weather Centre (AES), Bedford NS	1

UNITED KINGDOM

Assistant Director, Head of Defense Services, Meteorological Office	1

APPENDIX E

SAFFIR-SIMPSON HURRICANE SCALE[1]

CATEGORY ONE HURRICANE -- WEAK

Winds[2]: 75-95 mph (65-82 kt) at standard anemometer elevations. F-scale is 1.0-1.4. Damage is primarily to shrubbery, trees, foliage, and unanchored mobile homes. No real damage occurs to building structures. Some damage is done to poorly constructed signs.[3]

Storm Surge: Nominally is 4-5 ft (1.2-1.5 m) above normal. Low-lying coastal roads are inundated, minor pier damage occurs, some small craft in exposed anchorages break moorings.

CATEGORY TWO HURRICANE -- MODERATE

Winds: 96-110 mph (83-95 kt) at standard anemometer elevations. F-scale is 1.5-1.9. Considerable damage is done to shrubbery and tree foliage, some trees are blown down. Major structural damage occurs to exposed mobile homes. Extensive damage occurs to poorly constructed signs. Some damage is done to roofing material, windows, and doors; no major damage occurs to building structures.

Storm Surge: Nominally is 6-8 ft (1.8-2.4 m) above normal. Coastal roads and low-lying escape routes inland are cut by rising water 2-4 hr before arrival of center. Considerable pier damage occurs, marinas are flooded. Small craft in unprotected anchorages break moorings. Evacuation of some shoreline residences and low-lying island areas is required.

CATEGORY THREE HURRICANE -- STRONG

Winds: 111-130 mph (96-113 kt) at standard anemometer elevations. F-scale is 2.0-2.4. Damage occurs to shrubbery and trees: foliage is blown off trees, large trees are blown down. Practically all poorly constructed signs are blown down, some roofing material damage occurs, some window and door damage occurs, and some structural damage occurs to small residences and utility buildings. Mobile homes are destroyed. There is a minor amount of curtainwall failure.

Storm Surge: Nominally is 9-12 ft (2.7-3.7 m) above normal. Serious flooding occurs at the coast with many smaller structures near the coast destroyed. Larger structures are damaged by battering of floating debris. Low-lying escape routes inland are cut by rising water 3-5 hr before the center arrives. Terrain continuously lower than 5 ft (1.5 m) above sea level may be flooded inland 8 mi (12.9 km) or more. Evacuation of low-lying residences within several blocks of the shoreline may be required.

CATEGORY FOUR HURRICANE -- VERY STRONG

Winds: 131-155 mph (114-135 kt) at standard anemometer elevations. F-scale is 2.5-2.9. Shrubs and trees are blown down, all signs are down. Extensive roofing material damage occurs, extensive window and door damage occurs, complete failure of roof structures occurs on many small residences, and complete destruction of mobile homes occurs. Some curtainwalls experience failure.

Storm Surge: Nominally is 13-18 ft (3.9-5.5 m) above normal. Terrain continuously lower than 10 ft (3 m) above sea level may be flooded inland as far as 6 mi (9.7 km). Major damage occurs to lower floors of structures near the shore due to flooding and battering action. Low-lying escape routes inland may be cut by rising water 3-5 hr before the storm center arrives. Major erosion of beach areas occurs. Massive evacuation of all residences within 500 yds (457 m) of the shoreline may be required and of single-story residences on low ground within 2 mi (3.2 km) of the shoreline.

CATEGORY FIVE HURRICANE -- DEVASTATING

Winds: Greater than 155 mph (135 kt) at standard anemometer elevation. F-scale is 3.0 or greater. Shrubs and trees are down, roofing damage is considerable, all signs are down. Very severe and extensive window and door damage occurs. Complete failure of roof structures occurs on many residences and industrial buildings. Extensive glass failures occur, some complete buildings fail, small buildings are overturned and blown over or away, and complete destruction of mobile homes occurs.

Storm Surge: Height is nominally greater than 18 ft (5.5 m) above normal. Major damage occurs to lower floors of all structures located less than 15 ft (4.6 m) above sea level and within 500 yd (457 m) of the shoreline. Low-lying escape routes inland are cut by rising water 3-5 hr before the storm center arrives.

Massive evacuations of residential areas situated on low ground within 5-10 mi (8-16 km) of the shoreline may be required.

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[1] The Saffir-Simpson Hurricane (SSH) Scale does not apply to the Pacific Islands

[2] Definition of a sustained wind (from Fujita and Simpson, 1972). A sustained wind is one that persists for the minimum time period to establish optimal dynamic forces on a nominal building structure.

[3] T. Fujita, 1971: "Proposed Characteristics of Tornadoes and Hurricanes by Area and Intensity," University of Chicago (SMRP) Research Paper No. 91.

APPENDIX F

PHONETIC PRONUNCIATION LISTING

CARIBBEAN BASIN

Abaco	AB-a-ko
Anguilla	ang-GWIL-a
Antigua	an-TEE-gua
Aruba	ah-ROO-ba
Antille	san-TIL-leez
Azore	suh-ZOHRZ
Bahamas	ba-HAHM-ahs
Barbuda	bar-BOO-dah
Barranquilla	bahr-rahn-KEE-yah
Barahona	ba-ra-HO-na
Basse-Terre	bahs-TER
Bermuda	ber-MYOO-da
Biloxi	bi-LUX-ee
Bimini	BIM-i-ni
Bonaire	ba-NAIR
Cap Haitien	kahp ah-ee-SYAN
Caracas	kah-RAH-kahs
Caribbean	kar-a-BE-an
Castries	KAS-trees
Cayman	kay-MAHN
Charlotte Amalie	SHAR-lot a-MAHL-ye
Cozumel	koh-soo-MEL
Curacao	koor-a-SOH
Dominica	dom-i-NEE-ka
Eleuthera	el-OO-thera
Exuma	ek-SOO-ma
Flores	FLO-rish
Fort de France	for-de-FRAHNS
Grenada	gre-NAY-dah
Guadaloupe	GWAH-deh-loop
Guatemala	gwaht-eh-MAH-la
Leeward	LEE-ward
Maracaibo	mar-a-KYE-boh
Maracay	Mah-rah-KYE
Marigot	ma-ree-GOH
Merida	MAY-re-thah
Miami	mye-AM-ee
Montego	mon-TEE-go
Montserrat	mont-se-RAT
Nicaragua	nik-a-RAH-gwah
Ocho Rios	OH-cho REE-os
Oranjestad	o-RAHN-yuh-stat
Paramaribo	par-a-MAR-i-boh
Parguera	par-GWER-a
Pointe-a-Pitre	pwan-ta-PEE-tr
Ponce	PON-sa
Port-au-Prince	port-oh-PRINS
Saba	SAH-ba
Sao Miguel (Azores)	soun ME-gel
St. Croix	SAINT croy
St. Lucia	SAINT LOO-she-a
Soufriere	soo-free-AR
Surinam	SOOR-i-nam
Tampico	tam-PEE-ko
Tela	TAY-lah
Tobago	to-BAY-go
Yucatan	yoo-ka-TAN

APPENDIX G

RECCO, MINOB, AND TEMP DROP CODES, TABLES AND REGULATIONS

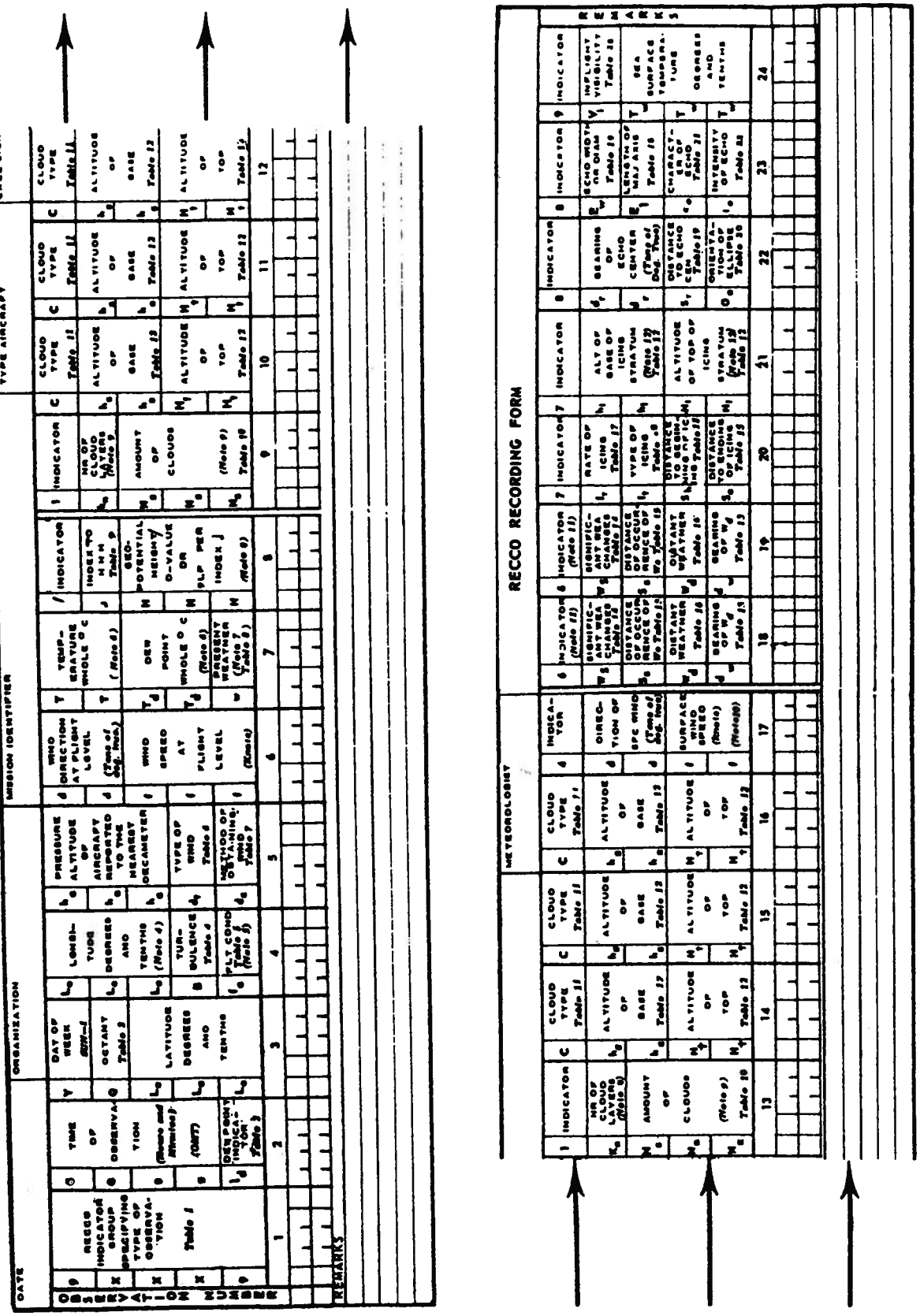

Figure G-1. Reconnaissance code recording form (AWS Form 32).

Table G-1. Reconnaissance code tables

TABLE 1 XXX

222 Sec One Observation without radar capability
555 Sec Three (intermediate) observation with or without radar capability
777 Sec One Observation with radar capabilities

TABLE 2 i_d

0 No dew point capability/acft below 10,000 meters
1 No dew point capability/acft at or above 10,000 meters
2 No dew point capability/acft below 10,000 meters and flight lvl tem -50°C or colder
3 No dew point capability/acft at or above 10,000 meters and flight lvl temp -50°C or colder
4 Dew point capability/acft below 10,000 meters
5 Dew point capability/acft at or above 10,000 meters
6 Dew point capability/acft below 10,000 meters and flight lvl temp -50°C or colder
7 Dew point capability/acft at or above 10,000 meters and flight lvl temp -50°C or colder

TABLE 3 Q

0	0° -90° W	Northern
1	90° W - 180°	Northern
2	180° - 90° E	Northern
3	90° - 0° E	Northern
4	Not Used	
5	0° - 90° W	Southern
6	90° - 180° W	Southern
7	180° - 90° E	Southern
8	90° - 0° E	Southern

TABLE 4 B

0 None
1 Light turbulence
2 Moderate turbulence in clear air, infrequent
3 Moderate turbulence in clear air, frequent
4 Moderate turbulence in cloud, infrequent
5 Moderate turbulence in cloud, frequent
6 Severe Turbulence in clear air, infrequent
7 Severe Turbulence in clear air, frequent
8 Severe Turbulence in cloud, infrequent
9 Severe Turbulence in cloud, frequent

TABLE 5 f_c

0 In the clear
8 In and out of clouds
9 In clouds all the time (continuous IMC)
/ Impossible to determine due to darkness or other cause

TABLE 6 d_t

0 Spot of Wind
1 Average wind
/ No wind reported

TABLE 7 d_a

0 Winds obtained using doppler radar or inertial systems
1 Winds obtained using other navigation equipment and/or techniques
/ Navigator unable to determine or wind not compatible

TABLE 8 w

0 Clear
1 Scattered (trece to 4/8 cloud coverage)
2 Broken (5/8 to 7/8 cloud coverage)
3 Overcast/undercast
4 Fog, thick dust or haze
5 Drizzle
6 Rain (continous or intermittent precip - from strate clouds)
7 Snow or rain and snow mixed
8 Shower(s) (continuous or intermittent precip - from cumuliform clouds)
9 Thunderstorm(s)
/ Unknown for any cause, including darkness

TABLE 9 j

0 Sea level pressure in whole millibars (*thousands fig if any omitted*)
1 Altitude 200 mb surface in geopotential decameters (*thousands fig if any omitted*)
2 Altitude 850 mb surface in geopotential meters (*thousands fig omitted*)
3 Altitude 700 mb surface in geopotential meters (*thousands fig omitted*)
4 Altitude 500 mb surface in geopotential decameters
5 Altitude 400 mb surface in geopotential decameters
6 Altitude 300 mb surface in geopotential decameters
7 Altitude 250 mb surface in geopotential decameters (*thousands fig if any omitted*)
8 D _ Value in geopotential decameters; if negative 500 is added to HHH
9 No absolute altitude available or geopotential data not within ± 30 meters/4 mb accuracy requirements

TABLE 10 N_s

0 No additional cloud layers (place holder)
1 1 okta or less, but not zero (*1/8 or less sky covered*)
2 2 oktas (*or 2/8 of sky covered*)
3 3 oktas (*or 3/8 of sky covered*)
4 4 oktas (*or 4/8 of sky covered*)
5 5 oktas (*or 5/8 of sky covered*)
6 6 oktas (*or 6/8 of sky covered*)
7 7 oktas or more but not 8 oktas
8 8 oktas or sky completely covered
9 Sky obscured (place holder)

TABLE 11 C

0 Cirrus (Ci)
1 Cirrocumulus (Cc)
2 Cirrostratus (Cs)
3 Altocumulus (Ac)
4 Altostratus (As)
5 Nimbostratus (Ns)
6 Statocumulus (Sc)
7 Stratus (St)
8 Cumulus (Cu)
9 Cumulonimbus (Cb)
/ Cloud type unknown due to darkess or other analogous phenomena

TABLE 12 $h_s h_s H_t H_t h_i h_i H_i H_i$

00 Less then 100
01 100 ft
02 200 ft
03 300 ft
etc, etc
49 4,900 ft
50 5,000 ft
51-55 Not used
56 5,600 ft
57 7,000 ft
etc, etc
79 29,000 ft
80 30,000 ft
81 35,000 ft
82 40,000 ft
etc, etc
89 Greater than 70,000 ft
// Unknown

TABLE 13 d_w

0	No report	
1	NE	7 NW
2	E	8 N
3	SE	9 all directions
4	S	
5	SW	
6	W	

TABLE 14 W_s

0 No change
1 Marked wind shift
2 beginning or ending of marked turbulence
3 Marked temperature change (not with altitude)
4 Precipitation begins or ends
5 Change in cloud forms
6 Fog or ice fog bank begins or ends
7 Werm front
8 Cold Front
9 front, type not specified

TABLE 15 $S_b S_e S_s$

0 No report
1 Previous position
2 Present position
3 30 nautical miles
4 60 nautical miles
5 90 nautical miles
6 120 nautical miles
7 150 nautical miles
8 180 nautical miles
9 More than 180 nauticel miles
/ Unknown (not used for S_s)

Table G-1. Reconnaissance code tables (continued)

TABLE 16 w_d

0 No report
1 Signs of a tropical Cyclone
2 Ugly threatening sky
3 Duststorm or sandstorm
4 Fog or ice fog
5 Waterspout
6 Cirrostratus shield or bank
7 Altostratus or altocumulus shield or bank
8 Line of heavy cumulus
9 Cumulonimbus heads or thunderstorms

TABLE 17 I_r

7 Light
8 Moderate
9 Severe
/ Unknown or contrails

TABLE 18 I_t

0 None
1 Rime ice in clouds
2 Clear ice in clouds
3 Combination rime and clear ice in clouds
4 Rime ice in precipitation
5 Clear ice in precipitation
6 Combination rime and clear ice in precip
7 Frost (icing in clear air)
8 Nonpersistent contrails (*less than 1/4 nautical miles long*)
9 Persistent contrails

TABLE 19 S_r, E_w, E_l

0 0NM	5 50NM
1 10NM	6 60-80NM
2 20NM	7 80-100NM
3 30NM	8 100-150NM
4 40NM	9 Greater than 150NM
	/ Unknown

TABLE 20 O_e

0 Circular
1 NNE - SSW
2 NE - SW
3 ENE - WSW
4 E - W
5 ESE - WNW
6 SE - NW
7 SSE - NNW
8 S - N
/ Unknown

TABLE 21 c_e

1 Scattered Area
2 Solid Area
3 Scattered Line
4 Solid Line
5 Scattered, all quadrants
6 Solid, all quadrents
/ Unknown

TABLE 22 i_e

2 Weak
5 Moderate
8 Strong
/ Unknown

TABLE 23 V_i

1 Inflight visibility 0 to and including 1 nautical mile
2 Inflight visibility greater than 1 and not exceeding 3 nautical miles
3 Inflight visibility greatar then 3 nautical miles

RECCO SYMBOLIC FORM

SECTION ONE (MANDATORY)

$9XXX9\ GGggi_d\ YQL_eL_aL_a\ L_oL_oL_oBf_c\ h_eh_ah_ad_td_e$

$ddfff\ TTT_dT_dw\ /jHHH$

SECTION TWO (ADDITIONAL)

$1k_nN_sN_sN_s\ Ch_sh_sH_tH_t$ 4ddff

$6W_sS_sW_dd_w\ 7I_rI_tS_bS_e\ 7h_ih_iH_iH_i\ 8d_rd_rS_rO_e$

$8E_wE_lc_ei_e\ 9V_iT_wT_wT_w$

SECTION THREE (INTERMEDIATE)

$9XXX9\ GGggi_d\ YQL_eL_aL_e\ L_oL_oL_oBf_c\ h_eh_eh_ad_td_a$

$ddfff\ TTT_dT_dw\ /jHHH$

Table G-2. Reconnaissance code regulations

1. At the time of the observation the aircraft observing platform is considered to be located on the axis of a right vertical cylinder with a radius of 30 nautical miles bounded by the earth's surface and the top atmosphere. Present weather, cloud amount and type, turbulence, and other subjective elements are reported as occurring within the cylinder. Flight level winds, temperature, dew point, and geopotential values are sensed or computed and reported as occurring at the center of the observation circle. Radar echoes, significant weather changes, distant weather, and icing are phenomena that may also be observed/reported. Code groups identifying these phenomena may be reported as necessary to adequately describe met conditions observed.

2. The intermediate observation (Section Three) is reported following Section One (or Section Two if appended to Section One) in the order that it was taken.

3. Plain language remarks may be added as appropriate. These remarks follow the last encoded portion of the horizontal or vertical observation and will clearly convey the intended message. Vertical observations will not include meteorological remarks. These remarks must begin with a letter or word-E.G. "FL TEMP" vice "700 MB FL TEMP." The last report plain language remarks are mandatory, i.e., "LAST REPORT. OBS 01 thru 08 to RJTY, OBS 09 and 10 to RPMK."

4. The hundreds digit of longitude is omitted for longitudes from 100° to 180°.

5. Describe conditions along the route of flight actually experienced at flight level by aircraft.

6. TT, T_dT_d. When encoding negative temperatures, 50 is added to the absolute value of the temperature with the hundreds figure, if any, being omitted. A temperature of -52°C is given as 02, the distinction between -52°C and 2°C being made from i_d. Missing unknown temperatures are reported as //. When the dew point is colder than -49.4°C, Code T_dT_d as // and report the actual value as a plain language remark - E.G. DEW POINT -52°C.

7. When two or more types of w co-exist, the type with the higher code figure will be reported. Code Figures 1, 2 and 3 are reported based on the total cloud amount through a given altitude, above or below the aircraft, and when other figures are inappropriate. The summation principle applies only when two or more cloud types share a given altitude.

8. When j is reported as a 9, HHH is encoded as ///.

9. If the number of cloud layers reported exceeds 3, k_n in the first 1-group reports the total number of cloud layers. The second 1-group reports the additional number of layers being reported exclusive of those previously reported. In those cases where a cloud layer(s) is discernible, but a descriptive cloud picture of the observation circle is not possible, use appropriate remarks such as "clouds blo" or As blo" to indicate the presence of clouds. In such cases, coded entries are not made for group 9. The sequence in which cloud amounts are encoded depends upon type of cloud, cloud base, and vertical extent of the cloud. The cloud with the largest numerical value of cloud type code (C) is reported first, regardless of coverage, base, or vertical extent. Among clouds of the same cloud type code sharing a common base, the cloud of greatest vertical extent is reported first. The summation principle is not used; each layer is treated as though no other clouds were present. The total amount of clouds through one altitude shared by several clouds will not exceed 8 oktas. Only use code figure 0 as a place holder when you can determine that no additional cloud layers exist. In case of undercast, overcast, etc., use code figure 9 as a placeholder.

10. Due to limitations in the ability to distinguish sea state features representative of wind speeds above 130 knots, surface wind speeds in excess of 130 knots will not be encoded. Wind speeds of 100 to 130 knots inclusive will be encoded by deleting the hundreds figure and adding 50 to dd. For wind speeds above 130 knots, dd is reported without adding 50 and ff is encoded as // with a plain language remark added, I.E., -sfc wind above 130 knots.

11. Significant weather changes which have occurred since the last observation along the track are reported for W_s.

12. When aircraft encounters icing in level flight, the height at which the icing occurred will be reported for h_ih_i. The H_iH_i will be reported as //.

SXXX50 KMIA 231120
AF966 01XXA CYCLONE MINOB 15 KMIA

1059	2619N	06556W	00350	0013	017	022	198	168	023	00378	0000000000
1100	2619N	06552W	00349	0013	016	023	196	170	023	00377	0000000000
1101	2619N	06549W	00349	0013	015	023	196	168	023	00378	0000000000
1102	2619N	06546W	00350	0012	015	024	196	172	025	00378	0000000000
1103	2619N	06542W	00350	0012	015	024	198	170	024	00378	0000000000
1104	2619N	06539W	00350	0011	015	024	196	174	024	00376	0000000000
1105	2619N	06535W	00350	0011	013	024	196	172	024	00377	0000000000
1106	2619N	06532W	00351	0011	015	024	196	174	024	00378	0000000000
1107	2619N	06529W	00351	0011	013	025	196	176	025	00378	0000000000
1108	2619N	06525W	00352	0011	014	024	196	176	025	00378	0000000000
1109	2619N	06522W	00354	0010	018	024	198	170	025	00379	0000000000
1110	2619N	06519W	00352	0010	013	025	200	170	026	00377	0000000000
1111	2619N	06515W	00354	0007	013	025	196	176	026	00377	0000000000
1112	2619N	06512W	00356	0007	015	026	194	176	026	00378	0000000000
1113	2618N	06508W	00357	0006	017	026	196	176	028	00378	0000000000
1114	2618N	06505W	00357	0005	018	028	196	178	028	00378	0000000000
1115	2617N	06502W	00358	0003	019	028	198	178	029	00376	0000000000
1116	2616N	06458W	00357	0002	023	031	198	178	032	00375	0000000000
1117	2615N	06455W	00358	0001	022	030	200	174	031	00374	0000000000
1118	2614N	06452W	00356	0001	021	030	200	179	030	00372	0000000000

Figure G-2. Sample MINOB message

Table G-3. MINOB message format

HHMM $L_aL_aL_a$mmH $L_oL_oL_o$mmH PPPPP DDDD WWW SSS TTT ddd MMM RRRRR FFFFFFFFFF

HHMM:	The time of observation in hours and minutes (UTC).
$L_aL_aL_a$mmH:	The latitude of the observation in degrees, minutes and hemisphere (N or S).
$L_oL_oL_o$mmH:	The longitude of the observation in degrees, minutes and hemisphere (E or W).
PPPPP:	The pressure altitude in meters.
DDDD:	The absolute value of the D-value in meters (a 5 occupies the thousands place if the D-value is negative. For example, -34m is encoded as 5034.
WWW:	The wind direction in degrees, with 0 being true north, increasing clockwise.
SSS:	The wind speed in knots.
TTT:	The air temperature in degrees and tenths Celsius. The tenths digit is even for temperatures at or above 0°C, odd for temperatures below 0°C.
ddd:	The dew point temperature, encoded the same way as air temperature.
MMM:	The maximum wind speed in knots measured during the minute. This is the peak wind speed averaged over a 10-sec period.
RRRRR:	Radar altitude in meters
FFFFFFFFFF:	Default status for the MINOB data. A "1" indicates the parameter is defaulted (suspect value) or based on a parameter that is defaulted. A "0" indicates the value is not defaulted. The field indicates default for (in order): latitude, longitude, pressure altitude, D-value, wind direction, wind speed, air temperature, dew point, maximum wind speed, radar altimeter.

Table G-4. TEMP DROP code breakdown

CODE FORM:

PART A

SECTION 1	$M_iM_iM_jM_j$	$YYGGl_d$	$99L_aL_aL_a$	$Q_cL_oL_oL_oL_o$	$MMMUL_aU_{Lo}$
SECTION 2	$99P_oP_oP_o$	$T_oT_oT_{do}D_oD_o$	$d_od_of_of_of_o$		
	$P_1P_1h_1h_1h_1$	$T_1T_1T_{d1}D_1D_1$	$d_1d_1f_1f_1f_1$		
	.....	.....	.....		
	$P_nP_nh_nh_nh_n$	$T_nT_nT_{dn}D_nD_n$	$d_nd_nf_nf_nf_n$		
SECTION 3	$88P_tP_tP_t$ or 88999	$T_tT_tT_{dt}D_tD_t$	$d_td_tf_tf_tf_t$		
SECTION 4	$77P_mP_mP_m$ or $66P_mP_mP_m$ or 77999	$d_md_mf_mf_mf_m$	$(4V_bV_bV_aV_a)$		

PART A

SECTION 1 - IDENTIFICATION AND POSITION

M_iM_i	Identification letters of the report = XX
M_jM_j	Identification letters of the part of the report = AA
YY	Day of the month (GMT) = 01,02 etc. When wind data are included (Dropwindsonde observation), 50 is added to YY.
GG	Actual time of the observation, to the nearest whole hour (GMT).
l_d	Highest level for which wind is available. 7 = 700mbs, 5 = 5000mbs, etc. If flight level is above a standard surface, for example 495, report a 5 for 500 MBs in the l_d group. When no winds are reported in any part of the message encode as "/"
99	Indicator for aircraft position
$L_aL_aL_a$	Latitude, in tenths of a degree.
Q_c	Quadrant of the globe. The earth is divided by the Greenwich Meridian and the Equator into quadrants. The code figure reported depends on the latitude and longitude of the observation position. i.e., 7 = NW, 1 = NE, 3 = SW, 5 = SE.
$L_oL_oL_oL_o$	Longitude, in tenths of a degree.
MMM	Marsden square. The number of the Marsden Square for aircraft position at the time of the observation is reported for MMM. Always report three digits for MMM, with zeros reported for the hundreds and tens digits when required. When an observation is within a depicted 10 degree square, report the number of that square. When on an even 10 degree latitude or longitude circle, the Marsden Square for MMM is obtained by moving in the direction of larger latitude and/or longitude. EXAMPLE: assuming a position of 18.1N, 131.4W, MMM is 050; assuming a position of 30.0N, 140.0E, MMM is 130. At the equator or on the prime meridian, report the Marsden square compatible with the Q_c reported.
U_{La}	Units digit in the reported latitude
U_{Lo}	Units digit in the reported longitude

Table G-4. TEMP DROP code breakdown (continued)

SECTION 2- SURFACE AND STANDARD ISOBARIC SURFACES

99-	Indicator for surface
$P_oP_oP_o$	Pressure in whole millibars, thousands digits omitted. ($P_oP_oP_o$ is always surface level)
P_1P_1 ... P_nP_n	Pressure of mandatory standard isobaric surfaces in units of tens of millibars. (1000mbs=00, 850mbs=85, 700mbs=70, etc.)
$h_1h_1h_1$ ... $h_nh_nh_n$	Height of the mandatory pressure level in geopotential meters or decameters above the surface. Encoded in meters up to 501mbs; Encoded in decameters above 501mbs. Add 500 to hhh for negative 1000mb heights. Report 1000mb groups as 00/// ///// when surface pressure is less than 950mbs.
T_oT_o T_1T_1 ... T_nT_n	Tens and units digit of air temperature (not rounded off) in degress. Celsius, at specified levels beginning with surface.
T_{so} T_{s1} ... T_{sn}	Approximate tenths value and sign (plus or minus) of the air temperature. Even = plus Odd = minus
D_oD_o D_1D_1 ... D_nD_n	Dewpoint depression (with respect to water) at standard isobaric surfaces beginning with surface level. When the depression is 4.9C or less encode the units and tenths digits of the depression. Encode depression of 5.0 through 5.4 as 50; Encode depressions of 5.5 through 5.9 as 56. Dewpoint depressions of 6.0 and above are encoded in tens and units with 50 added. Dewpoint depressions for relative humidities less than 20% are encoded as 80. When air temperature is below -40°C report D_nD_n as two solidi.
d_od_o d_1d_1 ... d_nd_n	True direction (rounded off to nearest 5 degrees) in tens of degrees. from which the wind is blowing. (Dropwindsonde)
$f_of_of_o$ $f_1f_1f_1$ ... $f_nf_nf_n$	Wind speed in knots (Dropwindsonde)

[NOTE: When flight level is just above a mandatory surface (Dropwindonde) and, in the operator's best meterological judgement, the winds are representative of the winds at the mandatory surface, then the operator may encode the mandatory surface winds using the data from flight level. If the winds are not representative, then encode /////.]

SECTION 3 - DATA FOR TROPOPAUSE LEVELS

88	Indicator for tropopause data.
$P_tP_tP_t$	Pressure at the tropopause level reported in whole millibars
T_tT_t	Air temperature in whole degrees Celsius, at the tropopause level.
T_{st}	Approximate tenths value and sign (plus or minus) of the air temperature at the tropopause level.
D_tD_t	Dewpoint depression at the tropopause level.
d_td_d	True direction (rounded off to the nearest 5 degrees), in tens of degrees, from which the wind is blowing at the tropopause level.

Table G-4. TEMP DROP code breakdown (continued)

$f_t f_t f_t$ Wind speed, in knots, at the tropopause level

88999 Tropopause data not available.

SECTION 4 - MAXIMUM WIND DATA

66 Indicator that data for maximum wind level and for vertical wind shear follow (the top of the wind sounding corresponds to the highest wind speed observed throughout the descent.)

77 Indicator that data for maximum wind level and for vertical wind shear follow (maximum wind level does not coincide with the top of the wind sounding.)

$P_m P_m P_m$ Pressure at maximum wind level in whole millibars

$d_m d_m$ True wind direction (rounded off to nearest 5 degrees), in tens of degrees, from which the maximum wind is blowing.

$f_m f_m f_m$ Maximum wind speed in knots

4 Indicator for vertical wind shear data

$v_a v_a$ Absolute value of vector difference between max wind and wind blowing 3000 feet ABOVE the level of maximum wind. Reported to the nearest knot. Use "//" if missing and 4 group is reported. A vector difference of 99 knots or more is reported with the code figure 99.

$v_b v_b$ Absolute value of vector difference between max wind and wind blowing 3000 feet BELOW the level of maximum wind. Reported to the nearest knot. Use "//" if missing and 4 group is reported. A vector difference of 99 knots or more is reported with the code figure 99.

CODE FORM:

PART B

SECTION 1	$M_j M_j M_j M_j$	YYGG/	$99L_a L_a L_a$	$Q_c L_o L_o L_o L_o$ MMMUL$_a$U$_{Lo}$
SECTION 5	$n_0 n_0 P_0 P_0 P_0$	$T_0 T_0 T_{a0} D_0 D_0$		
	$n_1 n_1 P_1 P_1 P_1$	$T_1 T_1 T_{a1} D_1 D_1$		
	.....	.....		
	$n_n n_n P_n P_n P_n$	$T_n T_n T_{an} D_n D_n$		
SECTION 6	21212	$n_0 n_0 P_0 P_0 P_0$	$d_0 d_0 f_0 f_0 f_0$	
	$n_1 n_1 P_1 P_1 P_1$	$d_1 d_1 f_1 f_1 f_1$		
	.....	.....		
	$n_n n_n P_n P_n P_n$	$d_n d_n f_n f_n f_n$		
SECTION 9	51515	10166	10167	10190 10191

PART B

SECTION 1 - IDENTIFICATION AND POSITION

$M_j M_j$ Identification letters of the part of the report = BB

/ Filler figure for YYGG group

All other groups are the same as reported in Part 1 - Section 1

Table G-4. TEMP DROP code breakdown (continued)

SECTION 5 - DATA FOR SIGNIFICANT TEMPERATURE AND RELATIVE HUMIDITY LEVELS

n_0n_0 Number of level, starting with surface level. Only surface level will be numbered as "00". When a mandatory level is also
n_1n_1 selected as significant, repeat the level in section 5. Encode significant levels n_an_a to indicate missing data as nn/// /////.
...
n_an_a

$P_0P_0P_0$ Pressure at specified levels in whole millibars, beginning with surface.
$P_1P_1P_1$
...
$P_aP_aP_a$

Temperature and humidity data groups are reported in the same manner as the temperature and humidity data in PART A - Section 2.

SECTION 6 - DATA FOR SIGNIFICANT WIND LEVELS

21212 Data for significant levels with respect to wind follow. Wind data groups are reported in the same manner as the wind data in PART A - Section 2

SECTION 9 - ADDITIONAL DATA GROUPS

51515 Additional data in regional code follow.

10166 Geopotential data are doubtful between the following levels. $P_aP_aP'_aP'_a$. This code figure is used only when geopotential data are doubtful from a level to termination of the descent.

NOTE: When radar altimeter is inoperative and surface reference is used, or if the ARWO advises that geopotential platform data are doubtful, a 10166 is reported for the entire run.

10167 Temperature Data are doubtful between the following levels: $0P_1P_1P_2P_2$

This code figure shall be reported when only temperature data are doubtful for a portion(s) of the descent. If the 10167 group is reported a 10166 will also be reported.

EXAMPLE: Temperature is missing from 540mbs to 510mbs. SLP is 1020mbs. The code would be 10166 00251 10167 05451.

10190 Extrapolated altitude data follows:

(1) When the sounding begins within 25 mbs below a standard surface, the height of the surface is reported in the format 10190 $P_aP_ah_ah_ah_a$. The temperature group is not reported.

EXAMPLES: Assume the release was made from 310 mbs and the 300 mb height was 966 decameters. The last reported standard level in Part A is the 400 mb level. The data for the 300 mb level is reported in Part B as 10190 30966.

(2) When the sounding does not reach surface, but terminates within 25 mbs of a standard surface, the height of the standard surface is reported in Part A of the code in standard format and in Part B of the code in the format 10190 PnPnhnhnhn (aircraft reference).

EXAMPLE: Assume termination occurred at 980 mbs and the extrapolated height of the 1000 mb level was 115 meters. The 1000 mb level would be reported in Part A of the code as 00115 ///// and in Part B as 10190 00115.

10191 Extrapolated surface pressure precedes. Extrapolated surface pressure is only reported when the termination occurs between 850 mbs and surface pressure is reported in Part A as $99P_0P_0P_0$///// and Part B as $00PP_0P_0P_0$ /////. When surface pressure is extrapolated, the 10191 group is the last additional data group reported in Part B.

APPENDIX H

TELEPHONE AND TELETYPE LISTING

DEPARTMENT OF COMMERCE

AGENCY	LOCATION	TTY[1]	TELEPHONE
Alternate NHC (NMC, Met Ops Div)	Washington, DC	A C	COM 301-763-8201 FTS 763-8201
AOC	Miami, FL		COM 305-526-2936 FTS 350-2936 DSN 434-1600
CPHC	Honolulu, HI	C	COM 808-836-1801 FTS 546-2853
CPHC Satellite Coordinator	Honolulu, HI	C	COM 808-836-2776
NDBC (Data Systems Div) (See USCG entry)	NSTL, MS		COM 601-688-2836 FTS 494-2836 DSN 485-4411
NESDIS SAB	Camp Springs, MD	A C	COM 301-763-8444 FTS 763-8444
NHC	Coral Gables, FL	ABC	COM 305-536-5547 FTS 350-5547
NHC Satellite Coordinator	Coral Gables, FL	ABC	COM 305-536-4460 FTS 350-4460
NMC Meteorological Operations Division	Washington, DC	A C	COM 301-763-8201 FTS 763-8201
NWS Warning and Forecast	Washington, DC		COM 301-713-0090

[1] A TG7073
B COMEDS
C AFOS
D AFTN
E TTY Address is KCFC7D7X

DEPARTMENT OF DEFENSE

AGENCY	LOCATION	TTY	TELEPHONE
AFGWC	Offutt AFB, NE	AB	COM 402-291-2586 FTS 866-2586 DSN 271-2586
CARCAH (OL-A, 815TAS)	Coral Gables, FL	ABC	COM 305-661-5076 FTS 350-5547 DSN 434-3420
CINCLANTFLT OAC	Oceana, VA		COM 804-433-2851 ext 233 DSN 433-2851 ext 233
Det 4, 20 WS (Weather Monitor)	Hickam AFB, HI	B	COM 808-449-1634 DSN 315-449-1634
Det 4, 20 WS (Hawaii ROCC/WE)	Hickam AFB, HI	B DSN	COM 808-449-7638 /7637 315-449-6262
416 OSS/DOW (formerly Det 8, 26WS) (Northeast Air Defense Sector/WE)	Griffiss AFB, NY	B	COM 315-330-2410 DSN 587-2410
325 OSS (formerly Det 9, 3 WS) (Southeast Air Defense Sector/WE)	Tyndall AFB, MS	B	COM 904-283-3215 DSN 523-3215
Keesler AFB Command Post	Keesler AFB, MS		COM 601-377-4330 DSN 597-4330
NAVEASTOCEANCEN	Norfolk, VA	B	COM 804-444-7750 /3770 FTS 954-7750 /3770 DSN 564-7750 /3770
NAVWESTOCEANCEN	Pearl Harbor, HI	B	COM 808-471-0353 DSN 315-430-0111 ask for 471-0004 COM 808-474-4856 DSN 315-474-4856
NAVOCEANCOMCEN/JTWC	Guam	D	COM 671-344-4224 DSN 344-4224 FAX 671-477-6186

815 WF/DO	Keesler AFB, MS	B	COM 601-377-2409 DSN 597-2409
34 AWF (Office)	Keesler AFB, MS		COM 601-377-3207 DSN 597-3207
34 AWF (Alternate CARCAH)	Keesler AFB, MS	B	COM 601-377-1939 DSN 597-1939

DEPARTMENT OF TRANSPORTATION

AGENCY	LOCATION	TTY	TELEPHONE
Air Traffic Control System Command Center	Washington, DC	E	COM 202-267-5500 FTS 267-5500 DSN 643-2080 24-hour Hotline (MIL USE ONLY) 800-333-4ATM
Houston ARTCC	Houston, TX	D	COM 713-230-5560 FTS 527-5560 DSN 729-1491
Miami ARTCC	Miami, FL	D	COM 350-592-9753 FTS 820-1210 DSN 894-1910
Kansas City ARTCC	Olathe, KS		FTS 753-1225
New York ARTCC	Ronkonkoma, L.I., NY		FTS 663-3490
Washington ARTCC	Leesburg, VA		FTS 925-4440
Chicago ARTCC	Aurora, IL		FTS 388-9203
Cleveland ARTCC	Oberlin, OH		FTS 292-8119
Indianapolis ARTCC	Indianapolis, IN		FTS 332-0222
Minneapolis ARTCC	Farmington, MN		FTS 784-3237
Boston ARTCC	Nashua, NH		FTS 834-6675
Denver ARTCC	Longmont, CO		FTS 323-4261
Salt Lake City ARTCC	Salt Lake City, UT		FTS 586-3128

Seattle ARTCC	Auburn, WA	FTS	390-5283
Atlanta ARTCC	Hampton, GA	FTS	249-3656
Jacksonville ARTCC	Hilliard, FL	FTS	965-1578
Memphis ARTCC	Memphis, TN	FTS	222-3181
Albuquerque ARTCC	Albuquerque, NM	FTS	476-0590
Ft. Worth ARTCC	Euless, TX	FTS	334-1520
Los Angeles ARTCC	Palmdale, CA	FTS	968-8250
Oakland ARTCC	Freemont, CA	FTS	449-6475
U.S. Coast Guard (for after hours contact with NDBC)	New Orleans, LA	COM FTS	504-589-6225 682-6225

INTERDEPARTMENTAL

AGENCY	LOCATION	TTY	TELEPHONE
OFCM	Rockville, MD		COM 301-443-8704 FTS 443-8704 DSN 851-1460

*U.S. G.P.O.:1992-313-153:60484

WORKING GROUP FOR HURRICANE AND WINTER STORM OPERATIONS

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Supporting Research