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

FEDERAL COORDINATOR FOR METEOROLOGICAL SERVICES AND SUPPORTING RESEARCH

National Hurricane Operations Plan

FCM-P12-1983

Washington, D.C.
May 1983

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U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
FEDERAL COORDINATOR FOR METEOROLOGICAL
SERVICES AND SUPPORTING RESEARCH

NATIONAL HURRICANE OPERATIONS PLAN

FCM-P-12-1983
May 1983
Washington, D.C.

FOREWORD

An Interdepartmental Plan was first issued in 1962. This document is the 21st edition and presents procedures and agreements reached at the 37th annual Interdepartmental Hurricane Conference held at the USAF Conference Center, Homestead Air Force Base, Florida, 11-14 January 1983.

The Conference is sponsored annually by the Committee for Basic Services, Interdepartmental Committee For Meteorological Services and Supporting Research, and brings together cognizant Federal agencies to achieve agreement on items of mutual concern related to hurricane warning services. The host this year for the Conference was the Aerospace Rescue and Recovery Services of the Military Airlift Command, United States Air Force.

William S. Barney
Acting Federal Coordinator for
Meteorological Services and
Supporting Research

NATIONAL HURRICANE OPERATIONS PLAN

(ATLANTIC, EASTERN PACIFIC, AND CENTRAL PACIFIC)

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CHAPTER 1

INTRODUCTION

1. Introduction. The Hurricane Warning Service is an interdepartmental effort to provide the Nation and designated international recipients with environmental data, forecasts, and assessments concerning tropical and subtropical weather systems. Interdepartmental cooperation achieves economy and efficiency in the operation of the Hurricane Warning Service. This plan provides the basis for implementing the agreements of the Department of Commerce (DOC), Department of Defense (DOD), and the Department of Transportation (DOT) reached at the annual Interdepartmental Hurricane Conference (combined Atlantic and Pacific). It is the 21st edition of the National Hurricane Operations Plan (first issued in 1962). The Hurricane Conference is sponsored by the Subcommittee on Basic Services, 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 Pacific hurricane warning services.

2. Terms used in this Plan:

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

b. Cyclone. An atmospheric closed-circulation rotating counterclockwise in the Northern Hemisphere.

c. Eye. The relatively calm center of a tropical cyclone which is more than 1/2 surrounded by wall cloud.

d. Hurricane Season. The portion of the year having a relatively high incidence of hurricanes. In the Atlantic, Caribbean, and Gulf of Mexico, this is the period from June through November; in the eastern Pacific June through November 15; and in the central Pacific the period from June through October.

e. Hurricane Warning Offices (HWO). The designated hurricane warning offices are: the National Hurricane Center, Miami, Florida, and the Weather Service Forecast Offices at San Juan, Puerto Rico; New Orleans, Louisiana; Washington, D.C.; Boston, Massachusetts; Eastern Pacific Hurricane Center (Redwood City, California); and Central Pacific Hurricane Center (Honolulu, Hawaii).

f. Miles. The term "miles" used in this Plan refers to nautical miles unless otherwise indicated.

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

h. 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.

i. Reconnaissance Aircraft Sortie. A flight which meets the requirements of the tropical cyclone plan of the day (TCPOD).

j. 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.

k. Storm Surge. The height difference between the observed level of sea water and the level of sea water that would have occurred in the absence of the storm.

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

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

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

(2) Subtropical Storm. A subtropical cyclone in which the maximum sustained surface wind (1-minute mean) is 34 knots (39 statute mph) or greater.

n. Tropical Cyclone Plan of the Day. A coordinated mission plan that tasks operational weather reconnaissance requirements during the next 05Z to 05Z day or as required; describes reconnaissance flights committed to satisfy both operational and research requirements; and identifies possible reconnaissance requirements for the succeeding 24-hour period.

o. Tropical Weather Systems:

(1) Tropical Disturbance. A discrete system of apparently organized convection--generally 100 to 300 miles in diameter--originating in the tropics or subtropics, having a nonfrontal migratory character and maintaining its identity for 24 hours or more. It may or may not be associated with a detectable perturbation of the wind field. As such, it is the basic generic designation, which, in successive stages of intensification, may be classified as a tropical wave, depression, storm, or hurricane.

(2) 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 troposphere cold-low or equatorial extension of a middle-latitude trough.

(3) Tropical Cyclone. A nonfrontal low pressure system of synoptic scale developing over tropical or subtropical waters and having a definite organized circulation.

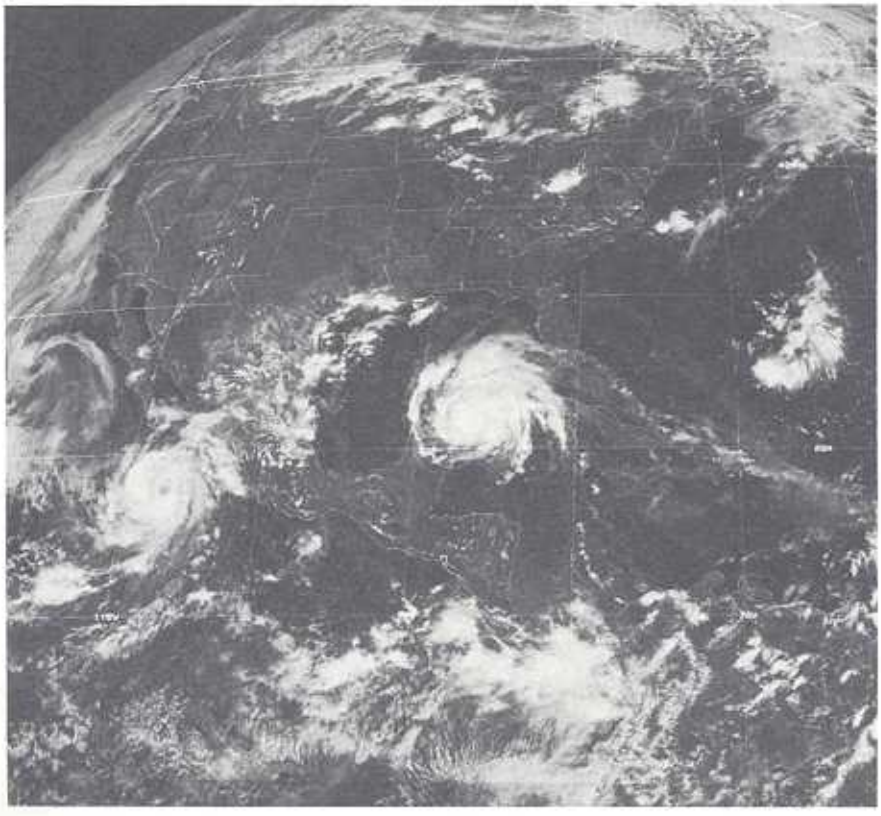
(a) Tropical Depression. A tropical cyclone in which the maximum sustained surface wind (1-minute mean) is 33 knots (38 statute mph) or less.

(b) Tropical Storm. A warm-core tropical cyclone in which the maximum sustained surface wind (1-minute mean) ranges from 34 knots (39 statute mph) to 63 knots (73 statute mph) inclusive.

(c) Hurricane. A warm-core tropical cyclone in which the maximum sustained surface wind (1-minute mean) is 64 knots (74 statute mph) or more.

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

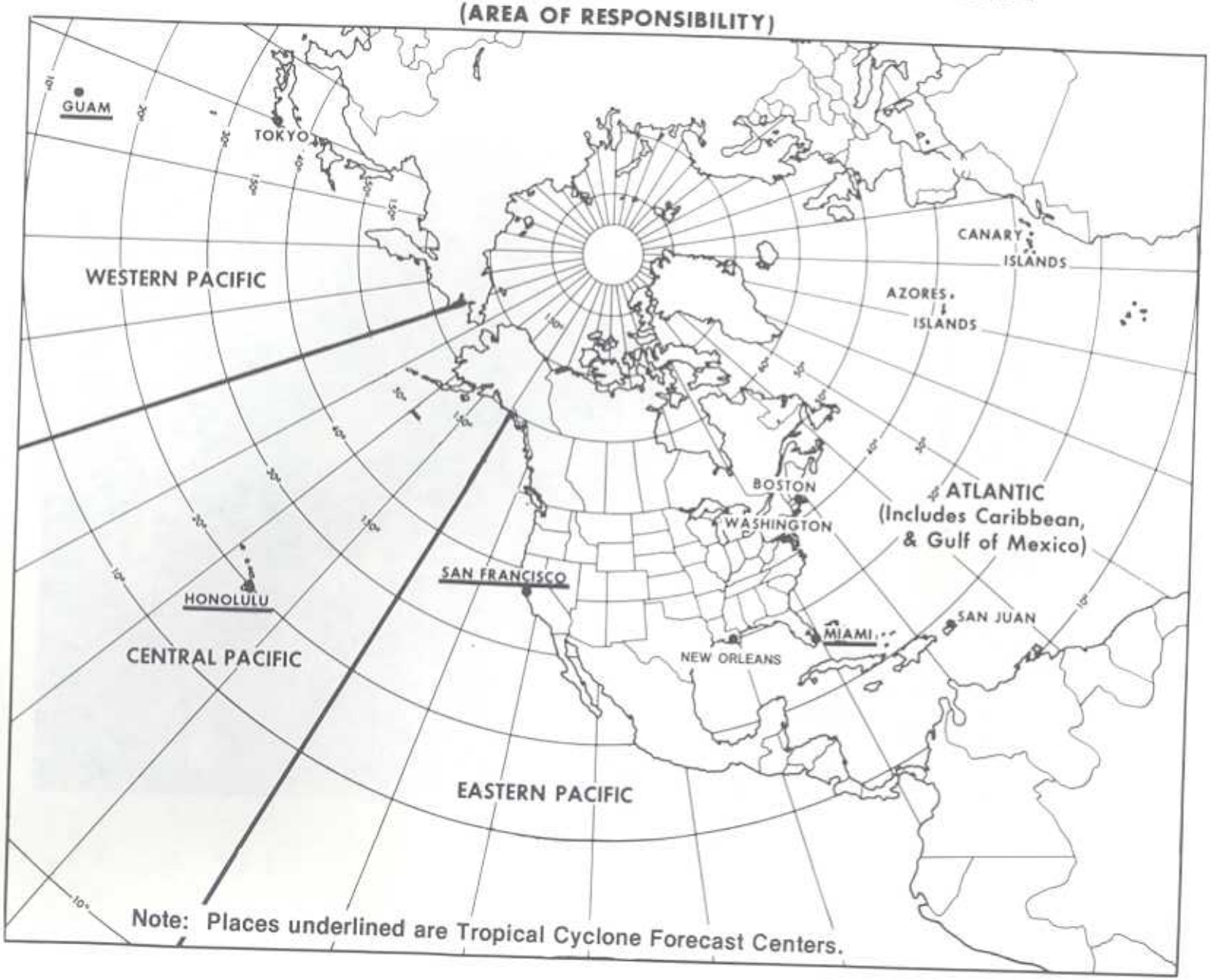
q. Wall Cloud. An organized band of cumuliform clouds immediately surrounding the center of a tropical cyclone. Wall cloud and eye wall are used synonymously.



Hurricane ALLEN in the Gulf of Mexico
and ISIS in the Eastern Pacific, August 7, 1980

NATIONAL HURRICANE OPERATIONS PLAN

(AREA OF RESPONSIBILITY)



CHAPTER 2

RESPONSIBILITIES OF COOPERATING AGENCIES

1. Department of Commerce (DOC) Responsibilities.

a. Provide timely dissemination of all significant information regarding tropical and subtropical cyclones to appropriate agencies, general public, and marine and aviation interests.

b. Through the National Weather Service (NWS) - consult as necessary with Department of Defense (DOD) regarding day-to-day DOD requirements for cyclone assessments and attempt to meet these requirements within the capabilities of the Hurricane 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/subtropical cyclones and disturbances; provide facilities, administrative support, and dissemination of weather observation data for Operating Location-G (OL-G), Air Weather Service (AWS) as agreed to by DOC and DOD; 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:

(1) Atlantic Ocean (north of the Equator including Caribbean Sea and Gulf of Mexico) - advices are the responsibility of the Director, NHC, Miami, FL. (NHC will consult with Naval Eastern Oceanography Center (NAVEASTOCEANCEN) Norfolk, VA, prior to issuance of an initial advisory.)

(2) Eastern Pacific Ocean (north of the Equator and east of 140°W) - advices are the responsibility of the Director, Eastern Pacific Hurricane Center (EPHC), Redwood City, CA. (EPHC will consult with Naval Western Oceanography Center (NAVWESTOCEANCEN), Pearl Harbor, HI, before issuance of initial and final advisories and prior to issuance of any advisory which indicates a significant change in forecast of intensity or track from last advisory.)

(3) Central Pacific Ocean (north of the Equator between 140°W and 180°) - advices are the responsibility of Director, Central Pacific Hurricane Center (CPHC), Honolulu, HI. [CPHC will consult with NAVWESTOCEANCEN Pearl Harbor, HI, and Detachment 4, 1 Weather Wing, Hickam AFB, HI, before issuance of an initial advisory.]

(4) Relating to (1) and (3) above, exchange of information is encouraged on subsequent warnings when significant changes are made, or as otherwise required.

c. Through the National Environmental Satellite, Data, and Information Service (NESDIS) - operate DOC environmental satellite systems capable of providing coverage of meteorological conditions in the Tropics during the tropical cyclone season, and monitor and interpret DOC satellite imagery; obtain as necessary, National Aeronautic and Space Administration (NASA) research/

development satellite data for NWS operational use; comply with NHC, EPHC, and CPHC satellite data requirements.

d. Through the NOAA Data Buoy Center (NDBC) - develop, deploy, and operate environmental data buoy systems to support data requirements of NHC, EPHC, and CPHC.

e. Through the Environmental Research Laboratory (ERL) Research Facilities Center (RFC) - provide weather reconnaissance flights as specified in Chapter 4, unless relieved of these responsibilities by the Administrator of the National Oceanic and Atmospheric Administration.

f. Through the NWS, 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 issuance to interested agencies.

g. Through NOAA, reimburse the Air Force for the aircraft reconnaissance flown in support of this plan in accordance with the NOAA/USAF memorandum of understanding, dated 16 March 1976.

2. DOD Responsibilities.

a. Provide NWS with timely dissemination of significant information received regarding tropical and subtropical cyclones.

b. Provide NHC, EPHC, and CPHC current DOD requirements for tropical and subtropical cyclone advices.

c. Meet DOC requirements for aircraft reconnaissance and other special observations as agreed to by DOD and DOC.

d. Provide a 24-hour aircraft operation interface (Chief, Aerial Reconnaissance Coordination, All Hurricanes--CARCAH) at the National Hurricane Center.

e. Designate OL-G, AWS 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.

f. Provide broadcast facilities of radio station NAM for tropical storm and hurricane forecasts and warnings.

g. Provide access to North American Aerospace Defense Command (NORAD) long-range radar sites. [See Chapter 6.]

h. Provide weather reconnaissance data monitor services to evaluate and disseminate reconnaissance reports.

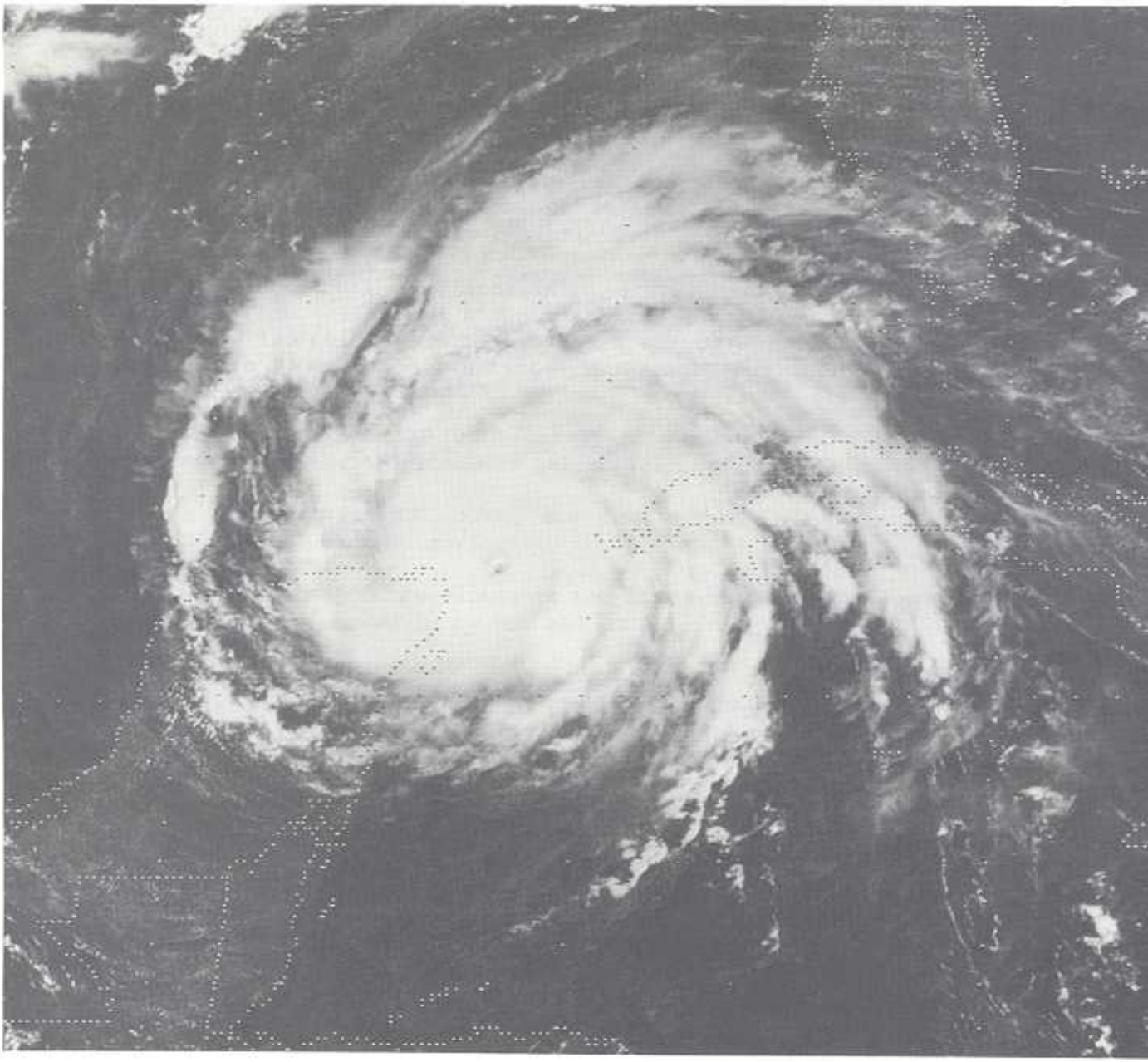
3. Department of Transportation (DOT) Responsibilities.

a. Provide NWS with timely dissemination of significant information received regarding tropical and subtropical cyclones.

b. Through the Federal Aviation Administration (FAA) - provide air traffic control, communication, and flight assistance services. In addition, FAA will provide access to Air Route Traffic Control Center (ARTCC) communication and radar facilities (see Chapter 6) and provide communication circuits for relay of weather information as required.

c. Through the U.S. Coast Guard (USCG) - provide personnel, vessel, and communication support to NDBO for development, deployment, and operation of moored environmental data buoy systems; provide surface observations to NWS from its coastal facilities and vessels; provide communication circuits for relay of weather observations to NWS in selected areas; provide primary guard Autodin support to OL-G, AWS; and provide coastal broadcast facilities at selected locations for tropical storm/hurricane forecasts and warnings.

4. 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.



Hurricane ALLEN approaching the Yucatan Peninsula,
August 1980

CHAPTER 3

OBSERVATIONS, FORECASTS, AND RELATED INFORMATION TO BE FURNISHED BY NWS TO DOD

1. Observations. The National Hurricane Center (NHC), Eastern Pacific Hurricane Center (EPHC), and Central Pacific Hurricane Center (CPHC) will make available to Department of Defense (DOD) all significant tropical/subtropical cyclone observations that they receive.

2. Military Advisories.

a. General. NHC, EPHC, and CPHC will provide DOD with 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 these disturbances. Advisories will be disseminated through the NWS weather communications facility at Suitland, MD, to the Automated Weather Network (AWN) at Carswell AFB, TX, for further relay to DOD agencies. Military advisories will not be disseminated to the public. DOD forecasters who must give advice concerning an imminent operational decision may contact the appropriate Hurricane Center forecaster (see Chapter 2) when published military advisories require elaboration. Phone numbers for the NHC/-EPHC/CPHC are published in Appendix C to Chapter 4.

b. Military Advisory Issue Frequency. The first military advisory will normally be issued when meteorological data indicate that a tropical or subtropical cyclone has formed. Subsequent advisories will be issued at 0400Z, 1000Z, 1600Z, and 2200Z, (0300Z, 0900Z, 1500Z, 2100Z in the Eastern and Central Pacific). 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 (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):

(1) Conditions require a hurricane watch or warning to be issued.

(2) A tropical depression becomes a tropical storm.

(3) A tropical storm changes to a hurricane or vice versa.

(4) Conditions require change or cancellation of an existing coastal warning.

(5) A tornado threat develops or the hurricane forecaster believes other significant changes have occurred.

c. Military Advisory Content. Military advisories will contain appropriate information as shown in Form 1 (WS Form C-13) of this chapter, Appendix A. Advisories will contain 12- and 24-hour forecasts and, when appropriate, 48- and 72-hour outlooks valid from times based on the latest 6-hourly synoptic time. At a minimum, advisories in which the winds are forecast to be greater than 33 knots within 24 hours will include outlooks through 72 hours.

d. Numbering of Advisories. All advisories will be numbered sequentially in the Eastern and Central Pacific; i.e., Advisory Number 1 on tropical depression (TD) 1, Advisory Number 2 on TD 1, Advisory Number 3 on Tropical Storm Anita, Advisory Number 4 on Hurricane Anita, Advisory Number 5 on TD Anita, etc. In the Atlantic, Caribbean, and Gulf of Mexico advisories will be numbered consecutively beginning with each new depression. When the depression is numbered as a subtropical storm or named, the advisory numbering will revert to 1 and start all over again. In both the Atlantic and Pacific, once the system is named, however, that name will be retained on military advisories until no further advisories are issued on that system; advisory numbering will continue sequentially.

3. Other Information Provided to DOD.

a. Tropical Cyclone Discussion.

(1) NHC will issue a Tropical Cyclone Discussion on Atlantic tropical cyclones at 0330Z, 0930Z, 1530Z, and 2130Z. Discussion will be disseminated for intragovernmental use only and will contain preliminary prognostic positions up to 48 hours; will describe objective techniques, synoptic features, and climatology used; will provide reasons for track changes; and will include plans for warning display. Additionally, the Saffir/Simpson Hurricane Scale (SSH) as described in Appendix C to this chapter will be included whenever the tropical cyclone is within 72 hours of landfall on the U.S. coast or a military installation.

(2) EPHC and CPHC will issue a Tropical Cyclone Discussion twice daily. CPHC will issue the discussions not later than 0330Z and 1530Z. The discussion will describe objective techniques, synoptic features and climatology used; will provide reasons for track changes; and will include plans for warning display.

b. Tropical Weather Outlook. Issued by NHC and EPHC during their respective hurricane seasons. In the Atlantic, it is transmitted at 0530, 1130, and 1730 Eastern Local Time (ELT). In the Eastern Pacific, it s transmitted at 0300 and 2000 GMT. The outlook will briefly describe both stable and potentially unstable areas out to 48 hours. A monthly summary of Atlantic tropical cyclone activity will be added to the Tropical Weather Outlook at the end of each month during the hurricane season.

c. Public Advisories. Issued by NHC for all tropical storms and hurricanes, and for tropical depressions or subtropical storms threatening land in the Gulf of Mexico, Caribbean, or western North Atlantic areas. In the Pacific, public advisories are issued for storms and hurricanes that are expected to affect the United States within 48 hours. Scheduled public advisories are issued at the same time scheduled military advisories are issued. When no coastal warnings are included, the 0400Z public advisory will be issued at 0230Z by NHC only. [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.]

d. Atlantic and Gulf of Mexico Tropical Cyclone Position Estimates. NHC may also issue hourly Tropical Cyclone Position Estimates when the tropical cyclone is under effective surveillance and within 200 nautical miles 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 will be disseminated to the public, DOD, and other Federal agencies and will provide geographical positions in latitude and longitude, and also by distance and direction from a well-known point.

e. Storm Summaries. Storm summaries are written by the National Severe Storms Forecast Center (NSSFC) 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 GMT.

f. Marine Advisories. Issued by NHC, EPHC, and CPHC with the same frequency and at the same times as the Military Advisories. The content and format of these advisories are identical to those of the Military Advisories (see Appendix A, Form 1, this chapter), but will not include a 48- and 72-hour extended outlook. Marine Advisories will be transmitted to high-seas shipping according to the details found in Worldwide Marine Weather Broadcasts, jointly published by U.S. Navy (USN) and NWS.

#g. Probability of Hurricane/Tropical Storm Conditions. The probability of the storm center passing within 50 miles to the right or 75 miles to the left of specific forecast points within 24, 36, 48 and 72 hours, is included in the military/marine/aviation, and public advisories, and the Tropical Cyclone Discussion for the Atlantic Basin. The probability is expressed in percentages and is cumulative during the forecast periods, i.e., the 36-hour forecast probability includes the 24-hour probability until the storm is forecast to be beyond the location during the forecast period. When appropriate, specific probabilities will be computed for the following locations:

Brownsville, Texas
Corpus Christi, Texas
Port O'Connor, Texas
Galveston, Texas
Port Arthur, Texas/Cameron, Louisiana
New Iberia, Louisiana
New Orleans, Louisiana
Buras, Louisiana
Gulfport, Mississippi
Mobile, Alabama
Pensacola, Florida
Panama City, Florida
Apalachicola, Florida
St. Marks, Florida
Cedar Key, Florida
Tampa, Florida
Venice, Florida
Fort Myers, Florida
Marco Island, Florida
Key West, Florida
Marathon, Florida
Miami, Florida
West Palm Beach, Florida
Vero Beach, Florida
Cape Canaveral, Florida
Daytona Beach, Florida
Jacksonville, Florida
Savannah, Georgia
Charleston, South Carolina
Wilmington, North Carolina
Hatteras, North Carolina
Norfolk, Virginia
Ocean City, Maryland
Atlantic City, New Jersey
New York, New York
Providence, Rhode Island
Boston, Massachusetts
Portland, Maine
Eastport, Maine

#4. Abbreviated Communications Headings. Abbreviated communications headings are assigned to advisories on tropical and subtropical cyclones and other advices based on depression number (or storm name) and standard communication procedures. [Note: An abbreviated heading consists of three groups with ONE space between groups. The first group contains a data type indicator (e.g., WH for hurricane), a geographical indicator (e.g., CA for Caribbean), and a number. The second group contains a location indicator of the message originator (e.g., KMIA for Miami). The third group is a date-time group in GMT. An example of a complete header is WHCA31 KMIA 180400.

a. Atlantic.

WHCA21-25 KMIA	Marine hurricane or tropical storm advisory
WHCA31-35 KMIA	Public hurricane or tropical storm advisory
WHNT31-35 KMIA	Military hurricane or tropical storm avisory
WOCA21-25 KMIA	Marine tropical depression advisory
WOCA31-35 KMIA	Public tropical depression advisory
WONT31-35 KMIA	Military tropical depression advisory
WWCA21-25 KMIA	Subtropical storm advisory
WOCA41 KMIA	Unnumbered depressions and suspicious areas
WHXX41-45 KMIA	Tropical cyclone discussion
ABCA20 KMIA	Tropical weather outlook
WOXX41-45 KMIA	Tropical depression discussion
WHXX51 KMIA	Tropical cyclone position estimate
WHXX90 KMIA	Tropical cyclone discussion for WMO Region IV stations

Example:

WH (named storms)	WO (depressions)
31 - A F K P W	31 - 1 6
32 - B G L R	32 - 2 7
33 - C H M S	33 - 3 8
34 - D I N T	34 - 4 9
35 - E J O V	35 - 5 0

In abbreviated headings shown in series in example above--21-25, 31-35, and 41-45--the second digit corresponds with the first letter of the name of the storm, or the last digit of the number of the depression.

b. East and Central Pacific. All advisories on hurricanes, tropical storms, and depressions are under WT abbreviated headings as follows:

WTPA21-25 KSFO	Marine
WTPA21-25 PHNL	Marine
WTPA31-35 KSFO	Public
WTPA31-35 PHNL	Public
WTPN31-35 KSFO	Military
WTPN31-35 PHNL	Military

Depressions are numbered internally and storms are named internally, but the number in the abbreviated heading 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 is upgraded to storm status.

WHXX41-45 KSFO	Tropical cyclone discussion
WHXX41-45 PHNL	Tropical cyclone discussion
WHXX51 KSFO	Tropical Cyclone position estimate
WHXX51 PHNL	Tropical cyclone position estimate
WOPN41 KSFO	Unnumbered despressions and suspicious areas
WOPN41 PHNL	Unnumbered depression and suspicious areas
WWPN21-25 PHNL	Subtropical storm advisory

5. Designation of Tropical and Subtropical Cyclones.

a. Numbering of Depressions. Each depression will be assigned a number that will be retained throughout the life of the cyclone. This depression number will not, however, be disseminated on advices after a depression is named as a tropical storm/hurricane or is numbered as a subtropical storm. For each hurricane center's area, numbering will begin with 01 at the start of each calendar year. When forecast responsibility is passed from one warning center to another, the assigned number will be retained.

(1) For the Atlantic, Caribbean, and Gulf of Mexico, depression numbers will be assigned by NHC after advising the NAVEASTOCEANCEN, Norfolk.

(2) For the Pacific area east of longitude 140°W, depression numbers, (with the suffix E, i.e., 1E, 2E, 3E, etc.) will be assigned by EPHC after advising the NAVWESTEOCEANCEN, Pearl Harbor.

(3) For the Pacific area west of longitude 140°W and east of 180°, depression numbers (with suffix C, i.e. 1C, 2C, 3C, etc.) will be assigned by CPHC after advising the NAVWESTOCEANCEN, Pearl Harbor.

(4) For the Pacific area west of longitude 180°, depression numbers are assigned by the Joint Typhoon Warning Center (JTWC), Guam.

b. Naming of Tropical Storms and Hurricanes.

(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 six years, except names of significant hurricanes will be retired and replaced with another. Lists of Atlantic and East and Central Pacific names are provided in Appendix B to this chapter.

(2) Central Pacific. When a tropical depression intensifies into a tropical storm or hurricane between longitude 140°W and the 180th meridian, the depression number will be discontinued and replaced by an appropriate name. The CPHC will select the name from the Central Pacific names in Appendix B to this chapter. All of the names listed in each column, beginning with column 1, will be used before going to the next column.

(3) Western Pacific. For the Pacific area west of longitude 180°, Tropical Storms and Typhoons are named by the Joint Typhoon Warning Center (JTWC), Guam. The names are listed in Appendix B to this chapter for information only.

c. Numbering of Subtropical Storms. When a system becomes a subtropical storm, it will be assigned a storm number to indicate its sequence of occurrence among subtropical storms for that area. Numbering will begin with 1 and be consecutive, returning to 1 each new year.

WS FORM C-13
(3-80)
(PRES. BY WSOM C-41)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

MILITARY/MARINE AVIATION HURRICANE ADVISORY

NOTE: Gusts included when maximum sustained winds reach 50 knots. Use of Quadrants is optional in East and Central Pacific. Twelve hour forecast not included for Atlantic Depressions and Subtropical Storms. *For use in Pacific only.

Subtropical Depression
Subtropical Storm
Tropical Depression _____ Military/Marine/Aviation Advisory _____ Corrected ☐
Tropical Storm Name Number Number Special ☐
Hurricane

NATIONAL WEATHER SERVICE _____ _____
City State

_____ Z _____ _____ _____
Time Month Day Year

(WARNINGS)

DEPRESSION, STORM, HURRICANE CENTER LOCATED/RELOCATED _____ NORTH _____ WEST AT _____ Z.

POSITION EXCELLENT (Within 10NM) BASED ON AF RECONNAISSANCE TIME OF FIX _____ Z
GOOD (Within 20NM) NOAA RECONNAISSANCE TIME OF FIX _____ Z.
FAIR (Within 40NM) LAND BASED RADAR SATELLITE SYNOPTIC REPORT
ACCURATE WITHIN _____ NM ACFT RADAR SHIP REPORT EXTRAPOLATION

Remarks

NOTE: Leave 3 spaces after each latitude and longitude entry.

PRESENT MOVEMENT _____ OR _____ DEGREES AT _____ KT
DIAMETER OF EYE _____ NM (If known)
MAXIMUM SUSTAINED WINDS _____ KT WITH GUSTS TO _____ KT.
*RADIUS OF 100 KT WINDS _____ NE _____ SE _____ SW _____ NW.
RADIUS OF 64 KT WINDS _____ NE _____ SE _____ SW _____ NW.
RADIUS OF 50 KT WINDS _____ NE _____ SE _____ SW _____ NW.
RADIUS OF 34 KT WINDS _____ NE _____ SE _____ SW _____ NW.
RADIUS OF SEAS 12 FT OR HIGHER _____ NE _____ SE _____ SW _____ NW.
REPEAT CENTER LOCATED/RELOCATED NEAR _____ N _____ W AT _____ Z.

FORECAST VALID _____ Z _____ N _____ W.
MAXIMUM SUSTAINED WINDS _____ KT WITH GUSTS TO _____ KT.
RADIUS OF 50 KT WINDS _____ NE _____ SE _____ SW _____ NW.
RADIUS OF 34 KT WINDS _____ NE _____ SE _____ SW _____ NW.
FORECAST VALID _____ Z _____ N _____ W.
MAXIMUM SUSTAINED WINDS _____ KT WITH GUSTS TO _____ KT.
RADIUS OF 50 KT WINDS _____ NE _____ SE _____ SW _____ NW.
RADIUS OF 34 KT WINDS _____ NE _____ SE _____ SW _____ NW.

AVIATION ADVISORY ENDS HERE

STORM-TIDE OF

HEAVY PRECIPITATION

REQUEST FOR 3-HOURLY SHIP REPORTS

SUBTROPICAL STORM AND MARINE ADVISORIES END HERE

EXTENDED OUTLOOK FOR INTRAGOVERNMENTAL USE ONLY
OUTLOOK VALID _____ Z _____ N _____ W.
MAXIMUM SUSTAINED WINDS _____ KT WITH GUSTS TO _____ KT.
RADIUS OF 50 KT WINDS _____ NE _____ SE _____ SW _____ NW.
OUTLOOK VALID _____ Z _____ N _____ W.
MAXIMUM SUSTAINED WINDS _____ KT WITH GUSTS TO _____ KT.
RADIUS OF 50 KT WINDS _____ NE _____ SE _____ SW _____ NW.

NEXT ADVISORY AT _____ Z | FORECASTER

ATLANTIC HURRICANE NAMES

1983	1984	1985	1986	1987	1988
ALICIA	ARTHUR	ANA	ANDREW	ARLENE	ALBERTO
BARRY	BERTHA	BOB	BONNIE	BRET	BERYL
CHANTAL	CESAR	CLAUDETTE	CHARLEY	CINDY	CHRIS
DEAN	DIANA	DANNY	DANIELLE	DENNIS	DEBBY
ERIN	EDOUARD	ELENA	EARL	EMILY	ERNESTO
FELIX	FRAN	FABIAN	FRANCES	FLOYD	FLORENCE
GABRIELLE	GUSTAV	GLORIA	GEORGES	GERT	GILBERT
HUGO	HORTENSE	HENRI	HERMINE	HARVEY	HELENE
IRIS	ISIDORE	ISABEL	IVAN	IRENE	ISAAC
JERRY	JOSEPHINE	JUAN	JEANNE	JOSE	JOAN
KAREN	KLAUS	KATE	KARL	KATRINA	KEITH
LUIS	LILI	LARRY	LISA	LENNY	LESLIE
MARILYN	MARCO	MINDY	MITCH	MARIA	MICHAEL
NOEL	NANA	NICHOLAS	NICOLE	NATE	NADINE
OPAL	OMAR	ODETTE	OTTO	OPHELIA	OSCAR
PABLO	PALOMA	PETER	PAULA	PHILIPPE	PATTY
ROXANNE	RENE	ROSE	RICHARD	RITA	RAFAEL
SEBASTIEN	SALLY	SAM	SHARY	STAN	SANDY
TANYA	TEDDY	TERESA	TOMAS	TAMMY	TONY
VAN	VICKY	VICTOR	VIRGINIE	VINCE	VALERIE
WENDY	WILFRED	WANDA	WALTER	WILMA	WILLIAM

1983	1984	1985	1986	1987	1988
ADOLPH	ALMA	ANDRES	AGATHA	ADRIAN	ALETTA
BARBARA	BORIS	BLANCA	BLAS	BEATRIZ	BUD
COSME	CRISTINA	CARLOS	CELIA	CALVIN	CARLOTTA
DALILIA	DOUGLAS	DOLORES	DARBY	DORA	DANIEL
ERICK	ELIDA	ENRIQUE	ESTELLE	EUGENE	EMILIA
FLOSSIE	FAUSTO	FEFA	FRANK	FERNANDA	FABIO
GIL	GENEVIEVE	GUILLERMO	GEORGETTE	GREG	GILMA
HENRIETTE	HERNAN	HILDA	HOWARD	HILARY	HECTOR
ISMAEL	ISELLE	IGNACIO	ISIS	IRWIN	IVA
JULIETTE	JULIO	JIMENA	JAVIER	JOVA	JOHN
KIKO	KENNA	KEVIN	KAY	KNUT	KRISTY
LORENA	LOWELL	LINDA	LESTER	LIDIA	LANE
MIRIAM	MANUEL	MARIE	MARTY	MADELINE	MAX
NARDA	NORBERT	NORA	NEWTON	NORMA	NORMAN
OCTAVE	ODILE	OLAF	ORLENE	OTIS	OLIVIA
PRISCILLA	POLO	PAULINE	PAINE	PILAR	PAUL
RAYMOND	RACHEL	RICK	ROSLYN	RAMON	ROSA
SONIA	SIMON	SANDRA	SEYMOUR	SELMA	SERGIO
TICO	TRUDY	TERRY	TINA	TODD	TARA
VELMA	VANCE	VIVIAN	VIRGIL	VERONICA	VICENTE
WINNIE	WALLIS	WALDO	WINIFRED	WILEY	WILLA

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-kah	ELE	EH-leh	ELA	EH-lah
HANA	HAH-nah	HALI	HAH-lee	HUKO	HOO-koh	HALOLA	hah-LOH-lah
IWA	EE-vah	INIKI	ee-NEE-kee	IOKE	ee-OH-keh	IUNE	ee-OO-neh
KELI	KEH-lee	KEONI	keh-OH-nee	KIKA	KEE-kah	KIMO	KEE-moh
LALA	LAH-lah	LI	LEE	LANA	LAH-nah	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 on to Column 2, etc.
All letters in the Hawaiian language are pronounced including double or triple vowels.

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
ANDY	ABBY	ALEX	AGNES
BESS	BEN	BETTY	BILL
CECIL	CARMEN	CARY	CLARA
DOT	DOM	DINAH	DOYLE
ELLIS	ELLEN	ED	ELSIE
FAYE	FORREST	FREDA	FABIAN
GORDON	GEORGIA	GERALD	GAY
HOPE	HERBERT	HOLLY	HAZEN
IRVING	IDA	IKE	IRMA
JUDY	JOE	JUNE	JEFF
KEN	KIM	KELLY	KIT
LOLA	LEX	LYNN	LEE
MAC	MARGE	MAURY	MAMIE
NANCY	NORRIS	NINA	NELSON
OWEN	ORCHID	OGDEN	ODESSA
PAMELA	PERCY	PHYLLIS	PAT
ROGER	RUTH	ROY	RUBY
SARAH	SPERRY	SUSAN	SKIP
TIP	THELMA	THAD	TESS
VERA	VERNON	VANESSA	VAL
WAYNE	WYNNE	WARREN	WINONA

SAFFIR/SIMPSON HURRICANE (SSH) SCALE

ONE

(a) WINDS* 75-95 mph at standard anemometer elevations (F-scale 1.0-1.4). **Damage primarily to shrubbery, trees, foliage, and unanchored mobile homes. No real damage to building structures. Some damage to poorly constructed signs, or

(b) STORM SURGE (nominally 4-5 feet above normal). Low-lying coastal roads inundated, minor pier damage, some small craft in exposed anchorages break moorings.

TWO

(a) WINDS 96-110 mph at standard anemometer elevations (F-scale 1.5-1.9). Considerable damage to shrubbery and tree foliage, some trees blown down. Major structural damage to exposed mobile homes. Extensive damage to poorly constructed signs. Some damage to roofing material, windows, and doors; no major damage to building structure or

(b) STORM SURGE (nominally 6-8 feet above normal). Coastal roads and low-lying escape routes inland cut by rising water 2-4 hours before arrival of center. Considerable pier damage, marinas flooded. Small craft in unprotected anchorages break moorings. Evacuation of some shoreline residences and low-lying island areas required.

THREE

(a) WINDS 111-130 mph at standard anemometer elevations (F-scale 2.0-2.4) Damage to shrubbery and trees. Foliage off trees, large trees blown down. Practically all poorly constructed signs blown down, some roofing material damage, some window and door damage, some structural damage to small residences and utility buildings, and mobile homes destroyed. Minor amount of curtainwall failures, or

(b) STORM SURGE (nominally 9-12 feet above normal). Serious flooding at coast with many smaller structures near coast destroyed. Larger structures damaged by battering of floating debris. Low-lying escape routes inland cut by rising water 3-5 hours before center arrives. Terrain continuously lower than 5 feet above sea level may be flooded inland 8 miles or more. Evacuation of low-lying residences within several blocks of the shoreline may be required.

FOUR

(a) WINDS 131-155 mph at standard anemometer elevations (F-scale 2.5-2.9). Shrubs and trees down, all signs down. Extensive roofing material damage, extensive window and door damage, complete failure of roof structures on many small residences, and complete destruction of mobile homes. Some curtainwall failure, or

(b) STORM SURGE (nominally 13 to 18 feet above normal). Terrain continuously lower than 10 feet above sea level may be flooded inland as far as 6 miles. Major damage to lower floors of structures near the shore due to flooding and battering action. Low-lying escape routes inland cut by rising water 3-5 hours before center arrives. Major erosion of beach areas. Massive evacuation of all residences within 500 yards of the shoreline may be required and of single-story residences on low ground within 2 miles of the shoreline.

FIVE

(a) WINDS greater than 155 mph at standard anemometer elevations (F-scale 3.0 or greater). Shrubs and trees down, roofing damage considerable, all signs down. Very severe and extensive window and door damage. Complete failure of roof structures on many residences and industrial buildings. Extensive glass failures, some complete building failures, small buildings overturned and blown over or away, and complete destruction of mobile homes, or

(b) STORM SURGE (height nominally greater than 18 feet above normal). Major damage to lower floors of all structures located less than 15 feet above sea level and within 500 yards of the shoreline. Low-lying escape routes inland cut by rising water 3-5 hours before center arrives. Massive evacuations of residential areas situated on low ground within 5-10 miles of the shoreline may be required.

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* 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.

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

CHAPTER 4

AIRCRAFT RECONNAISSANCE

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. Department of Defense (DOD) will attempt to fulfill all DOC requirements; however, based on stated DOC needs, DOD will normally be prepared to generate up to five reconnaissance aircraft sorties per day. Requirements exceeding this capability will be executed on a "resource permitting" basis. Research aircraft of the NOAA Research Facilities Center (RFC) may be diverted to fulfill urgent operational requirements. In times of national emergency or war, some or all DOD reconnaissance resources may not be available to fulfill DOC needs.

2. Responsibilities.

a. DOD has operational reconnaissance responsibility for providing vortex fixes/data and investigative flights in response to DOC needs.

b. DOC/NOAA/RFC may be requested to:

(1) Provide augmentation to the U.S. Air Force (USAF) for operational aircraft reconnaissance with high-density/accuracy data, when storms are within 24 hours of landfall of the continental United States.

(2) Provide augmentation capabilities for USAF aircraft reconnaissance when DOC needs exceed the capabilities of DOD resources.

(3) Assume responsibility for hurricane reconnaissance over foreign airspace that may be restricted for military operations.

c. Additionally, RFC may conduct research flights which assume an operational responsibility to the hurricane centers.

3. Control of Aircraft. Operational control of aircraft engaged in tropical or subtropical cyclone reconnaissance will be exercised by the operating agencies.

4. Reconnaissance Requirements.

a. Meteorological Parameter Requirements. Data needs in priority order are:

(1) Geographical position of vortex center (surface center if known).

(2) Central sea-level pressure (by dropsonde or extrapolation from within 1,500 feet of sea surface).

(3) Minimum 700-millibar height (if available).

(4) Wind profile data (surface and flight level).

(5) Temperature (flight level).

(6) Sea-surface temperature.

(7) Dewpoint temperature (flight level).

b. Required Meteorological Reconnaissance Data, Ranges and Accuracies. Required reconnaissance data accuracies are as follows:

(1) Geographic position:

(a) Data position (aircraft) - within 3 n.mi.
(b) Storm surface center (wind/pressure) - within 6 n.mi.
(c) Flight level storm center (wind/pressure) - within 6 n.mi.

(2) Wind direction:

(a) Surface - within 10 degrees.
(b) Flight level (winds greater than 20 kts.) - within 5 degrees.

(3) Wind speed:

(a) Surface - within 10 kts.
(b) Flight level - within 4 kts.

(4) Pressure Height:

(a) Surface - within 2 mb.
(b) Flight level - within 2 decameters above 500 mb, within 10 meters at or below 500 mb.

(5) Temperature:

(a) Sea surface - within $1^{\circ}C$.
(b) Flight level - within $1^{\circ}C$.

(6) Dew point:

(a) Range from $-20^{\circ}C$ to $40^{\circ}C$ - within $1^{\circ}C$.
(b) Colder than $-20^{\circ}C$ - within $3^{\circ}C$.

(7) Absolute altitude - within 10 m.

(8) Vertical sounding:

(a) Pressure - within 2 mb.
(b) Temperature - within $1^{\circ}C$.
(c) Dew point: Range $-20^{\circ}C$ to $+40^{\circ}C$ - within $1^{\circ}C$.
Colder than $-20^{\circ}C$ - within $3^{\circ}C$.
(d) Wind direction - within 10°.
(e) Wind speed - within 5 kts.

c. Required Frequency and Content of Observations.

(1) ASDL - ADDS (automated systems):

(a) Time, latitude, longitude, flight level - pressure altitude, radar altitude, D value, wind, temperature, dewpoint, height of standard pressure surface - every minute. Observations transmitted each one-half hour.

(b) Standard RECCO and Vortex observations as required.

(2) Standard (non-automated systems):

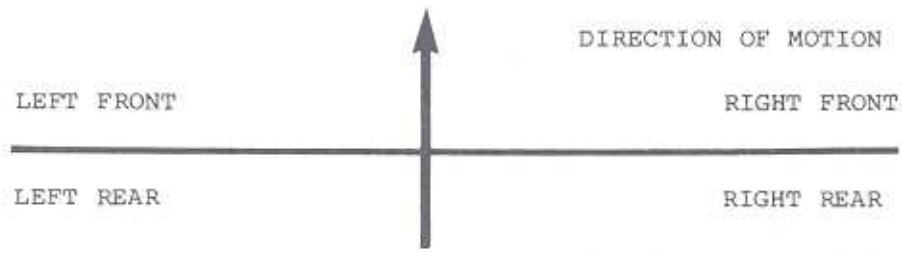
(a) Horizontal observations - RECCO Code Section 1 or Section 3 plus 4ddff and 9ViTwTwTw (4 and 9 groups if applicable) every 15 minutes enroute to and from storm within 15° from tasked coordinates (over water). 500 mb data preferred. RECCO obs transmitted hourly enroute to and from storm. Standard RECCO encoding and transmission IAW AWSR 105-25 outside of 15° from tasked coordinates. Horizontal observation data collection frequency, format, and transmission as specified (NHOP flight patterns) within tasked area.

(b) Vertical observations - Frequency enroute to and from tasked coordinates IAW AWSR 105-25 unless otherwise specified. Frequency as specified (NHOP flight patterns) within tasked areas. Format for all vertical observations is WMO TEMP DROP Code.

(c) Vortex and Supplementary Vortex observations collected, encoded, and transmitted IAW NHOP pattern requirements. (See Chapter 4, Appendix B, Forms 3 and 4, for data format.)

NOTE: Present weather reconnaissance capabilities are marginal in satisfying these requirements; data will be collected as close to stated requirements as possible. While the crews will attempt to meet customer requirements, it is understood that observations will not be considered unsatisfactory as long as they are accomplished every 30 minutes.

d. Standard Flight Patterns. Operational hurricane reconnaissance flights will fly designated flight patterns (Appendix A of this chapter) that use a quadrant system based upon the predicted direction of motion of the cyclone center. (See following diagram.) A tasked pattern may be adjusted by the flight meteorologist to best fulfill data requirements within operational capabilities of the aircraft or agency concerned.



e. High-Density Accuracy Requirements. DOC requires rapid acquisition and dissemination of high-density/accuracy data. Only a limited number of aircraft now have the capability to meet these requirements. DOC requests for aircraft reconnaissance should include the requirements for these resources to be committed to a particular system(s). Specific DOD aircraft resources will be provided on a "Resources Permitting" basis only.

f. High Level Profile Data Requirements. At times, the National Hurricane Center (NHC) will request mid-tropospheric reconnaissance data on the periphery of systems approaching the United States. The NHC will provide a specific track profile to include control point and control time to CARCAH for coordination with the reconnaissance units.

5. Reconnaissance Planning and Flight Notification.

a. DOC Requests for Aircraft Reconnaissance Data.

(1) NHC will coordinate with Eastern Pacific Hurricane Center (EPHC) and 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-hour period (0500Z - 0500Z) and an outlook for the succeeding 24-hour period. This coordinated request will be provided to CARCAH as soon as possible, but not later than (NLT) 1630Z each day (in the format of Form 1, Appendix B). Amendments will be provided as required.

(2) From this coordinated DOC request, CARCAH will publish the Tropical Cyclone Plan of the Day (TCPOD). When DOC needs exceed DOD and RFC resources, CARCAH will coordinate with NHC to establish priorities of accomplishment.

(3) The following requests can be anticipated for a forecast or actual storm location:

#(a) Atlantic, Gulf of Mexico, Caribbean, Eastern and Central Pacific - up to four 6-hourly fixes per day when a storm is within 500 nautical miles of landfall west of 55°W and north of 8°N, and up to eight 3-hourly fixes per day when a storm is forecast to be within 300 nautical miles 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 as required for disturbances in areas defined in paragraphs (a) and (b) 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.

b. DOD Aircraft Reconnaissance Responsiveness.

(1) Notification of requirements must occur at least 16 hours plus en route time to the area of concern.

(2) The "Succeeding Day Outlook" portion of the TCPOD provides advance notification of requirements and authorizes units to preposition aircraft. For missions requiring prepositioning, the "Succeeding Day Outlook" may not provide adequate advance notification. In these situations an "Additional Day Outlook" may be included in the TCPOD to authorize units to preposition aircraft.

(3) When circumstances do not allow the appropriate notification lead time, the requirement will be levied as "resources permitting". When a "Resources Permitting" requirement is levied in an amendment, NHC will indicate the priority of all existing or remaining requirements.

(4) At times a storm may develop unexpectedly and cause a serious threat to lives and property within a shorter time frame than provided for in the paragraphs above. These cases will be dealt with through emergency procedures not included in this plan.

c. Reconnaissance Tropical Cyclone Plan of the Day (TCPOD).

(1) Preparation. CARCAH will prepare the TCPOD (Appendix B, Form 2) daily during the period from 1 June through 30 November and at other times during the year as required. CARCAH will coordinate the TCPOD with NHC, 920th WRG, 53rd WRS, and RFC before publication.

(a) TCPOD will list all DOC-required tropical/subtropical reconnaissance operational missions. The Remarks section of the TCPOD will include appropriate comments whenever research and operational flights overlap.

(b) DOD-required tropical or subtropical cyclone reconnaissance missions in the Atlantic or the Pacific west to 180° will also be listed in the TCPOD and identified as Navy or USAF requirements.

(c) Amendments to the TCPOD will be prepared only when requirements change.

(2) Dissemination. The TCPOD will be made available to all appropriate agencies that provide support to or exercise control of reconnaissance missions or that are a part of the hurricane warning service. The TCPOD will be disseminated by 1800Z each day. Amendments will be disseminated as required.

d. Air Traffic Control (ATC) Clearances.

(1) Air traffic control will provide air traffic control separation between all aircraft operating on storm missions and between storm mission aircraft and nonparticipating aircraft operating on Instrument Flight Rules (IFR) within controlled airspace. Mission commanders should be aware that nonparticipating aircraft may be operating near storm areas; thus, adherence to ATC clearances is mandatory for safety purposes.

(2) When storm aircraft cannot maintain assigned altitudes due to turbulence, ATC should be advised. Normal vertical separation of 1,000 feet at FL 290 and below and 2,000 feet 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.

(3) Any procedure desired by storm-mission commanders which is outside the above parameters must be coordinated with the appropriate ATC facility.

(4) Dropsonde releases will be coordinated with the appropriate Air Route Traffic Control Center (ARTCC) 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 Chapter 4, Appendix C, paragraph 3.

6. Reconnaissance Effectiveness Criteria.

a. 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 effectiveness:

(1) ON-TIME - Fix is made not earlier than 1 hour before nor later than 1/2 hour after scheduled fix time. Investigative aircraft are within 250 nautical miles of the specified coordinates by the scheduled time.

(2) EARLY - Fix is made from 1 hour before scheduled fix time to one-half of the time interval to the preceding scheduled fix (not to exceed 3 hours).

(3) LATE - Fix is made within the interval from 1/2 hour after scheduled fix time to one-half of the time interval to the succeeding scheduled fix (not to exceed 3 hours). Investigative aircraft are within 250 nautical miles of specified coordinates no later than 2 hours after scheduled time.

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

(5) EXCEPTIONS - 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.

b. NHC, CPHC, or EPHC will provide CARCAH a written assessment of the reconnaissance mission anytime its timeliness or quality is outstanding or substandard (see Appendix B, Form 5). Requirements levied as "resources permitting" will not be assessed for timeliness.

c. CARCAH will maintain monthly and seasonal reconnaissance summaries detailing missions actually flown to satisfy NHC levied requirements.

7. Aerial Reconnaissance Weather Encoding and Reporting.

a. Vortex Data. The detailed Vortex Data Message (Form 3, Appendix B) 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.

b. Center Fix Data. All radar fix reports and other type aircraft center fixes will be made in plain text and appended to the RECCO observation also taken at fix time. Remarks stating the degree of confidence should be included for radar fixes in the same manner as in Chapter 6, paragraph 2.b.

c. Supplementary Vortex Data. Penetration and collection of supplementary vortex data on operational flight patterns A will normally start at 700 millibars at a radius of approximately 100 nautical miles from the center as determined by the flight meteorologist. The supplementary vortex data required are as shown in Appendix B, Form 4. #Note: Present weather reconnaissance equipment is inadequate to provide full data for 15NM supplemental vortex data; data will be collected as close to stated requirements as possible and within the capabilities of the flight crew.

d. Postflight Debriefing. At the forecaster's request, the flight meteorologist will provide either an airborne or postflight debriefing to the appropriate hurricane center.

e. 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 5-digit agency/aircraft indicator followed by the CARCAH-assigned mission-system indicator. Elements of the mission identifier are:

Agency - Aircraft Indicator -- Mission System Indicator

Agency - Aircraft Number	No. of missions this system	Depression No. or XX if not a depression or greater	Storm name or words
AF plus last 3 digits of tail number	(2 digits)	(2 digits)	CYCLONE or INVEST
NOAA plus last digit of aircraft registration number			

EXAMPLES:

AF985	01XX	INVEST	(Air Force aircraft 985 on the first mission to investigate a suspect area.)
AF987	0503	CYCLONE	(Air Force aircraft 987 on the fifth mission on depression No. 3. Invest or fix as specified in TCPOD.)
NOAA2	0701	AGNES	(NOAA aircraft 42RF on the seventh mission to fix depression No. 1, which has acquired the name AGNES.)

f. Observation Numbering and Content.

(1) The first weather observation will have appended as remarks the ICAO four-letter departure station identifier, time of departure, and estimated time of arrival (ETA) at the coordinates or storm.

EXAMPLE:

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

(2) All observations (RECCO, Vortex, Supplemental, and Dropsonde) from the first to the last will be numbered sequentially. When an aircraft is diverted from standard reconnaissance to fulfill NHC requirements, 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 to coodinates of interest. If diverted from an NHC mission to fulfill new NHC requirements or if the aircraft is programmed to satisfy separate NHC system requirements, the same rule applies except that last report remarks will be added to the terminated mission.

EXAMPLE:

AF968 01XX INVEST OB 01
97779 TEXT TEXT...DPTD FOXTROT TRACK AT 05/1438Z ETA 18N 85W AT 05/1630Z

(3) If a CARCAH assigned mission identifier is changed inflight as a result of system intensity changes, observation numbers will continue sequentially and appropriate remarks made.

EXAMPLE:

AF987 0308 EMMY OB 06
97779 TEXT TEXT...OBS 01 THRU 05 XMTD AS AF987 0308 CYCLONE

(4) Appended to the final weather observation will be a last report remark, which will include destination, ETA, number of observations, and monitor(s) that copied the observations.

EXAMPLE:

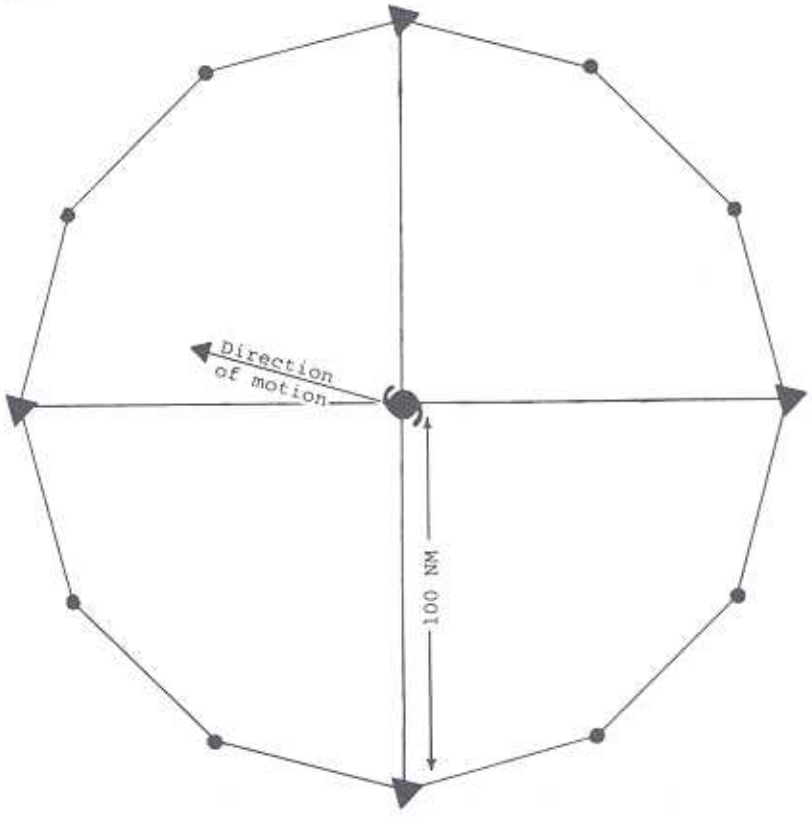
AF553 0308 EMMY OB 16
XXAA TEXT TEXT...LAST REPORT ETA KBIX 11/0910Z OBS 01 THRU 10 and 12 THRU 16 KMIA OB 11 KMHR

CHAPTER 4
APPENDIX A
ATTACHMENT 1

OPERATIONAL FLIGHT PATTERN "A"

Provides vortex and peripheral data on tropical and subtropical cyclones including two 6-hourly and intermediate fixes.

DATA REQUIREMENTS



OBSERVATION DETAILS

1. Flight level - normally 700 millibars, but may be low level if requested.

2. RECCO (Section 1 plus 4ddff and 9ViTwTwTw is required for each transit of a triangle position. Transmit immediately. RECCO (Section 3 plus 4ddff and 9ViTwTwTw) is required for each transit of a circle position. Section 3 data are appended to next RECCO (Section 1) observation. Groups with indicator 4 or 9 are included in observations only when surface winds are discernable or flight is at low level.

3. Supplementary Vortex data are required for each radial flown inbound or outbound. Transmit data to the apapropriate monitor at the end of each pair of inbound/outbound radial legs flown.

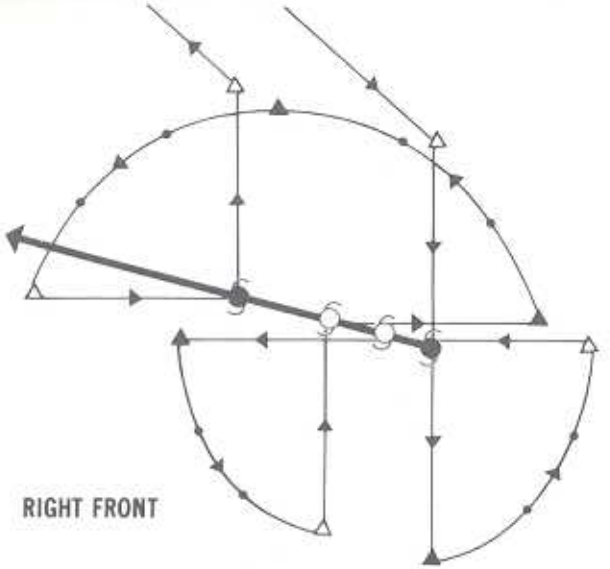
4. On each transit of the center a fix will be made and a Vortex Data Message completed. If it is a scheduled fix, the Detailed Vortex Data Message will be completed using data gathered since the previous fix and will be transmitted immediately. If it is an intermediate (nonscheduled) fix, an Abbreviated Vortex Data Message using data gathered 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 millibars or above.

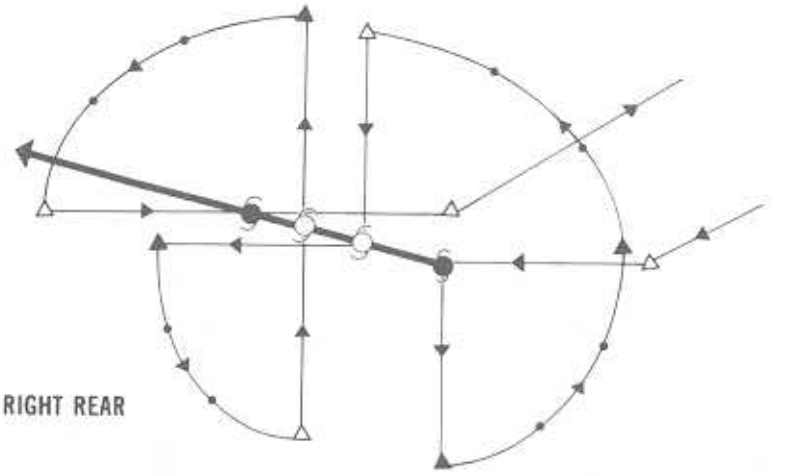
5. Dropsonde data when required in the periphery of the storm will be taken at the triangular positions indicated. The requirement for these data will be determined on a case-by-case basis and coordinated through the POD.

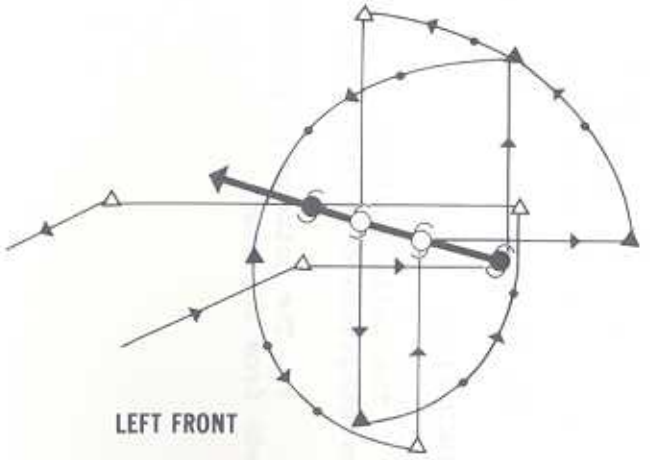
#6. Entry and exit headings should be one of the cardinal directions (see recommended pattern "A" execution, Attachment No. 1A). These radial headings should be maintained within 20^{o}.

7. Current weather reconnaissance capability may preclude complete and timely satisfaction of these requirements.

Weather Instrumented USAF WC-130 Flown
for Hurricane Reconnaissance

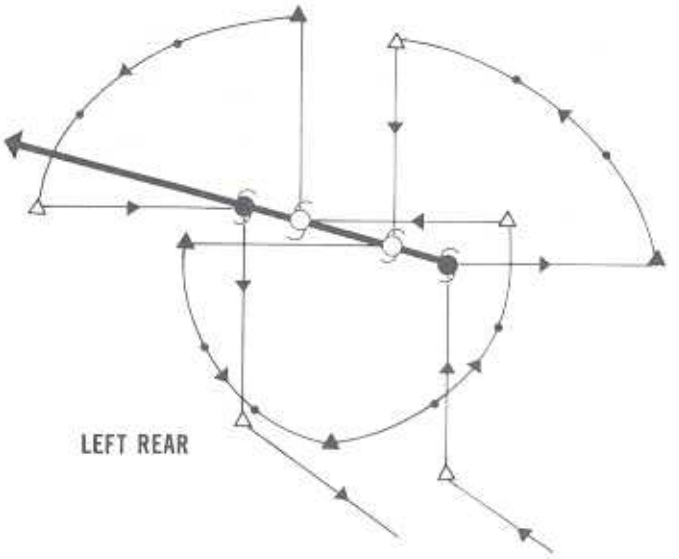






Legend

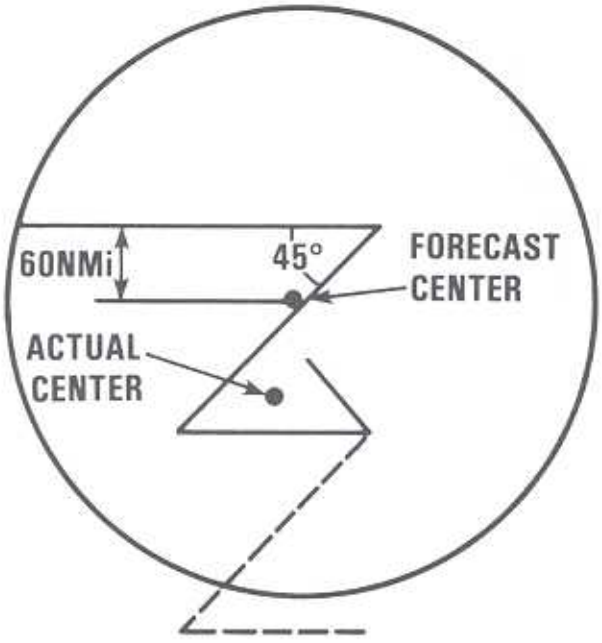
- DETAILED VORTEX DATA PLUS CENTER DROP
- DETAILED/ABBREVIATED VORTEX DATA
- RECCO (SECTION 1) PLUS DROP
- RECCO (SECTION 1)
- RECCO (SECTION 3)
- DIRECTION OF STORM MOVEMENT
- DIRECTION OF FLIGHT



CHAPTER 4
APPENDIX A
ATTACHMENT 2

OPERATIONAL FLIGHT PATTERN DELTA

Provides a suggested approach to the investigation of a disturbance to ascertain the existence or nonexistence of a closed circulation, supply RECCO observations in required areas, and locate the vortex center.



1. Flight altitude - normally 1,500 feet, but may be adjusted as dictated by data requirements, meteorological conditions, or flying safety factors.

2. RECCO (Section 1 plus 4ddff and 9ViTwTwTw) required every 30 minutes. RECCO (Section 3 plus 4ddff and 9ViTwTwTw) required approximately every 15 minutes. Section 3 data are appended to next RECCO Section 1 observation. The 4 or 9 Group will not be reported if data are not available.

3. Detailed Vortex Data Message required if vortex fix is made.

DISCUSSION:

The Delta pattern is designed to provide the flexibility required in the investigation of a disturbance as follows:

1. The pattern is converted west-east to a mirror image if entry is to be made from the east.

2. The length of the legs is to be adjusted during the pattern to coincide with cyclonic circulation wind shifts, i.e., turn points are selected by the flight meteorologist after observing appropriate sustained wind shifts.

3. If observed data indicate that the aircraft is on the southern side of the circulation, the pattern is converted south-north to a mirror image pattern to enable investigation in the proper areas.

4. If data indicate to the flight meteorologist that the aircraft is far north of any existing circulation, the pattern is extended (as shown by dashed lines) to allow further investigation.

5. If the location of the center becomes obvious, the pattern may be broken off to accomplish a vortex fix. Forecast agencies may request changes in the pattern as dictated by their data requirements.

CHAPTER 4
APPENDIX B
FORM 1
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 _____

CHAPTER 4
APPENDIX B
FORM 2

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

FM OL-G HQ AWS CORAL GABLES FL/CARCAH

TO (MAC-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)

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 degrees, i.e., 01–010 to 190; 17–170 to 350. Transmit diameter in nautical miles. *Examples:* C8–Circular eye 8 miles in diameter. E09/15/5 – Elliptical eye, major axis 090–270, length of major axis 15 NM, length of minor axis 5NM. 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 – 1500 ft; 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.

J70865

SUPPLEMENTARY VORTEX DATA MESSAGE

MANOP HEADING *(Completed by monitor/aid only)*

UR___ ___12 ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

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

AF ___ ___ ___

SUPPLEMENTARY VORTEX DATA MESSAGE

($L_aL_aL_a$) 00	($L_oL_oL_oL_o$) 0	(jHHH) 0	(TTT_dT_d) 0	(ddfff)
80	8	8	8	
60	6	6	6	
45	4	4	4	
30	3	3	3	
15	1	1	1	
CC	C	C	C	(YYGGgg)
(fff) MF	(BBRRR)	(ddd) AZ		
($L_aL_aL_a$) 15	($L_oL_oL_oL_o$) 1	(jHHH) 1	(TTT_dT_d) 1	(ddfff)
30	3	3	3	
45	4	4	4	
60	6	6	6	
80	8	8	8	
00	0	0	0	
(fff) MF	(BBRRR)			

REMARKS *(End of message)*

LEGEND

00/0 = INDICATORS FOR DATA COLLECTED APPROX 100NM FROM SYSTEM CENTER

80/8 = INDICATORS FOR DATA COLLECTED APPROX 80NM FROM SYSTEM CENTER

60/6 = INDICATORS FOR DATA COLLECTED APPROX 60NM FROM SYSTEM CENTER

45/4 = INDICATORS FOR DATA COLLECTED APPROX 45NM FROM SYSTEM CENTER

30/3 = INDICATORS FOR DATA COLLECTED APPROX 30NM FROM SYSTEM CENTER

15/1 = INDICATORS FOR DATA COLLECTED APPROX 15NM FROM SYSTEM CENTER

CC/C = INDICATORS FOR DATA COLLECTED AT THE SYSTEM CENTER

ddd = TRUE DIRECTION IN TENS OF DEGREES OF STORM MOTION

MF = INDICATOR FOR MAX FLIGHT LEVEL WIND OBSERVED

AZ = INDICATOR FOR TRUE DIRECTION OF STORM MOTION

fff = SPEED OF WIND IN KNOTS

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

BBRRR = BEARING (BB) AND RANGE (RRR) FROM CENTER OF MF

YYGGgg = ZULU DATE/TIME OF CENTER DATA

TTT_dT_d = TEMP/DEWPOINT IN DEGREES CELSIUS. ADD 50 FOR NEGATIVE VALUES

jHHH = PRESSURE HEIGHT DATA IN RECCO FORMAT

$L_aL_aL_a$ = LATITUDE IN DEGREES/TENTHS

$L_oL_oL_oL_o$ = LONGITUDE IN DEGREES/TENTHS

/ = DATA UNKNOWN/UNOBTAINABLE

SAMPLE MESSAGE

URNT 12 KMIA 241703
AF966 0411 FREDERIC OB 14
SUPPLEMENTARY VORTEX DATA MESSAGE
00178 00899 03107 00908 36027
80177 80895 83100 80909 35042
60178 60891 63092 60807 36052
45177 40887 43088 40907 35070
30178 30883 33070 30908 36088
15178 10880 13000 11010 35108
CC177 C0876 C3947 C1811 241647
MF148 27003 AZ310
15177 10872 13000 11010 18120
30178 30860 33070 31009 17098
45178 40862 43088 40909 18080
60177 60858 63093 60908 17050
80177 80854 83102 80908 17048
00178 00850 03108 00905 18031
MF145 09005
REMARKS LAST REPORT OBS 01 THRU 14 TO KMIA ETA KBIX 241930Z

PREPARED BY: TRANSMISSION TIME:

CHAPTER 4
APPENDIX B
FORM 5

MISSION EVALUATION FORM

DATE: _____

TO: OL-G, HQ AWS/CARCAH

FROM: _____(Director, NHC, CPHC, EPHC)_____

SUBJECT: Mission _____ Evaluation
(Mission Identifier)

PUBLISHED REQUIREMENTS:

Permission 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 ____Timely ____Accurate
____Incomplete ____Untimely ____Inaccurate

Vertical Data Coverage: ____Complete ____Timely ____Accurate
____Incomplete ____Untimely ____Inaccurate

Requirements Accomplished: ____On Time ____Early ____Late
____Missed

Remarks: _____

_____

_____

OVERALL MISSION EVALUATION:

	Outstanding	Satisfactory	Unsatisfactory
Equipment:	_____	_____	_____
Accuracy:	_____	_____	_____
Timeliness:	_____	_____	_____
Procedures:	_____	_____	_____
Completeness:	_____	_____	_____

Remarks: _____

_____

DATE | ORGANIZATION | MISSION IDENTIFIER | TYPE AIRCRAFT | CALL SIGN

OBSERVATION NUMBER

9	RECCO INDICATOR GROUP SPECIFYING TYPE OF OBSERVATION *Table 1*	G	TIME OF OBSERVATION *(Hours and Minutes)* *(GMT)*	Y	DAY OF WEEK *SUN=1*	L_o	LONGITUDE DEGREES AND TENTHS *(Note 4)*	h_o	PRESSURE ALTITUDE OF AIRCRAFT REPORTED TO THE NEAREST DECAMETER	d	WIND DIRECTION AT FLIGHT LEVEL *(Tens of deg. true)*	T	TEMPERATURE WHOLE °C *(Note 6)*	/	INDICATOR	1	INDICATOR	C	CLOUD TYPE *Table 11*	C	CLOUD TYPE *Table 11*	C	CLOUD TYPE *Table 11*
X		G		Q	OCTANT *Table 3*	L_a		h_o		d		T		J	INDEX TO H H H *Table 9*	k_n	NR OF CLOUD LAYERS *(Note 9)*	h_s	ALTITUDE OF BASE *Table 12*	h_s	ALTITUDE OF BASE *Table 12*	h_s	ALTITUDE OF BASE *Table 12*
X		g		L_a	LATITUDE DEGREES AND TENTHS	L_o		B	TURBULENCE *Table 4*	d_t	TYPE OF WIND *Table 6*	f	WIND SPEED AT FLIGHT LEVEL *(Knots)*	T_d	DEW POINT WHOLE °C *(Note 6)*	H	GEOPOTENTIAL HEIGHT or D-VALUE OR SLP PER INDEX *(Note 8)*	N_s	AMOUNT OF CLOUDS *(Note 9)* *Table 10*	h_s	ALTITUDE OF BASE *Table 12*	h_s	ALTITUDE OF BASE *Table 12*
X		g		L_a		L_o		f_c	FLT COND *Table 5 (Note 5)*	d_o	METHOD OF OBTAINING WIND *Table 7*	f		T_d		H		H_s		H_t	ALTITUDE OF TOP *Table 12*	H_t	ALTITUDE OF TOP *Table 12*
9		i_d	DEW POINT INDICATOR *Table 2*	L_a		L_o						f		w	PRESENT WEATHER *(Note 7 Table 8)*	H		H_t		H_t		H_t	
1		2		3		4		5		6		7		8		9		10		11		12	

REMARKS

METEOROLOGIST

RECCO RECORDING FORM

1	INDICATOR	C	CLOUD TYPE *Table 11*	C	CLOUD TYPE *Table 11*	C	CLOUD TYPE *Table 11*	4	INDICATOR	6	INDICATOR *(Note 11)*	6	INDICATOR *(Note 11)*	7	INDICATOR	7	INDICATOR	8	INDICATOR	8	INDICATOR	9	INDICATOR	REMARKS
K_n	NR OF CLOUD LAYERS *(Note 9)*	h_s	ALTITUDE OF BASE *Table 12*	h_s	ALTITUDE OF BASE *Table 12*	h_s	ALTITUDE OF BASE *Table 12*	d	DIRECTION OF SFC WIND *(Tens of deg. true)*	W_s	SIGNIFICANT WEA CHANGES *Table 14*	W_s	SIGNIFICANT WEA CHANGES *Table 14*	I_r	RATE OF ICING *Table 17*	h_1	ALT OF BASE OF ICING STRATUM *(Note 12) Table 12*	d_r	BEARING OF ECHO CENTER *(Tens of Deg. True)*	E_w	ECHO WIDTH OR DIAM *Table 19*	V_j	INFLIGHT VISIBILITY *Table 23*	
N_s	AMOUNT OF CLOUDS *(Note 9)* *Table 10*	H_t	ALTITUDE OF TOP *Table 12*	H_t	ALTITUDE OF TOP *Table 12*	H_t	ALTITUDE OF TOP *Table 12*	f	SURFACE WIND SPEED *(Knots)* *(Note10)*	S_a	DISTANCE OF OCCURRENCE OF Wa *Table 15*	S_a	DISTANCE OF OCCURRENCE OF Wa *Table 15*	I_t	TYPE OF ICING *Table 18*	h_1		d_r		E_l	LENGTH OF MAJ AXIS *Table 19*	T_w	SEA SURFACE TEMPERATURE DEGREES AND TENTHS	
H_s										W_d	DISTANT WEATHER *Table 16*	W_d	DISTANT WEATHER *Table 16*	S_b	DISTANCE TO BEGINNING OF ICING *Table 15*	H_1	ALTITUDE OF TOP OF ICING STRATUM *(Note 12) Table 12*	S_r	DISTANCE TO ECHO CEN *Table 19*	F_e	CHARACTER OF ECHO *Table 21*	T_w		
N_s										d_w	BEARING OF W_d *Table 13*	d_w	BEARING OF W_d *Table 13*	S_e	DISTANCE TO ENDING OF ICING *Table 15*	H_1		O_e	ORIENTATION OF ELLIPSE *Table 20*	I_e	INTENSITY OF ECHO *Table 22*	T_w		
13		14		15		16		17		18		19		20		21		22		23		24	

CHAPTER 4
APPENDIX B
FORM 6
NOTES

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 of the atmosphere. Present weather, cloud amount and type, turbulence, and other subjective elements are reported as occuring within the cylinder. Flight level winds, temperature, dew point, and geopotential values are sensed or computed and reported as occuring 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 Figure 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 i_i 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 posible, use appropriate remarks such as "clouds blo" or As blo" to indicate the presence of lcouds. 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 place–holder.

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 Ws.

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 //.

CHAPTER 4
APPENDIX B
FORM 6
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 capability

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 temp −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° W	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 (continous IMC)
/ Impossible to determine due to darkness or other cause

TABLE 6 d_t

0 Spot 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 wind or wind not compatible

TABLE 8 w

0 Clear
1 Scattered (trace 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 stratiform clouds)
7 Snow or rain and snow mixed
8 Shower(s) (continous 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 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 Stratocumulus (Sc)
7 Stratus (St)
8 Cumulus (Cu)
9 Cumulonimbus (Cb)
/ Cloud type unknown due to darkness or other analogous phenomena

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

00 Less than 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 6,000 ft
57 7,000 ft
etc, etc
79 29,000ft
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 Warm 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 nautical miles
/ Unknown (not used for S_s)

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_c

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_1

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 quadrants
/ 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 greater than 3 nautical miles

RECCO SYMBOLIC FORM

SECTION ONE (MANDATORY)
9XXX9 GGggi$_d$ YQL$_c$L$_o$L$_o$ L$_o$L$_o$L$_o$Bf$_c$ h$_o$h$_o$h$_o$d$_t$d$_o$
ddfff TTT$_d$T$_d$w /iHHH

SECTION TWO (ADDITIONAL)
Ik$_n$N$_s$N$_s$N$_s$ Ch$_s$h$_s$H$_t$H$_t$ 4ddff
6W$_s$S$_s$W$_d$d$_w$ 7I$_r$I$_t$S$_b$S$_e$ 7h$_i$h$_i$ H$_i$H$_i$ 8d$_r$d$_r$S$_r$O$_e$
8E$_w$E$_1$c$_e$i$_e$ 9V$_i$T$_w$T$_w$T$_w$

SECTION THREE (INTERMEDIATE)
9XXX9 GGggi$_d$ YQL$_o$L$_o$L$_o$ L$_o$L$_o$L$_o$Bf$_c$ h$_o$h$_o$h$_o$d$_t$d$_o$
ddfff TTT$_d$T$_d$w /iHHH

CHAPTER 4

APPENDIX C

AIRCRAFT RECONNAISSANCE COMMUNICATIONS

1. General. USAF and NOAA aircraft will normally transmit reconnaissance observations using HF single sideband radio through the USAF Aeronautical Station complex to the appropriate weather reconnaissance data monitor. Weather monitors will evaluate these reports and disseminate them to either the AWN at Carswell AFB, TX, or the weather communications facility at Suitland, MD.

2. Air Ground Communications. The USAF aeronautical station contacted will depend upon aircraft location and radio propagation conditions. Initial contact radio frequencies are as published in appropriate en-route flight publications. After initial contact, aeronautical stations will provide a discrete frequency for mission use if possible. Aircrew relay of weather °reconnaissance data will be by direct phone-patch to the weather monitor. Specific radio procedures and terminology will be described in Allied Communications Publication (ACP) 125. USAF has authorized the use of "Immediate" precedence for transmission of hurricane reconnaissance reports as follows:

PRIMARY	SECONDARY
Direct phone-patch between aircraft and Miami Monitor (Atlantic and Eastern Pacific) or Hickam Weather Monitor (Central Pacific) through any aero station.	Direct phone-patch between aircraft and any weather monitor through any aero station.

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 plane-to-plane communications and coordination:

a. Primary VHF 123.05 MHz.

b. Secondary UHF 304.8 MHz

c. Back-up HF 4701 KHz USB

4. Aircraft Satellite Data Link (ASDL) equipped aircraft. Aircraft equipped with ASDL have the option to utilize the ASDL system using the following procedures:

a. Data Format - This format will be used for data transmission by the ASDL System.

(1) One Minute Observation - All locations

(Message Header)	(Date/Time)
URNT40 KMIA	291630
(Platform Identifier)	(Date/Time-NESDIS)
15C9419C	23012 3220
(Mission Identifier)	
NOAA2 0401 ANA	

(TIME)	(LATITUDE)	(LONGITUDE)	(PRESS ALT)	(D VALUE)
1233	2803	08037	06173	+0436

(WIND)	(TEMP)	(DP)
213010	±138	±096

NNNN

(2) RECCO Observation - Atlantic Area

(Message Header) (Date/Time) Same as for 1 minute observation.

(Platform Identifier) (Date/Time-NESDIS) - Same as for 1 minute observation.

(Observation Manop Heading) (Date/Time)

URNT11 KMIA 281642

NOAA2 0401 ANA OB 03

(RECCO text)

97779 12428.....93275

NNNN

(3) RECCO Observation - Eastern and Central Pacific - Same as for Atlantic except that observation manop heading is URPN11 KMIA.

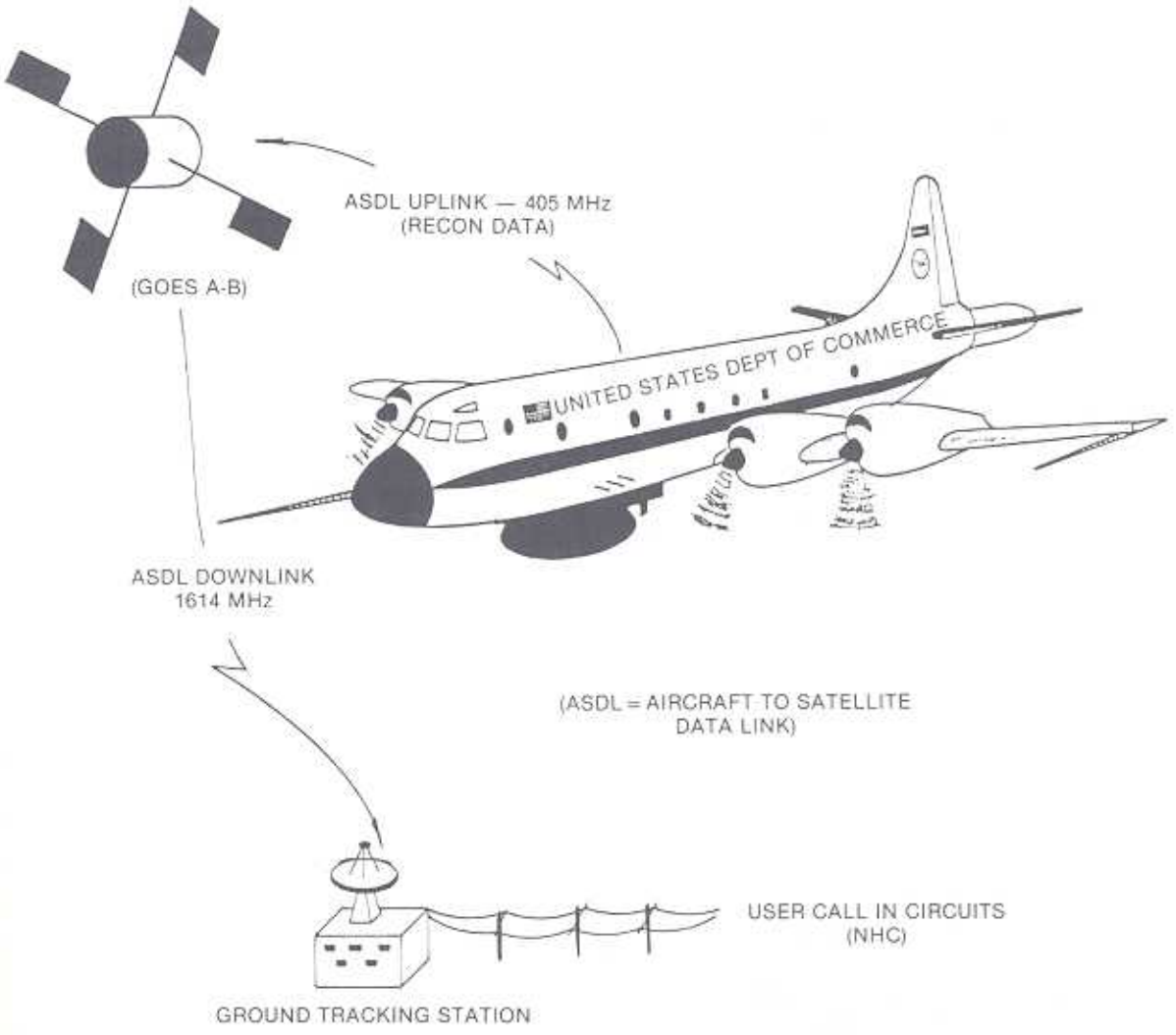
Note: 11 used for routine tropical cyclone observation
12 used for vortex reports, etc.

b. Data Transmission Schedule - To facilitate 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 using the following schedule:

0—— +5	+5—— +10	+10—— +15	+15—— +20
	RFC 42RF P-3(A)	RFC 43RF P-3(B)	
+20—— +25	+25—— +30	+30—— +35	+35—— +40
RADAR	RADAR		RFC 42RF P-3(A)
+40—— +45	+45—— +50	+50—— +55	+55—— +60
RFC 43RF P-3(B)		RADAR	RADAR

Because only 4 minutes and 28 seconds of each 5-minute time block can be used for data transmission, roughly 1/2 minute 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.

c. Data Transmission Test - Prior to the beginning of the hurricane season (June), each aircraft equipped with ASDL 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 Chairman, WG/HO.



Schematic of the Aircraft to Satellite Data Link (ASDL)
on NOAA P-3 Aircraft

RECONNAISSANCE ORGANIZATION COMMUNICATION CAPABILITIES

STATION	ADDRESS	TELETYPE	TELEPHONE
Federal Coordinator for Meteorology (OFCM)	Suite 300, 11426 Rockville Pike Rockville, MD 20852	-	AV 851-1460 CO 301-770-3464 FTS 443-8704
CARCAH/MIAMI Monitor	OL-G, AWS Coral Gables, FL	A B C	AV 894-3430 CO 305-666-4612 FTS 350-5547 AV 894-1150 (phone patch only)
Mather Weather Monitor	Det 7, 24 WS Mather AFB, CA	B	AV 828-4377
Hickam Weather Monitor	Det 4, 1 WW Hickam AFB, HI	B	AV 315-449-1279
National Hurricane Center	Nat'l. Hurricane Center Coral Gables, FL	A B C	CO 305-667-3108 FTS 350-5547
Alternate National Hurricane Center	WSFO Washington, DC	A C	CO 301-899-3152 FTS-763-8300
	WSFO New Orleans, LA	A C	CO 504-522-7330 FTS 682-6891
Eastern Pacific Hurricane Center	WSFO Redwood City, CA	C	CO 415-876-9381 FTS 463-7767
Central Pacific Hurricane Center	WSFO Honolulu, HI	C	CO 808-839-7692
Naval Eastern Oceanography Center, Norfolk	NAVEASTOCEANCEN Norfolk, VA	B	AV 690-7750
Naval Western Oceanography Center, Pearl Harbor	NAVWESTOCEANCEN Pearl Harbor, HI	B	AV 315-430-0111 (ask for 471-0004)
RFC	RFC Miami, FL	A	CO 305-526-2936
Det 5, AWS	Det 5, AWS Keesler AFB, MS		AV 868-2544
AF Global Weather Central	AFGWC Offutt AFB, NE	B	AV 271-2586 FTS 866-2586
CINCLANTFLT OAC	CINCLANTFLT OAC Ronkonkoma, NY	C	AV 938-1694
ARTCC Miami	ARTCC Miami, FL	C	AV 894-1910
53 WRS	53 WRS Keesler AFB, MS		AV 868-4540 CO 601-377-4540
920 WRG	920 WRG Keesler AFB, MS		AV 868-4318 CO 601-377-4318

A - GT7072
B - COMEDS
C - AFTN

CHAPTER 5

SATELLITE SURVEILLANCE OF TROPICAL AND SUBTROPICAL CYCLONES

1. Satellites

a. Geostationary Operational Environmental Satellite (GOES). The GOES system consists of two operational spacecraft, GOES East at 75 degrees W and GOES West at 135 degrees W. Standby spacecraft with limited operational capabilities are positioned between 75W and 135W. The principal GOES products are 1/2-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. During the night (also available in daylight), the same geographical coverage standard sectors are produced with 7 Km resolution infrared (IR). The IR data may be enhanced to emphasize various features. Floating sectors which are scheduled by the Satellite Field Services Stations (SFSS's) are produced to augment the standard sector coverage support. All products are delivered in near real time to the National Environmental Satellite, Data and Information Service (NESDIS) Synoptic Analysis Branch (SAB), the SFSS's, and Weather Service Forecast Offices (WSFOs). (See GOES Operational Data Flow, Appendix A, Attachment 1; Satellite Data Availability, Appendix A, Attachment 2.)

b. NOAA Polar-Orbiting Satellites. These satellites cross the U.S. twice daily near the equatorial crossing times as indicated in Appendix A, Attachment 2. Data are available via direct read-out (HRPT and APT) or central processing. AVHRR data are available on a limited basis through the GOES distribution system. AFGWC receives global NOAA imagery data direct from central readout sites on pass by pass basis. Data are processed in mapped and unmapped form for use internally.

2. Satellite Field Services Stations (SFSS)

a. Support Concept. GOES imagery in support of the hurricane warning service is distributed to the Central Data Distribution Facility (CDDF) at Marlow Heights, MD, to the SFSS's in Miami, San Francisco, Washington, New Orleans, and Honolulu. These SFSS's are colocated with NWS hurricane warning offices and are responsible for providing direct satellite support to the warning center. This support includes the use of floating sectors at 1, 2, and 4 km visible and 7 km IR positioned over the storm area. SFSS's and SAB routinely provide classification of storms using Dvorak Techniques for both visible and IR data.

b. Station Contact. SFSS satellite meteorologists can be contacted as follows:

(1) Miami - between 0630-1630 EDST and 2000-0400 EDST at (305) 350-4310 or FTS 350-4460/4310.

(2) San Francisco - 24 hours a day at (415) 896-9122/23 or FTS470-9122/9123.

(3) Honolulu - 24 hours a day at (808)836-2776.

(4) Washington - 24 hours a day at (301)763-8239 or FTS 763-8425.

(5) New Orleans - 24 hours a day at (504)649-5130 or FTS 682-2807.

c. Satellite Tropical Disturbance Summary. The Miami, San Francisco, and Honolulu SFSS's distribute twice daily at the times indicated (Appendix B, Form 1 to this Chapter) a satellite summary which describes significant weather in the tropical regions of the Atlantic, Eastern Pacific, and Central Pacific (north and south between 140°W to 170°E, respectively).

3. NESDIS Synoptic Analysis Branch (SAB). SAB operates 24 hours a day to provide satellite support to the National Meteorological Center (NMC). The SAB also distributes twice daily a "Satellite Tropical Disturbance Summary for the Pacific (West of 170°E) and the Indian Ocean." SAB may be contacted at (301) 763-8444 or FTS 763-8444.

4. The Defense Meteorological Satellite Program (DMSP). DMSP will provide coverage of tropical/subtropical cyclones whenever possible. Data covering the National Hurricane Operations Plan (NHOP) areas of interest will be received centrally at the Air Force Global Weather Central (AFGWC) at Offutt AFB, NE; and locally at the direct readout site at Hickam AFB, HI.

a. North Atlantic Surveillance. AFGWC readouts will augment NESDIS surveillance for the North Atlantic. AFGWC will transmit teletype bulletins describing the location and intensity classification of the system (in the format shown in Appendix B, Form 2) to the National Hurricane Center (NHC) on organized disturbances evident at the Tropical Classification - 1 (T-1) level or higher.

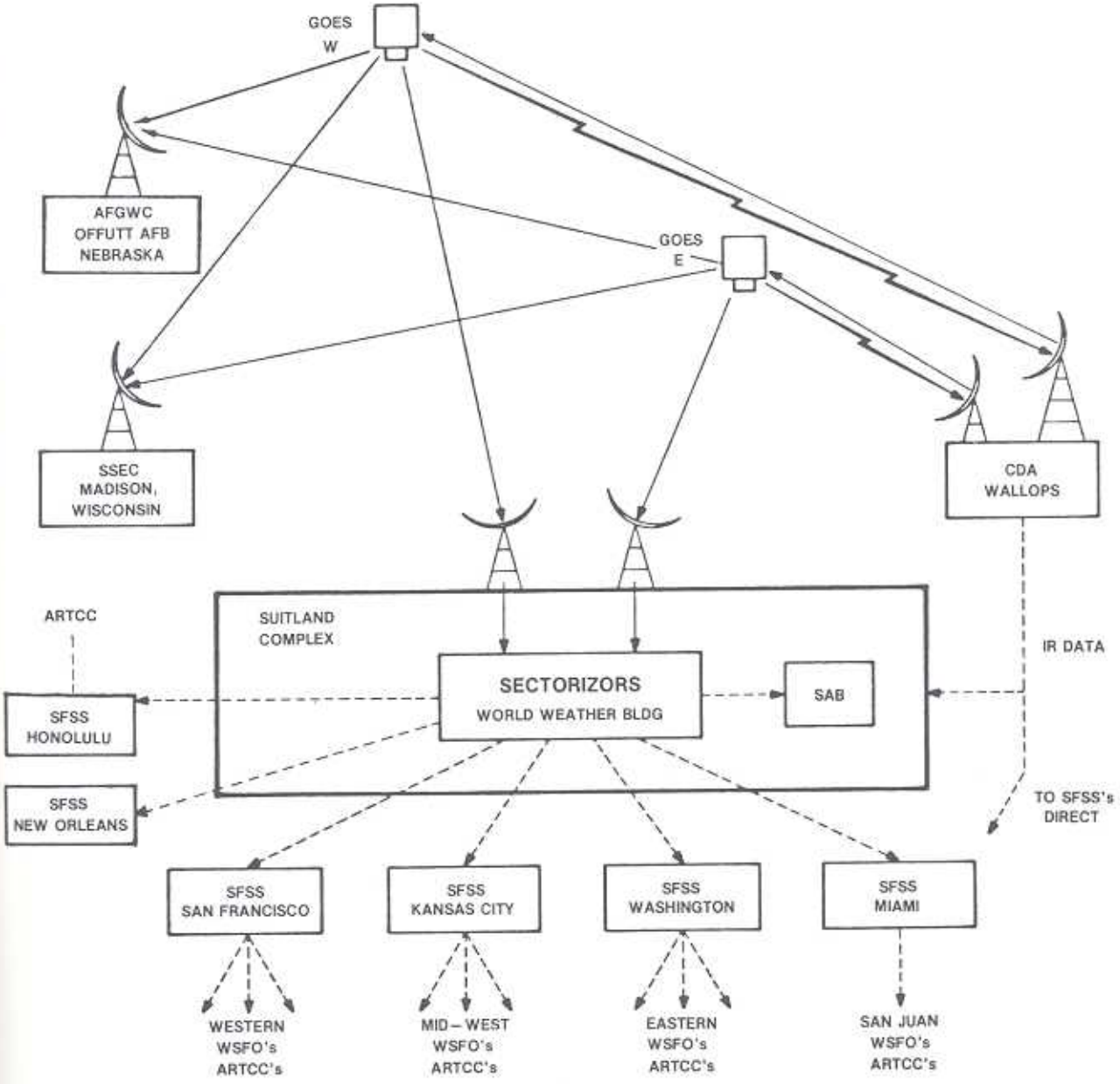
b. Eastern Pacific Surveillance. AFGWC will provide data at special request to the Eastern Pacific Hurricane Center (EPHC) if EPHC determines the coverage from available NESDIS satellites should be supplemented.

c. Central Pacific Surveillance. Hickam readout will provide data at special request to the Central Pacific Hurricane Center (CPHC) under the rationale of paragraph 4b.

5. Satellites and Satellite Data Availability for the 1982 Hurricane Season. Appendix A, Attachment 2 of this chapter lists satellite capabilities for the 1983 hurricane season.

GOES

OPERATIONAL DATA FLOW



NOTE: Anchorage SFSS is in the GOES Operational Data Flow, but primarily uses the NOAA Polar-Orbiting Satellite data.

CHAPTER 5
APPENDIX A
ATTACHMENT 2

SATELLITES AND SATELLITE DATA AVAILABILITY FOR 1983 HURRICANE SEASON

Satellite	Type of Data	Local Time	Remarks
GOES East - 75.0 W GOES West - 135.0 W 4 Spacecraft (standby) limited operational capability	VISSR VAS	Every 30 minutes (24 hr/day) (Limited scan for short-interval viewing available)	1. 1, 2, and 4 km resolution visible standard sectors covering Western United States, Midwest, and Eastern United States (daylight). 2. 9 km resolution equivalent IR standard sectors for the entire United States (night). 3. Equivalent IR-enhanced imagery. 4. Floating sectors at 1, 2 and 4 km resolution (visible) (equivalent IR 7 km). 5. Full disc IR (day and night). 6. Movie loops 7. Wind analysis 8. Cloud top heights
NOAA-6	AVHRR GAC and LAC (recorded) HRPT and APT (direct) TOVS	0740 /1940	1. Mapped digitized data (cloud cover 2. Unmapped imagery (all data types) at DMSP sites. 3. Sea-surface temperature analysis 4. Moisture analysis 5. Soundings
NOAA-7		1430 /0230	
DMSP	LF	0700/1900	1. Unmapped imagery (LF only) 2. Mapped imagery (none)

GAC - Global Area Coverage (recorded reduced resolution data for Central Processing)
LAC - Local Area Coverage (recorded high resolution data, limited amount)
TOVS - TIROS Operational Vertical Sounder
HRPT - High Resolution Picture Transmission (1.1 km)
APT - Automatic Picture Transmission (4 km)
AVHRR - Advanced Very High Resolution Radiometer
VAS - VISSR Atmospheric Sounder
VISSR - Visible-Infrared Spin Scan Radiometer

LF - Light Fine (Visual Scanning Radiometer 0.3 nmi)

CHAPTER 5
APPENDIX B
FORM 1

SAMPLE OF SATELLITE TROPICAL DISTURBANCE SUMMARY

ABXX15 KSFO 210800Z
ABXX( ) KWBC, KSFO, KMIA, PHNL
SATELLITE TROPICAL DISTURBANCE SUMMARY
ALL MOVEMENTS AND TRENDS 24 HOURS UNLESS OTHERWISE STATED

EAST PACIFIC	GOES WEST IR NITE	210745Z
(OCEANIC AREA)	(SATELLITE & SENSOR(S)	(PREPARATION TIME)

(Location) (Time) (Satellite Code) (Name and/or No.)

TROPICAL STORM SUSAN. SEE LATEST EPHC ADVISORY.

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

ATLANTIC	GOES EAST IR NITE	210630Z
(OCEANIC AREA)	(SATELLITE AND SENSOR(S))	(PREPARATION TIME)

(Location) (Time) (Satellite Code) (Name and/or No.)

NO TROPICAL CYCLONES OBSERVED

ITC 3 TO 5 DEG WIDE FM 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

(Heading)	(TIME)	(OCEANIC AREA)	(TYPE OF DATA)
*ABXX15 KMIA	0700Z	Atlantic/Caribbean	IR NITE
*ABXX11 KMIA	1900Z	Atlantic/Caribbeen	VIS/IR DAY
*ABXX15 KSFO	0800Z	Eastern Pacific	IR NITE
*ABXX11 KSFO	2000Z	Eastern Pacific	VIS/IR DAY
*ABXX15 PHNL	1000Z	Central Pacific (N&S 140W-170E)	IR NITE
*ABXX11 PHNL	2200Z	Central Pacific (N&S 140W-170E)	VIS/IR DAY
ABXX12 KWBC	1100Z	Indian Ocean	IR NITE
ABXX13 KWBC	0500Z	Western Pacific (N&S W of 170°E)	VIS
ABXX14 KWBC	2300Z	Indian Ocean	VIS/IR DAY
ABXX16 KWBC	1900Z	Western Pacific (N&S W of 170°E)	IR NITE

*Whenever a tropical system is located in these areas, Part 1 will carry the following statement: See latest (NHC, EPHC, or CPHC) advisory(ies).

CHAPTER 5
APPENDIX B
FORM 2

CENTER FIX DATA FORM AND MESSAGE FORMAT (SATELLITE)

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 IWW/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 parenthesis 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 (modelled) intensities, etc.

CHAPTER 5
APPENDIX B

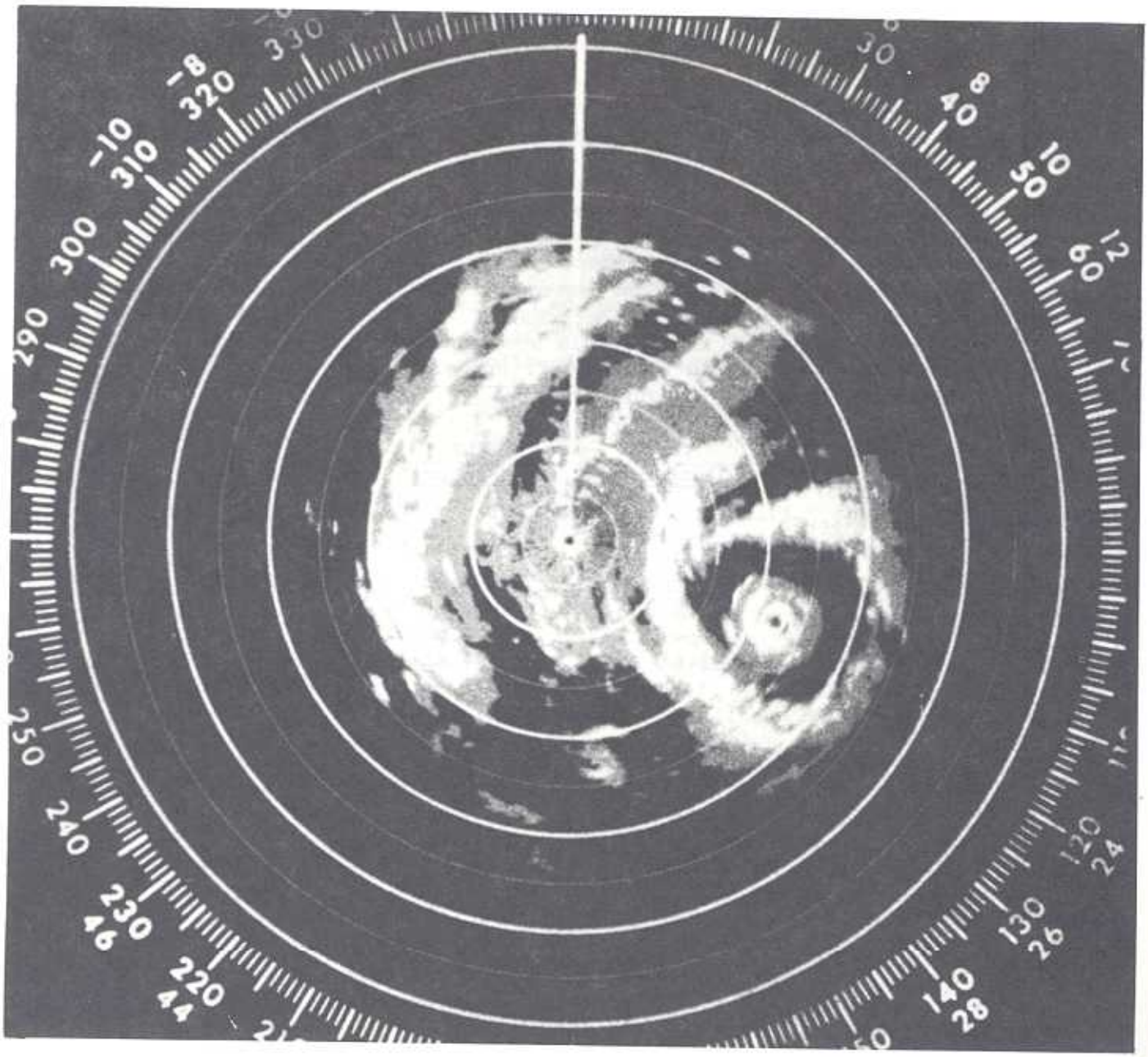
CURRENT INTENSITY AND "T" NUMBER
CLASSIFICATION TABLE

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 this table.

The C.I. number is the same as the T-number (Tropical Classification 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 fluctulations 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.

C.I. Number	MWS (Knots)	T-Number	MSLP (Atlantic)	MSLP (NW Pacific)
1	25K	1		
1.5	25K	1.5		
2	30K	2	1009 mb	1003 mb
2.5	35K	2.5	1005 mb	999 mb
3	45K	3	1000 mb	994 mb
3.5	55K	3.5	994 mb	988 mb
4	65K	4	987 mb	981 mb
4.5	77K	4.5	979 mb	973 mb
5	90K	5	970 mb	964 mb
5.5	102K	5.5	960 mb	954 mb
6	115K	6	948 mb	942 mb
6.5	127K	6.5	934 mb	929 mb
7	140K	7	921 mb	915 mb
7.5	155K	7.5	906 mb	900 mb
8	170K	8	890 mb	884 mb

The empirical relationship between the current intensity (C.I.) number and the maximum wind speed (MWS), and the relationship between the T-number and the minimum sea level pressure (MSLP).



Hurricane ALLEN (August 9, 1980) as seen by the
National Weather Service WSR-57 Radar
at Brownsville, Texas (250 Nautical Mile Range)

CHAPTER 6

SURFACE RADAR REPORTING

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.

2. Procedures

a. Radar observation of tropical cyclones will be made in accordance with the Federal Meteorological Handbook (FMH) No. 7, Part A, Weather Radar Observations. Stations that normally transmit hourly radar weather observations (network stations) will include tropical cyclone features in routine reports (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 (WSR-74C's) to make and transmit a radar observation whenever an eye, center, or spiral band is observed. The weather surveillance radar (WSR-74C) sites may transmit only abbreviated special observations, defined in FMH-7, at H+10 and H+35.

b. 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 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.

c. Timely transmission of tropical cyclone radar reports is essential. Normally, radar reports are transmitted on Radar Report and Warning Coordination Circuit (RAWARC), GT 7072, or Conus Meteorological Data System (COMEDS) circuit equipment. Those radar facilities not having weather transmission capability may call the nearest Weather Service Office (WSO) collect.

3. Special Provisions

a. If NWS Weather Surveillance Radar (WSR 57) and DOD weather radar facilities are collocated (within 25 nautical miles), 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 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.

b. If radar reports are needed from NORAD long-range radar facilities or Air Route Traffic Control Centers (ARTCCs), NWS will dispatch weather radar specialists to these facilities to make and transmit tropical cyclone radar observations. DOD and FAA have authorized the Director, NWS, to dispatch NWS radar specialists to ARTCCs and NORAD sites during critical hurricane threat situations 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 Severe Weather Branch, Operations Division, NWS Headquarters, and will be strictly adhered to.

c. Air Weather Service Staff weather officers providing support to NORAD long-range radar units act as coordinators for visits. These coordinators are: Commander, Det. 41, 12 Weather Sq., 20th North American Aerospace Defense Command Regional Control Center (NRCC), Ft. Lee, AFS, VA (804) 732-7256, ext. 765); Commander Det. 27, 12 Weather Sq., 21 NRC, Hancock Field, Syracuse, NY (315) 458-5500, ext. 3535); Commander, Det. 4, 1 Weather Wing, 326 Air Division, Det. 4, 1WW, Hickam AFB, HI (AV 315-449-6262). Sites are listed in Appendix A of this chapter.

#4. Procedures for Detailing National Weather Service Radar Meteorologists to the FAA's ARTCCs.

a. NWS has been authorizd by FAA to send NWS radar meteorologists to ARTCCs during the hurricane season. These meteorologists will make, record, and transmit hurricane radar observations as well as act as focal points to solicit and process pilot reports from the hurricane areas.

b. Owing to the limited facilities at ARTCCs, NWS agrees that no more than two persons will visit a Center at any given time. Each visit will normally be short, one or two days, but will depend upon the progress of the hurricane under observation.

(1) The Meteorologist in Charge (MIC) of the NWS facility must notify the appropriate MIC of the Center Weather Service Unit (CWSU) at the FAA facility of the intent of NWS personnel to visit such a facility. This notification will include the name(s) of the individual(s) and inclusive date(s) of visit. Appendix B lists FAA ARTCCs and NWS tie-in facilities.

(2) The CWSU/MIC will obtain approval from the air traffic facility manager for the visit and notify the NWS/MIC. A memorandum of understanding between the CWSU/MIC and the NWS/MIC will be maintained to assure well-coordinated visits. It will be the responsibility of the Severe Weather Branch, Operations Division, NWS Headquarters, Silver Spring, MD, to keep Appendix B current.

(3) Positive identification must be presented for access to FAA facilities.

(4) Only those personnel from the appropriate NWS facility will be admitted to FAA facilities.

(5) Copies of this plan shall be forwarded to appropriate ARTCCs.

CHAPTER 6
APPENDIX A
PARTICIPATING RADAR STATIONS

National Weather Service	Radar	Latitude	Longitude
Apalachicola, FL	WSR-57	29°44'N	84°59'W
Atlantic City, NJ	WSR-57	39°27'N	74°35'W
Baton Rouge, LA	WR-100-5	30°32'N	91°09'W
Brownsville, TX	WSR-57	25°54'N	97°26'W
Brunswick, ME	WSR-57	43°54'N	69°56'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-57	41°39'N	69°57'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
Miami, FL	WSR-57	25°43'N	80°17'W
New York, NY	WSR-57	40°46'N	73°59'W
Patuxent, MD	WSR-57	38°17'N	76°25'W
Pensacola, FL	WSR-57	30°21'N	87°19'W
San Juan, PR	FPS-67*	18°16'N	65°46'W
Slidell, LA	WSR-57	30°17'N	89°46'W
Tampa, FL	WSR-57	27°42'N	82°24'W
Victoria, TX	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
Wilmington, NC	WSR-57	34°16'N	77°55'W

*FAA-U.S. Navy joint-use radar.

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-77	28°28'N	80°33'W
Chase Field NAS, Beeville, 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	FPS-77	08°77'N	79°36'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
Norfolk NAVEASTOCEANCEN, VA	FPS-106	36°56'N	76°18'W

Pope AFB, NC	FPS-77	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

ADCOM Sites

20 NORAD Region Control Center (20th NRCC)

	Latitude	Longitude
**OLAF, 20 ADS, Patrick AFB, FL	28°13'N	80°36'W
**OLAD, 20 ADS, Ft. Lonesome, FL	27°36'N	82°06'W
OLAJ, 20 ADS, Key West NAS, FL	24°35'N	81°41'W
**678 Radar Sq., Tyndall AFB, FL	30°05'N	85°37'W
**679 Radar Sq., Jacksonville NAS, FL	30°13'N	81°41'W
701 Radar Sq., Ft. Fisher AFS, NC	33°59'N	77°55'W
**771 Radar Sq., Cape Charles AFS, VA	37°08'N	75°57'W
OLAC, 20 ADS, Jedburg, SC	33°06'N	80°12'W

21 NORAD Region Control Center (21st NRCC)

762 Radar Sq., North Truro AFS, MA	42°02'N	70°03'W
772 Radar Sq., Gibbsboro AFS, NJ	39°49'N	74°57'W
OLAA, 21 ADS, Sulfolk, NY	40°54'N	72°42'W
**Det 1, 21 ADS, Bucks Harbor AFS, ME	44°38'N	67°24'W

**Remoted in the FAA ARTCC

Cooperating Sites

Bay St. Louis, MS (NASA)	CPS-9	30°42'N	89°07'W
Cambridge, MA (Massachusetts Institute of Technology)	CPS-9 and M-33	42°42'N	71°06'W
College Station, TX (Texas A. & M. University)	CPS-9	30°37'N	96°21'W
Coral Gables, FL (University of Miami)	SP-1M and CPS-68	25°43'N	80°17'W
Wallops Station, VA (NASA)	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

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

CHAPTER 6
APPENDIX B

FAA Radar Sites Remoted to ARTCC's

FAA--ARTCCs	FAA Radar Sites	NWS Tie-in Facilities
New York ARTCC (Islip NY) L.I. MacArthur Airport Ronkonkoma, LI, NY 11779 COM: 516-663-3401 FTS: 8-737-3401	Trevose, PA Benton, PA	Information to be added at a later date.
Boston ARTCC Federal Aviation Admin. Air Route Traffic Control Center Northeastern Blvd. & Harris Rd. Nashua, NH 03060 COM: 603-889-1171 x633 FTS: 8-834-6633	Boston, MA Bucks Harbor, ME	
Miami ARTCC 7500 N.W. 58th St. Miami, FL 33166 COM: 305-592-9770 FTS: 8-350-2678	Patrick, FL Richmond, FL	
Jacksonville ARTCC P.O. Box 98 Hilliard, FL 32046 COM: 904-845-3311 (Hilliard) 904-791-2581 (Jacksonville) FTS: 8-946-2581	Jacksonville, FL Charleston, SC Tyndall, FL Jedburg, SC	
Houston ARTCC P. O. Box 60308 Houston, TX 77205 COM: 713-443-8545 FTS: 8-521-3070	Alexandria, LA Ellington, TX Lackland, TX New Orleans, LA Oilton, TX	
Oakland ARTCC 5125 Central Ave. Fremont, CA 94536 COM: 415-797-3200 FTS: 8-449-6200	Oakland, CA Paso Robles, CA Red Bluff, CA Sacramento, CA	

FAA--ARTCCs	FAA Radar Sites	NWS Tie-in Facilities
Los Angeles ARTCC 2555 E. Ave. Palmdale, CA 93550 COM: 805-947-4101 x201 FTS: 8-799-1011	San Pedro, CA Boron, CA Cedar City, UT Las Vegas, NV Paso Robles, CA	
Washington ARTCC Intersection Rts. 7 and 654 Leesburg, VA 22075 COM: 703-777-4400 FTS: 8-925-4400	Raleigh (Benson), NC	

Control Room at a Typical
Air Route Traffic Control Center

CHAPTER 7

NOAA DATA BUOY CENTER REPORTING STATIONS

1. General. NOAA Data Buoy Center (NDBC) Reporting Stations in the Gulf of Mexico and Great Lakes, and off the U.S. east and west coasts obtain data on meteorological and oceaonographic parameters for operational and research purposes. Station location and configuration are given in paragraph 4. The status and capability of stations can be obtained from the Data Systems Division, NOAA Data Buoy Center, NSTL Station, MS 39529, telephone: (601) 688-2836, FTS 494-2836. During non-working hours, NDBC can be contacted through the U. S. Coast Guard in New Orleans, LA, telephone: (504) 589-6225, or FTS 682-6225.

2. Procedures. Reporting stations routinely acquire, store, and transmit data every hour. Data obtained operationally include sea-level pressure, wind speed and direction, air temperature, sea-surface temperature, and wave spectral data.

3. Communications. Data are transmitted by UHF communications via the GOES satellite to NESDIS and then are relayed on to NMC, Suitland, MD, for processing and dissemination. Data are formatted into WMO FM13VII synoptic code (see Attachment 1).

#4. NOAA Data Buoy Locations and Configurations

a. Gulf of Mexico

Station ID	Location °N/°W	Buoy Size	Sensor Height
42001	25.9/89.7	10 m	10 m
42002	26.0/93.5	10 m	10 m
42003	26.0/85.9	10 m	10 m
42008*	28.7/95.3	Platform	15 m
42011*	26.6/93.5	Platform	12 m

b. Atlantic Ocean

Station ID	Location °N/°W	Buoy Size	Sensor Height
41001	34.9/72.9	12 m	10 m
41002	32.3/75.3	6 m	5 m
41006	29.3/77.3	6 m	5 m
44003	40.8/68.5	6 m	5 m
44004	38.5/70.7	12 m	10 m
44005	42.7/68.3	12 m	10 m
44007	43.5/70.1	12 m	13 m
44008	40.5/69.4	12 m	13 m

*Temporary sites established in support of other programs.

CHAPTER 7
ATTACHMENT 1

#CODE FORM FM 13-V

Report of Synoptic Surface Observation
from a Sea Station (AUTOMATIC Weather Station)

$M_iM_iM_jM_j$				
$A_ib_wN_bN_bN_b$	$YYGGi_w$	$99L_aL_aL_a$	$Q_cL_oL_oL_o$	
i_ri_x///	/ddff	$1s_nTTT$	4PPP	5appp
22200	$Os_nT_wT_wT_w$		$1P_{wa}P_{wa}H_{wa}H_{wa}$	
	921ff	925ff	926dd	

The numbers of the code tables are the numbers given in the WMO Manual on Codes.

CHAPTER 8

MARINE WEATHER BROADCASTS

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. Appendix A of this chapter lists the stations involved.

The broadcasts are for the purpose of providing warnings to meet U.S. international obligations in Department of Commerce (DOC) areas of forecast responsibility given in Chapter 2.

2. Broadcast Procedures. DOT and DOD will arrange for broadcast of all marine tropical cyclone advices 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 position estimates are being issued. These broadcasts will be made in both voice and cw mode.

CHAPTER 8

APPENDIX A

List of Marine Tropical Cyclone Forecast Broadcast Stations

Station Call Letters	Location
NMW	Astoria, OR
NMF	Boston, MA
NMO	Honolulu, HI
NMQ	Channel Island, CA
NMA	Miami, FL
NMG	New Orleans, LA
NAM	Norfolk, VA
NMN	Portsmouth, VA
NMC	San Francisco, CA
NMR	San Juan, PR

CHAPTER 9

WARNING TRANSFER POLICIES

1. Transfer of Warning Responsibility.

a. When a tropical/subtropical cyclone approaches longitude 140°W, the coordinated transfer of warning responsibility from Eastern Pacific Hurricane Center (EPHC) to Central Pacific Hurricane Center (CPHC) will be made and appropriate advice issued.

b. When a tropical/subtropical cyclone crosses the 180° meridian from east to west, the coordinated transfer of warning responsibility from CPHC to Joint Typhoon Warning Center (JTWC) will be made and appropriate advice issued.

c. When a tropical/subtropical cyclone crosses the 180° meridian from west to east, the coordinated transfer of warning responsibility from JTWC to CPHC will be made. JTWC will append the statement "Next advisory by CPHC-HNL" to their last advisory.

2. Alternate Responsibilities.

a. In the event of impending or actual operational failure of a hurricane forecast center, responsibilities will be transferred to the appropriate alternate facility in accordance with existing directives and retained there until resumption of responsibility is made. Naval Eastern Oceanography Center, Norfolk, will be advised of impending or actual National Hurricane Center (NHC) and Chief, Aerial Reconnaissance Coordination, All Hurricanes (CARCAH) transfer of responsibility by the most rapid means available.

b. Alternate facilities are as follows:

PRIMARY	ALTERNATE
(1) NHC	HWO (Hurricane Warning Office): Washington (covers Atlantic only) New Orleans (covers Gulf only)
(2) EPHC	NHC
(3) CPHC	EPHC
(4) JTWC	AJTWC, NAVWESTOCEANCEN, Pearl Harbor
(5) HWO San Juan	NHC

c. In the event of the operational failure of CARCAH, direct communication is authorized between DET. 5, AWS, and the forecast facility. Contact Detachment 5, AWS, at AV 868-4545/CO 601-377-4555, or through the Keesler AFB Command Post at AV 868-4330/CO 601-377-4330.

CHAPTER 10

PUBLICITY

News media releases, other than warnings and/or advisories for the purpose of informing the public of the operational and research activities of DOD, DOC, and DOT, should reflect the joint effort of these agencies by giving due credit to the participation of other agencies. Copies of these releases should be forwarded to:

Commander, Naval Oceanography Command
NSTL Station
Bay St. Louis, MS 39529

Headquarters Military Airlift Command (MAC/PA)
Scott Air Force Base, IL 62225

Headquarters Air Force Reserve
Robins Air Force Base, GA 31093

NOAA, Office of Public Affairs
6010 Executive Boulevard
Rockville, MD 20852

Chief, Environmental Services Division
The Joint Chiefs of Staff
Washington, DC 20301

APPENDIX I

ACRONYMS AND ABBREVIATIONS
AS USED IN THIS PLAN

ACP	Allied Communications Publication
ADCOM	Aerospace Defense Command
AFB	Air Force Base
AFGWC	Air Force Global Weather Central
AFTN	Aeronautical Fixed Telecommunications Network
AJTWC	Alternate Joint Typhoon Warning Center
APT	Automatic Picture Transmission
ASDL	Aircraft Satellite Data Link
ATC	Air Traffic Control
AVHRR	Advanced Very High Resolution Radiometer
AWN	Automated Weather Network
AWS	Air Weather Service
CARCAH	Chief, Aerial Reconnaissance Coordination, All Hurricanes
COMEDS	Continental U.S. Meteorological Data System
CONF	Confidence Factor
CPHC	Central Pacific Hurricane Center
CW	Continuous Wave
DCS	Data Collection System
DMSP	Defense Meteorological Satellite Program
DOC	Department of Commerce
DOD	Department of Defense
DOT	Department of Transportation
EDB	Environmental Data Buoy
ELT	Eastern Local Time
EPHC	Eastern Pacific Hurricane Center
ERL	Environmental Research Laboratories
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
FAA	Federal Aviation Administration
FCM	Federal Coordinator for Meteorology
FMH	Federal Meteorological Handbook
FOFAX	Forecast Office Facsimile
GOES	Geostationary Operational Environmental Satellite
GMT	Greenwich Mean Time
HF	High Frequency
HWO	Hurricane Warning Office
ICAO	International Civil Aviation Organization
IR	Infrared
ITOS	Improved TIROS Operational Satellite
JTWC	Joint Typhoon Warning Center
LF	Light Fine (Visual Scanning Radiometer 0.3 n mi)
LS	Light Smooth (Visual Scanning Radiometer 1.5 n mi)
MAC	Military Airlift Command
MIC	Meteorologist in Charge
MSD	Meteorological Services Division

(continued)

NAM	Navy Communications Area Master Station Atlantic
NASA	National Aeronautics and Space Administration
NAVEASTOCEANCEN	Naval Eastern Oceanography Center
NAVWESTOCEANCEN	Naval Western Oceanography Center
NDBO	NOAA Data Buoy Office
NESDIS	National Environmental Satellite, Data and Information Service
NHC	National Hurricane Center
NHOP	National Hurricane Operations Plan
NLT	Not Later Than
NMC	National Meteorological Center
NOAA	National Oceanic and Atmospheric Administration
NPSU	National Public Service Unit
NRCC	North American Air Defense Command Regional Control Center
NWS	National Weather Service
OL-G	Operating Location G
PM	Preventive Maintenance
RAWARC	Radar Report and Warning Coordination
RECCO	Reconnaissance Code
RFC	Research Facilities Center
SAB	Synoptic Analysis Branch
SFSS	Satellite Field Services Station
SMS	Synchronous Meteorological Satellite
SR	Scanning Radiometer
SSH	Saffir/Simpson Hurricane
SST	Sea Surface Temperature
TCPOD	Tropical Cyclone Plan of the Day
TD	Tropical Depression
TF	Thermal Fine (Infrared Scanning Radiometer 0.3 n mi)
TS	Thermal Smooth (Infrared Scanning Radiometer 1.5 n mi)
UHF	Ultra High Frequency
US	United States
USAF	United States Air Force
USCG	United States Coast Guard
USN	United States Navy
VIS	Visible
VISSR	Visible - Infrared Spin Scan Radiometer
VTPR	Vertical Temperature Profile Radiometer
WMO	World Meteorological Organization
WRG	Weather Reconnaissance Group
WRS	Weather Reconnaissance Squadron
WSFO	Weather Service Forecast Office
WSO	Weather Service Office
WSOM	Weather Service Operations Manual
WSR	Weather Surveillance Radar
Z	Zulu (Coordinated Universal Time)

APPENDIX II

This appendix presents in capsular form a description of the International System of Units (SI) metric system and selected standard conversion factors commonly used in meteorology and hydrology. The American National Standard Institute/IEEE Standard 268-1982 Metric Practice has been approved for use by the Department of Defense, other Federal agencies, and by many industries. Users are encouraged to acquire and use the ANSI/IEEE 268-1982 Standard Metric Practice to ensure consistent conversion and implementation.

The first part of this appendix is the Federal Register Notice of February 26, 1982, titled: "Metric System of Measurement; Interpretation and Modification of the International System of Units for the United States." The table herein is a list of selected conversion factors by classification excerpted from the ANSI/IEEE Standard. Finally, the figure shows the relationships of SI units with names. It shows graphically how the 19 SI derived units with special names listed in Table 2 of the Federal Register Notice are derived in a coherent manner from the base and supplementary units. A description of the chart precedes the figure.

National Bureau of Standards

Metric System of Measurement; Interpretation and Modification of the International System of Units for the United States

Section 3 of Pub. L. 94-168, the Metric Conversion Act of 1975, declares that the policy of the United States shall be to coordinate and plan the increasing use of the metric system in the United States. Section 403 of Pub. L. 93-380, the Education Amendments of 1974, states the policy of the United States to encourage educational agencies and institutions to prepare students to use the metric system of measurement as part of the regular education program. Under both these acts, the "metric system of measurement" is defined as the International System of Units as established by the General Conference on Weights and Measures in 1960 and interpreted or modified for the United States by the Secretary of Commerce (sec. 4(4), Pub. L. 94-168; sec. 403(a)(3), Pub. L. 93-380). The Secretary has delegated his authority under these subsections to the Director of the National Bureau of Standards.

In implementation of this authority, tables and associated materials were published in the **Federal Register** of October 26, 1977 (42 FR 56513-56514), setting forth the interpretation and modification of the International System of Units (hereinafter "SI") for the United States.

In accordance with recent decisions of the International Committee for Weights and Measures of the General Conference on Weights and Measures, and to refine the earlier interpretation and modification, it is deemed appropriate to amend that interpretation and modification, as published in the above-cited **Federal Register** notice of October 26, 1977. To assist interested parties and encourage the proper use of SI, the entire interpretation and modification, as hereby amended, is republished. Accordingly, this notice supersedes the notice of October 26, 1977.

The amendments consist of the inclusion in table 2 of the sievert, a special name for the SI derived unit of dose equivalent, the inclusion in table 6 of the electronvolt and the unified atomic mass unit, and the inclusion in table 7 of the rem, a unit of dose equivalent. The unit "standard atmosphere" is no longer included in table 7. The amendments are indicated by a dagger symbol (†).

The SI is constructed from seven base units for independent quantities plus two supplementary units for plane angle and solid angle, listed in table 1.

TABLE 1.—SI BASE AND SUPPLEMENTARY UNITS

Quantity	Name	Symbol
SI base units:		
length	meter	m
mass [1]	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature	kelvin	K
amount of substance	mole	mol
luminous intensity	candela	cd
SI supplementary units:		
plane angle	radian	rad
solid angle	steradian	sr

[1] Weight in common parlance is often used to mean mass.

Units for all other quantities are derived from these nine units. In table 2 are listed 19 SI derived units with special names which were derived from the base and supplementary units in a coherent manner, which means, in brief, that they are expressed as products and quotients of the nine base and supplementary units without numerical factors.

TABLE 2.—SI DERIVED UNITS WITH SPECIAL NAMES

Quantity	SI unit		
	Name	Symbol	Expression in terms of other units
frequency	hertz	Hz	s^{-1}
force	newton	N	$kg\,m/s^2$
pressure, stress	pascal	Pa	N/m^2
energy, work, quantity of heat	joule	J	N·m
power, radiant flux	watt	W	J/s
electric charge, quantity of electricity	coulomb	C	A·s
electric potential; potential difference; electromotive force	volt	V	W/A
capacitance	farad	F	C/V
electric resistance	ohm	Ω	V/A
conductance	siemens	S	A/V
magnetic flux	weber	Wb	V·s
magnetic flux density	tesla	T	Wb/m^2
inductance	henry	H	Wb/A
luminous flux	lumen	lm	cd·sr
illuminance	lux	lx	lm/m^2
Celsius temperature [1]	degree Celsius	°C	K
activity (of a radionuclide)	becquerel	Bq	s^{-1}
absorbed dose, specific energy imparted, kerma, absorbed dose index	gray	Gy	J/kg
[2]dose equivalent, dose equivalent index	sievert	Sv	J/kg

[1] In addition to the thermodynamic temperature (symbol T) expressed in kelvins (see table 1), use is also made of Celsius temperature (symbol t) defined by the equation

$$t = T - T_0$$

where $T_0 = 273.15$ K by definition. The unit "degree Celsius" is equal to the unit "kelvin," but "degree Celsius" is a special name in place of "kelvin" for expressing Celsius temperature. A temperature interval or a Celsius temperature difference can be expressed in degrees Celsius as well as in kelvins.

All other SI derived units, such as those in tables 3 and 4, are similarly derived in a coherent manner from the 28 base, supplementary, and special-name SI units.

TABLE 3.—EXAMPLES OF SI DERIVED UNITS EXPRESSED IN TERMS OF BASE UNITS

Quantity	SI unit	Unit symbol
area	square meter	m^2
volume	cubic meter	m^3
speed, velocity	meter per second	m/s
acceleration	meter per second squared	m/s^2
wave number	1 per meter	m^{-1}
density, mass density	kilogram per cubic meter	kg/m^3
specific volume	cubic meter per kilogram	m^3/kg
current density	ampere per square meter	A/m^2
magnetic field strength	ampere per meter	A/m
concentration (of amount of substance)	mole per cubic meter	mol/m^3
luminance	candela per square meter	cd/m^2

TABLE 4.—EXAMPLES OF SI DERIVED UNITS EXPRESSED BY MEANS OF SPECIAL NAMES

Quantity	Name	Unit symbol
dynamic viscosity	pascal second	Pa·s
moment of force	newton meter	N·m
surface tension	newton per meter	N/m
heat flux density, irradiance	watt per square meter	W/m^2
heat capacity, entropy	joule per kelvin	J/K
specific heat capacity, specific entropy	joule per kilogram kelvin	J/(kg·K)
specific energy	joule per kilogram	J/kg
thermal conductivity	watt per meter kelvin	W/(m·K)
energy density	joule per cubic meter	J/m^3
electric field strength	volt per meter	V/m
electric charge density	coulomb per cubic meter	C/m^3
electric flux density	coulomb per square meter	C/m^2
permittivity	farad per meter	F/m
permeability	henry per meter	H/m
molar energy	joule per mole	J/mol
molar entropy, molar heat capacity	joule per mole kelvin	J/(mol·K)
exposure (x and γ rays)	coulomb per kilogram	C/kg
absorbed dose rate	gray per second	Gy/s

For use with the SI units there is a set of 16 prefixes (see table 5) to form multiples and submultiples of these units. It is important to note that the kilogram is the only SI unit with a prefix. Because double prefixes are not to be used, the prefixes of table 5, in the case of mass, are to be used with gram (symbol g) and not with kilogram (symbol kg).

TABLE 5.—SI PREFIXES

Factor	Prefix	Symbol
10^{18}	exa	E
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10^{1}	deka	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a

Certain units that are not part of the SI are used so widely that it is impractical to abandon them. The units that are accepted for continued use in the United States with the International System are listed in table 6.

TABLE 6.—UNITS IN USE WITH THE INTERNATIONAL SYSTEM

Name	Symbol	Value in SI unit
minute (time)	min	1 min = 60 s
hour	h	1 h = 60 min = 3 600 s
day	d	1 d = 24 h = 86 400 s
degree (angle)	°	1° = (π/180) rad
minute (angle)	′	1′ = (1/60)° = (π/10 800) rad
second (angle)	″	1″ = (1/60)′ = (π/648 000) rad
liter	L*	1 L = 1 dm^3 = 10^{-3} m^3
metric ton	t	1 t = 10^3 kg
hectare (land area)	ha	1 ha = 10^4 m^2
*electronvolt	eV	1 eV = 1.602 × 10^{-19} J, approximately**
*unified atomic mass unit	u	1 u = 1.660 57 × 10^{-27} kg, approximately**

* Both L and l are international symbols for liter. Because "l" can easily be confused with the numeral "1" the symbol "L" is recommended for United States use.

** The values of these units in terms of SI units are obtained experimentally.

In those cases where their usage is already well established, the use, for a limited time, of the units in table 7 is accepted, subject to future review.

TABLE 7.—UNITS IN USE TEMPORARILY WITH THE INTERNATIONAL SYSTEM

nautical mile	angstrom	curie
knot	barn	roentgen
	bar	rad [2]
	gal [1]	rem [3]

[1] Unit of acceleration.
[2] Unit of absorbed dose.
[3] Unit of dose equivalent.

Metric units, symbols, and terms that are not in accordance with the foregoing Interpretation and Modification are no longer accepted for continued use in the United States with the International System of Units. Accordingly, the following units and terms listed in the table of metric units in section 2 of the Act of July 28, 1866 that legalized the metric system of weights and measures in the United States are no longer accepted for use in the United States:

myriameter
stere
millier or tonneau
quintal
myriagram
kilo (for kilogram)

For more information regarding the International System of Units, contact Dr. David T. Goldman, National Measurement Laboratory, National Bureau of Standards, U.S. Department of Commerce, Washington, D.C. 20234, telephone (301) 921-3304.

Dated: February 2, 1982.

Ernest Ambler,

Director.

[FR Doc. 82-5150 Filed 2-23-82; 8:45 am]

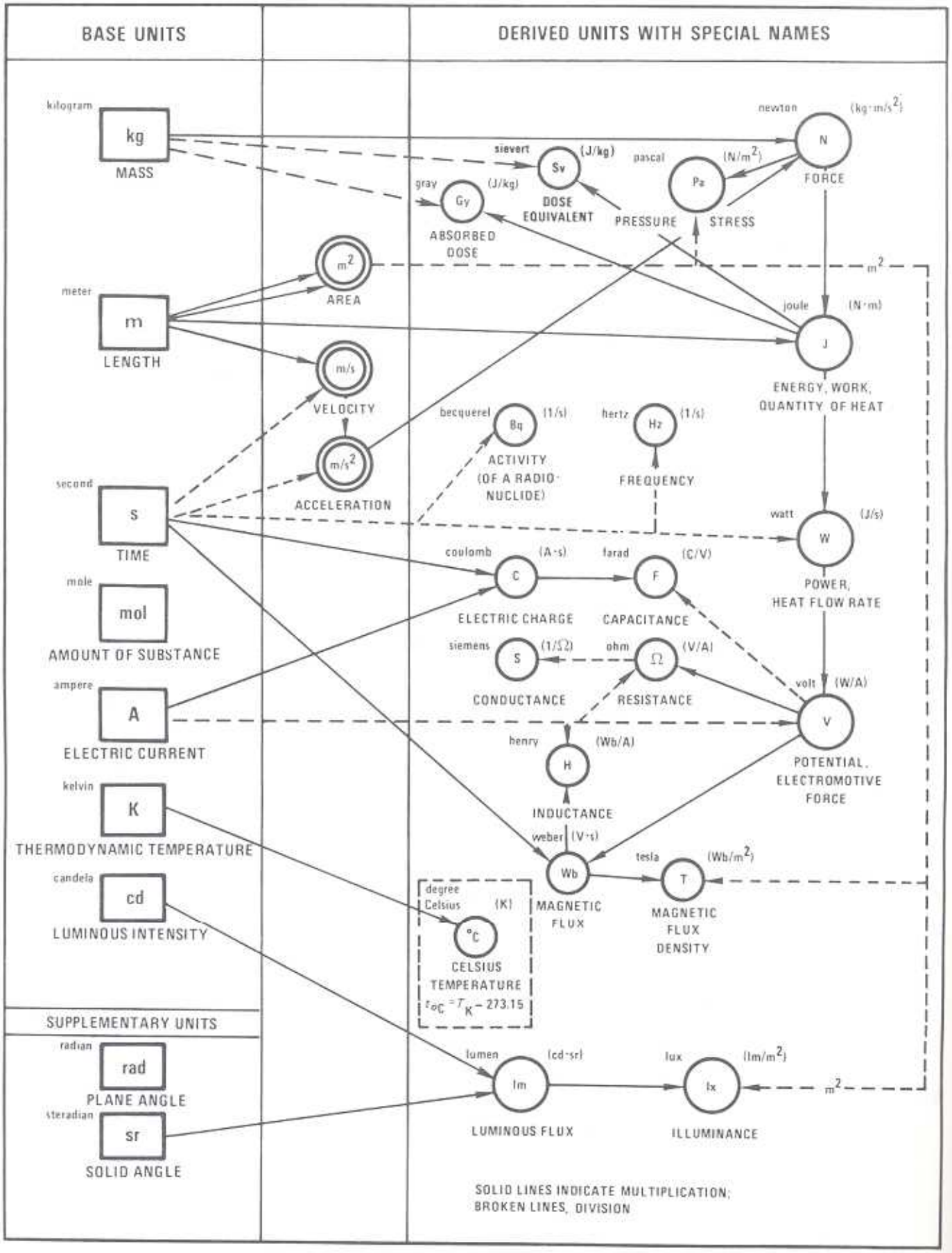
BILLING CODE 3510-13-M

The following chart shows graphically how the 19 SI derived units with special names listed in Table 2 of the Federal Register Notice are derived in a coherent manner from the base and supplementary units. In the first column the symbols of the base and supplementary units are shown in rectangles, with the name of the unit shown toward the upper left of the rectangle and the name of the quantity (measurable attribute) shown below the rectangle. In the third column the symbols of the derived units with special names are shown in solid circles, with the name of the quantity shown below the circle, and an expression of the derived unit in terms of other units shown toward the upper right. In the second column are shown those derived units without special names that are used in the derivation of the derived units with special names. In the chart the derivation of each unit is indicated by arrows bringing in numerator factors (solid lines) and denominator factors (broken lines).

The degree Celsius, shown on the chart in a broken-line rectangle, is a special name for the kelvin, for use in expressing Celsius temperatures or temperature intervals. Where it is used to express temperature intervals, it is equal to the kelvin, as shown on the chart, with the symbol K toward the upper right of the ^{o}C circle; where it is used to express Celsius temperatures, the equation below "CELSIUS TEMPERATURE" relates Celsius temperature (t_{oC}) to thermodynamic temperature (T_K).

As stated in the ANSI/IEEE 268 Standard Metric Practice, "The SI unit of pressure and stress is the pascal (newton per square meter) and with proper SI prefixes is applicable to all such measurements. Old metric gravitational units for pressure and stress such as kilogram-force per square centimeter shall not be used. Widespread use has been made of other non-SI units such as bar and torr for pressure, but this use is strongly discouraged. The millibar has been widely used by meteorologists for communication within their profession; there is now some attempt to introduce the name hectopascal as a substitute for millibar. However, the kilopascal should be used in presenting meteorological data to the public."

RELATIONSHIPS OF SI UNITS WITH NAMES



SELECTED STANDARD CONVERSION FACTORS

Factors with an * are exact

Unit	=	SI Standard Unit
ACCELERATION		
1 ft/s^2	=	3.048 000*E-01 m/s^2
standard acceleration of free fall	=	9.806 650*E+00 m/s^2
ANGLE		
1 degree	=	1.745 329 E-02 rad
AREA		
1 acre	=	4.046 873 E+03 m^2
1 ft^2	=	9.290 304*E-02 m^2
1 hectare	=	1.000 000*E+04 m^2
1 in^2	=	6.451 600*E-04 m^2
BENDING MOMENT OR TORQUE		
1 dyne.cm	=	1.000 000*E-07 N.m
1 lbf.ft	=	1.355 818 E+00 N.m
ELECTRICITY AND MAGNETISM		
1 ampere hour	=	3.600 000*E+03 C
1 EMU of capacitance	=	1.000 000*E+09 F
1 EMU of current	=	1.000 000*E+01 A
1 EMU of electric potential	=	1.000 000*E-08 V
1 EMU of inductance	=	1.000 000*E-09 H
1 EMU of resistance	=	1.000 000*E-09
1 ESU of capitance	=	1.112 650 E-12 F
1 ESU of current	=	3.335 641 E-10 A
1 ESU of electric potential	=	2.997 925 E+02 V
1 ESU of inductance	=	8.987 554 E+11 H
1 ESU of resistance	=	8.987 554 E+11
ENERGY (Includes WORK)		
1 British thermal unit (International Table)	=	1.055 056 E+03 J
1 British thermal unit (thermochemical)	=	1.054 350 E+03 J
1 calorie (International Table)	=	4.186 800*E+00 J
1 calorie (thermochemical)	=	4.184 000*E+00 J
1 electronvolt	=	1.602 19 E-19 J
1 erg	=	1.000 000*E-07 J
1 kW.h	=	3.600 000*E+06 J
1 therm	=	1.054 804*E+08 J

ENERGY PER UNIT AREA TIME

1 Btu (International Table)/(ft^2.h)	=	3.154 591 E+00 W/m^2
1 erg/(cm^2.s)	=	1.000 000*E-03 W/m^2

FLOW (See MASS PER UNIT TIME or VOLUME PER UNIT TIME)

FORCE

1 dyne	=	1.000 000*E-05 N
1 kilogram-force	=	9.806 650*E+00 N
1 pound-force (lbf)	=	4.448 222 E+00 N

FORCE PER UNIT AREA (See PRESSURE)

FORCE PER UNIT LENGTH

1 lbf/ft	=	1.459 390 E+01 N/m

HEAT

1 Btu (International Table).ft/ ($h.ft^2.{}^\circ F$) (thermal conductivity)	=	1.730 735 E+00 W/(m.K)
1 Btu (thermochemical).ft/($h.ft^2.{}^\circ F$) (thermal conductivity)	=	1.729 577 E+00 W/(m.K)
1 Btu (Internatinal Table)/$lb_{}^\circ$	=	2.326 000*E+03 J/kg
1 cal (thermochemical)/($cm.s.{}^\circ C$)	=	4.184 000*E+02 W/(m.K)
1 cal (thermochemical)/s	=	4.184 000*E+00 W_2
1 ft^2/h (thermal diffusivity)	=	2.580 640*E-05 m^2/s

LENGTH

1 angstrom	=	1.000 000*E-10 m
1 astronomical unit	=	1.495 979 E+11 m
1 foot	=	3.048 000*E-01 m
1 inch	=	2.540 000*E-02 m
1 micron	=	1.000 000*E-06 m
1 mile (nautical)	=	1.852 000*E+03 m
1 mile (statute)	=	1.609 344*E+03 m

LIGHT

1 footcandle	=	1.076 391 E+01 lx
1 lambert	=	3.183 099 E+03 cd/m^2
1 lumen per ft^2	=	1.076 391 E+01 lm/m^2

MASS

1 gram	=	1.000 000*E-03 kg
1 pound (avoirdupois)	=	4.535 923 7*E-01 kg
1 tonne	=	1.000 000*E+03 kg

MASS PER UNIT TIME (Includes FLOW)

1 lb/min	=	7.559 873 E-03 kg/s

MASS PER UNIT VOLUME (Includes DENSITY and MASS CONCENTRATION)

1 g/cm^3	=	1.000 000*E+03 kg/m^3
1 lb/ft^3	=	1.601 846 E+01 kg/m^3

POWER

1 Btu (International Table)/h	=	2.930 711 E-01 W
1 Btu (thermochemical)/h	=	2.928 751 E+01 W
1 cal (thermochemical)/s	=	4.184 000*E+00 W
1 erg/s	=	1.000 000*E-07 W
1 horsepower (electric)	=	7.460 000*E+02 W
1 ton of refrigeration (12 000 Btu/h)	=	3.517 E+03 W

PRESSURE OR STRESS (FORCE PER UNIT AREA)

1 atmosphere (standard)	=	1.013 250*E+05 Pa
1 inch of mercury (60 °F)	=	3.376 85 E+03 Pa
1 millibar	=	1.000 000*E+02 Pa
1 psi	=	6.894 757 E+03 Pa

RADIOLOGY

1 rem (dose equivalent)	=	1.000 000*E-02 Sv
1 roentgen	=	2.58 E-04 C/kg

TEMPERATURE

Celsius Temperature	=	$(t_{°F}-32)/1.8$
Fahrenheit Temperature	=	$1.8t_{°C}+32$
Kelvin Temperature	=	$t_{°C}+273.15$

TIME

1 day (mean solar)	=	8.640 000*E+04 s
1 day (sidereal)	=	8.616 409 E+04 s
1 year (sidereal)	=	3.155 815 E+07 s
1 year (tropical)	=	3.155 693 E+07 s

VELOCITY (Includes SPEED)

1 ft/min	=	5.080 000*E-03 m/s
1 knot (international)	=	5.144 444 E-01 m/s
1 mi/h (international)	=	4.470 400*E-01 m/s
1 mi/h (international)	=	1.609 344*E+00 km/h

VISCOSITY

1 poise	=	1.000 000*E-01 Pa.s
1 lb/ft.s	=	1.488 164 E+00 Pa.s

VOLUME (Includes CAPACITY)

1 acre-foot	=	1.233 5 E+03 m^3
1 barrel (oil, 42 gal)	=	1.589 873 E-01 m^3
1 in^3	=	1.638 7064*E-05 m^3
1 L (liter)	=	1.000 000*E-03 m^3

VOLUME PER UNIT TIME (Includes FLOW)

1 ft^3/min	=	4.719 474 E-04 m^3/s

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