DEPARTMENT OF COMMERCE / National Oceanic and Atmospheric Administration

FEDERAL COORDINATOR FOR METEOROLOGICAL SERVICES AND SUPPORTING RESEARCH

National Hurricane Operations Plan

FCM-P12-1981

Washington, D.C.
May 1981

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National Hurricane Operations Plan

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FOREWORD

An Interdepartmental Plan was first issued in 1962. This document is the 19th edition and presents procedures and agreements reached at the 35th annual Conference held at the USAF Conference Center, Homestead Air Force Base, Florida, 27-29 January 1981.

The Conference is sponsored annually by the Subcommittee on 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 Service 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)

CONTENTS

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NOTE: The symbol (#) indicates a significant change from the previous edition.

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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 Warning Conference (combined Atlantic and Pacific). It is the 19th 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. 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.

#g. 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.

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

i. 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.

j. Subtropical Cyclones. Nonfrontal, low-pressure systems comprising initially baroclinic circulations developing over subtropical waters. There are two types: (1) A cold low with circulation extending to the surface layer and maximum sustained winds generally occurring at a radius of about 100 miles or more from the pressure center. These cyclones sometimes metamorphose and become tropical storms or hurricanes. (2) A mesoscale cyclone originating in or near a frontolyzing zone of horizontal wind shear, with radius of maximum sustained winds generally less than 30 miles. The entire circulation sometimes encompasses an area initially no more than 100 miles in diameter. These marine cyclones may change in structure from cold to warm core. While generally short-lived, they may ultimately evolve into major hurricanes or into extratropical wave cyclones. Subtropical cyclones are classed according to intensity as follows:

(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.

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

l. 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 equatorward 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.

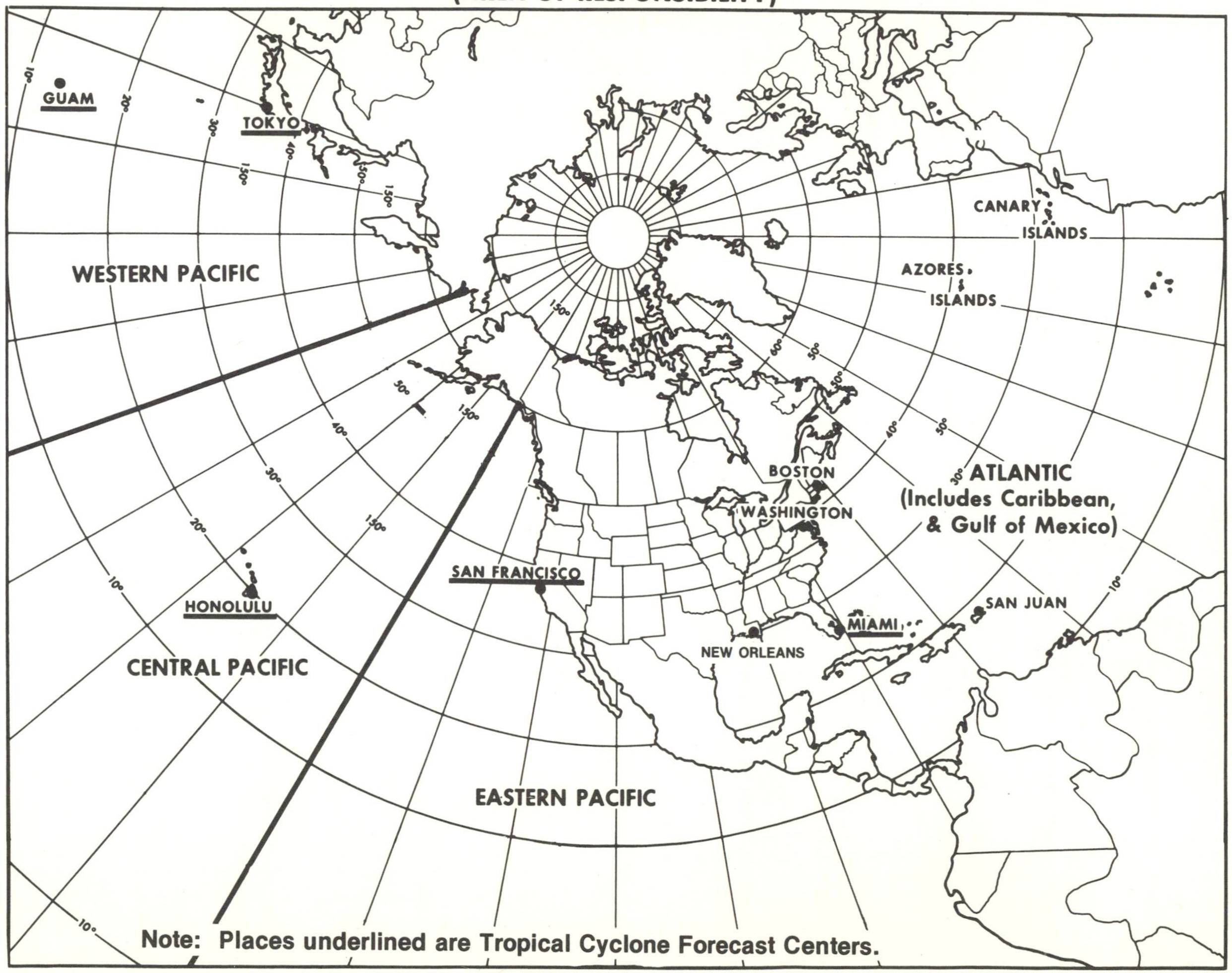
m. Vortex Fix. The location of the surface and/or flight level center of a tropical or subtropical cyclone obtained by reconnaissance aircraft penetration.

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

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

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^{o}W) - advices are the responsibility of the Meteorologist-in-Charge (MIC), 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^{o}W and 180^{o}) - advices are the responsibility of MIC, 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 Earth Satellite Service (NESS) - 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 Office (NDBO) - 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 Aerospace Defense Command (ADCOM) 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 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; 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.

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 0300Z, 0900Z, 1500Z, and 2100Z. Discussion will be disseminated for intragovernmental use only and will contain preliminary prognostic positions up to 72 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 before the 0300Z and 1500Z advisories, and EPHC before the 1000Z and 2130Z advisories. 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 three times a day 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 0330, 1430, and 2030 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 the appropriate Hurricane Warning Office (HWO) for any tropical cyclone 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.)

d. Atlantic and Gulf of Mexico Tropical Cyclone Position Estimates. The HWO that issues the public advisory 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. Their format and content will follow that of the Storm Summary for winter storms. (See National Weather Service Operations Manual, Chapter C-42.)

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, 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.

4. Abbreviated Communications Headings. Abbreviated communications headings will be assigned to advisories on tropical and subtropical cyclones and other advices based on depression number (or storm name) and standard communication procedures. Details are found in appropriate communications manuals.

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 separate set of names will be used each calendar year, beginning with the first name in the set. After the sets have been used, the same sets will be used again. Names beginning with the letters Q, U, X, Y, and Z are not included, because of the scarcity of suitable names beginning with these letters. Lists of Atlantic and Eastern 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)*
GOOD *(Within 20NM)*
FAIR *(Within 40NM)*
ACCURATE WITHIN _____ NM

BASED ON AF RECONNAISSANCE TIME OF FIX _____ Z.
NOAA RECONNAISSANCE TIME OF FIX _____ Z.
LAND BASED RADAR SATELLITE SYNOPTIC REPORT
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 15 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	FORECASTER
Z	

1981	1982	1983	1984	1985	1986
ARLENE	ALBERTO	ALICIA	ARTHUR	ANA	ALLEN
BRET	BERYL	BARRY	BERTHA	BOB	BONNIE
CINDY	CHRIS	CHANTAL	CESAR	CLAUDETTE	CHARLEY
DENNIS	DEBBY	DEAN	DIANA	DANNY	DANIELLE
EMILY	ERNESTO	ERIN	EDOUARD	ELENA	EARL
FLOYD	FLORENCE	FELIX	FRAN	FABIAN	FRANCES
GERT	GILBERT	GABRIELLE	GUSTAV	GLORIA	GEORGES
HARVEY	HELENE	HUGO	HORTENSE	HENRI	HERMINE
IRENE	ISAAC	IRIS	ISIDORE	ISABEL	IVAN
JOSE	JOAN	JERRY	JOSEPHINE	JUAN	JEANNE
KATRINA	KEITH	KAREN	KLAUS	KATE	KARL
LENNY	LESLIE	LUIS	LILI	LARRY	LISA
MARIA	MICHAEL	MARILYN	MARCO	MINDY	MITCH
NATE	NADINE	NOEL	NANA	NICHOLAS	NICOLE
OPHELIA	OSCAR	OPAL	OMAR	ODETTE	OTTO
PHILIPPE	PATTY	PABLO	PALOMA	PETER	PAULA
RITA	RAFAEL	ROXANNE	RENE	ROSE	RICHARD
STAN	SANDY	SEBASTIEN	SALLY	SAM	SHARY
TAMMY	TONY	TANYA	TEDDY	TERESA	TOMAS
VINCE	VALERIE	VAN	VICKY	VICTOR	VIRGINIE
WILMA	WILLIAM	WENDY	WILFRED	WANDA	WALTER

1981	1982	1983	1984	1985	1986
ADRIAN	ALETTA	ADOLPH	ALMA	ANDRES	AGATHA
BEATRIZ	BUD	BARBARA	BORIS	BLANCA	BLAS
CALVIN	CARLOTTA	COSME	CRISTINA	CARLOS	CELIA
DORA	DANIEL	DALILIA	DOUGLAS	DOLORES	DARBY
EUGENE	EMILIA	ERICK	ELIDA	ENRIQUE	ESTELLE
FERNANDA	FABIO	FLOSSIE	FAUSTO	FEFA	FRANK
GREG	GILMA	GIL	GENEVIEVE	GUILLERMO	GEORGETTE
HILARY	HECTOR	HENRIETTE	HERNAN	HILDA	HOWARD
IRWIN	IVA	ISMAEL	ISELLE	IGNACIO	ISIS
JOVA	JOHN	JULIETTE	JULIO	JIMENA	JAVIER
KNUT	KRISTY	KIKO	KENNA	KEVIN	KAY
LIDIA	LANE	LORENA	LOWELL	LINDA	LESTER
MADELINE	MAX	MIRIAM	MANUEL	MARIE	MARTY
NORMA	NORMAN	NARDA	NORBERT	NORA	NEWTON
OTIS	OLIVIA	OCTAVE	ODILE	OLAF	ORLENE
PILAR	PAUL	PRISCILLA	POLO	PAULINE	PAINE
RAMON	ROSA	RAYMOND	RACHEL	RICK	ROSLYN
SELMA	SERGIO	SONIA	SIMON	SANDRA	SEYMOUR
TODD	TARA	TICO	TRUDY	TERRY	TINA
VERONICA	VICENTE	VELMA	VANCE	VIVIAN	VIRGIL
WILEY	WILLA	WINNIE	WALLIS	WALDO	WINIFRED

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
LAKA	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.

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.

---

* 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).

(8) Height of eye wall.

b. Required Meteorological Reconnaissance Observations, 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:

(a) Surface - within 2 mb.
(b) Flight level - within 1 mb.

(5) Temperature:

(a) Sea surface - within 1°C.
(b) Flight level - within 1°C.

(6) Dew point:

(a) Range from -20°C to 40°C - within 1°C.
(b) Colder than -20°C - within 3°C.

(7) Absolute altitude - within 10 m.

(8) Vertical sounding:

(a) Pressure - within 2 mb.
(b) Temperature - within 1°C.
(c) Dew point:
Range -20°C to +40°C - within 1°C.
Colder than -20°C - within 3°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):

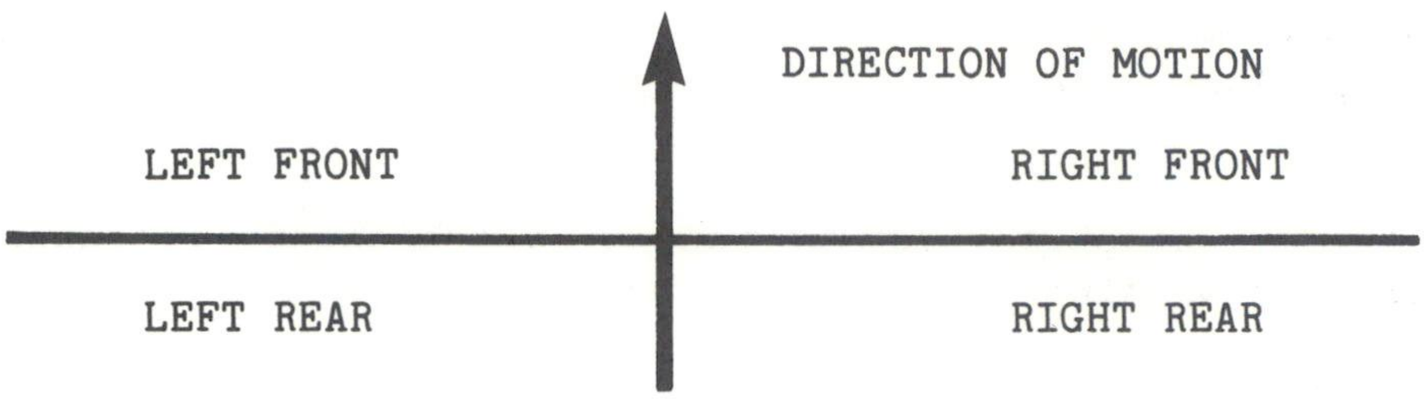
(a) Time, latitude, longitude, radar altitude, wind, temperature, dewpoint, height of standard pressure surface - every 15 minutes enroute to and from storm, within 15° of tasked coordinates (over water). Observations transmitted hourly enroute.

(b) Standard RECCO (see Appendix C) and Vortex observations as required.

(c) Supplementary Vortex data for all radial legs within 100 n.mi. of storm center. (Chapter 4, Appendix B, Form 4 - Remarks section used to designate radial for data collected on patterns other than "A".)

NOTE: Present weather reconnaissance capabilities are marginal in satisfying these requirements; data will be collected as close to stated requirements as possible.

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, and Caribbean - 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, Puerto Rico, Virgin Islands, DOD installations, and other DOD assets when specified.

(b) Eastern and Central Pacific - up to two consecutive 6-hourly fixes per day when a storm is within 300 nautical miles of landfall, DOD installations and other DOD assets when specified.

(c) 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).

(d) 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) ATC clearances, unless otherwise coordinated before the flight with the responsible ATC facility, will provide ATC separation between all aircraft operating on storm missions and between these aircraft and other nonparticipating aircraft operating within controlled airspace. Mission commanders should be aware that nonparticipating aircraft may be operating over and nearby the storm area; thus, adherence to ATC clearances is mandatory for safety purposes.

(2) ATC will increase the vertical separation between aircraft when reports from pilots indicate their inability to maintain assigned altitudes because of turbulence. Pilots should be aware, however, that unless such reports are received, only normal vertical separation of 1,000 feet below FL290 and 2,000 feet above FL290 will be provided by ATC to aircraft operating in the storm area. Thus, the fact that storm-mission aircraft have filed flight plans and are operating 5,000 or 10,000 feet apart does not imply that the altitudes (flight levels) in between may not be in use by nonstorm aircraft.

(3) Any procedures, desired by storm-mission commanders concerning ATC separation outside the above parameters, must be specifically coordinated with the ATC center(s) of concern.

(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. Horizontal and Vertical. Horizontal meteorological observations and vertical observations will be coded and transmitted in RECCO code and TEMP DROP Code, respectively. Enroute to and from tasked coordinates, RECCO observations will be taken and transmitted at least hourly. When the aircraft is within 200 nautical miles of the center of the storm, observation frequency will be at least every 30 minutes.

b. 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.

c. 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.

d. Supplementary Vortex Data. Penetration and collection of supplementary vortex data on operational flight patterns A and B will normally start at 700 millibars at a radius of 80 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 marginal in satisfying these requirements; data will be collected as close to stated requirements as possible and within the capabilities of the flight crew.

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

f. 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	# of missions this system	Depression # 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 #3. Invest or fix as specified in TCPOD.)
NOAA2	0701	AGNES	(NOAA aircraft 42RF on the seventh mission to fix depression #1, which has acquired the name AGNES.)

g. 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:

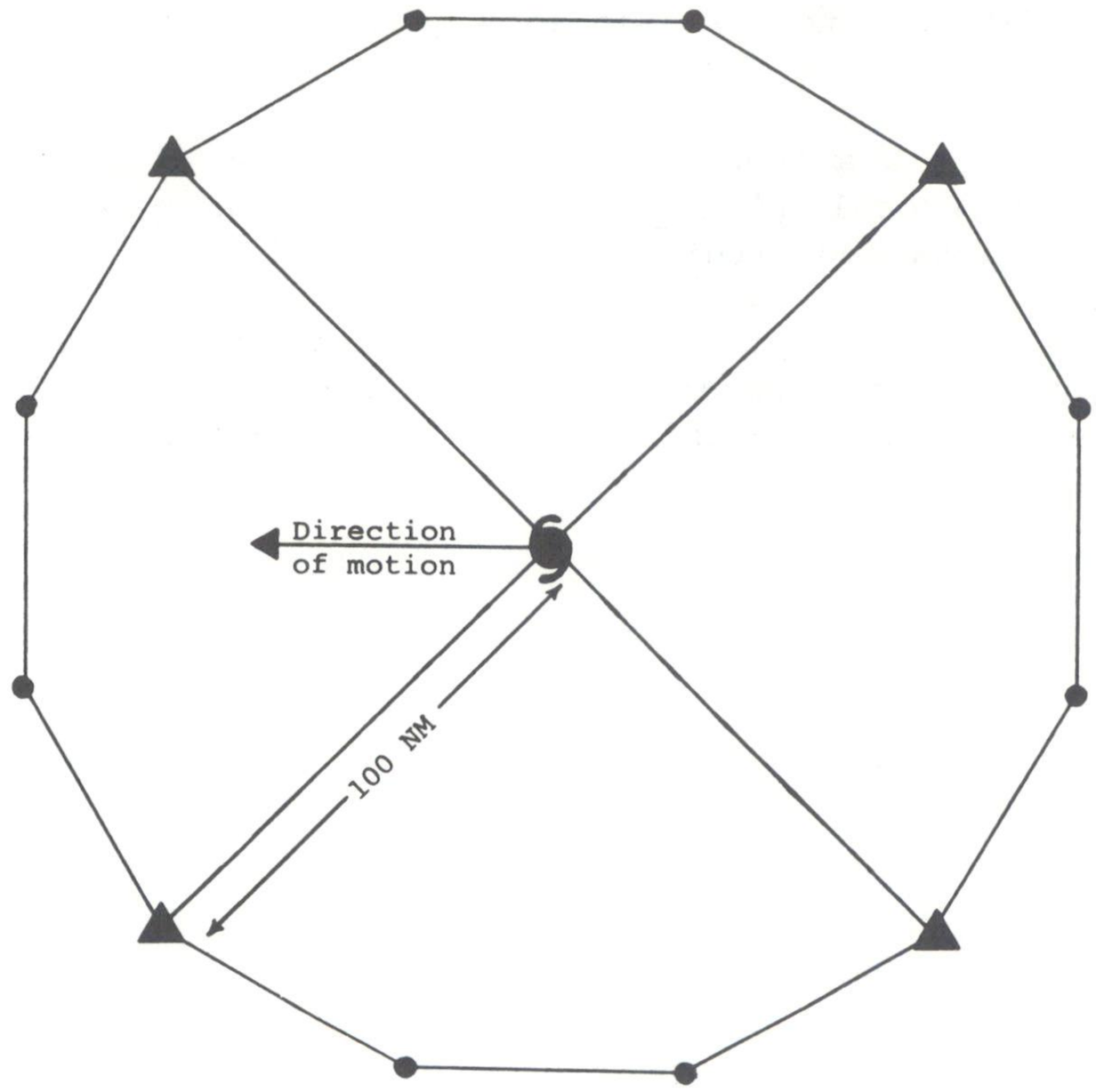
AF553 0308 EMMY OB 16
XXAA TEXT TEXT...LAST REPORT ETA KBIX 11/0910Z OBS 01 THRU 10 and 12 THRU 16 KMIA OB 11 KMHR

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. Message is normally prepared and transmitted after completion of all radial legs.

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.

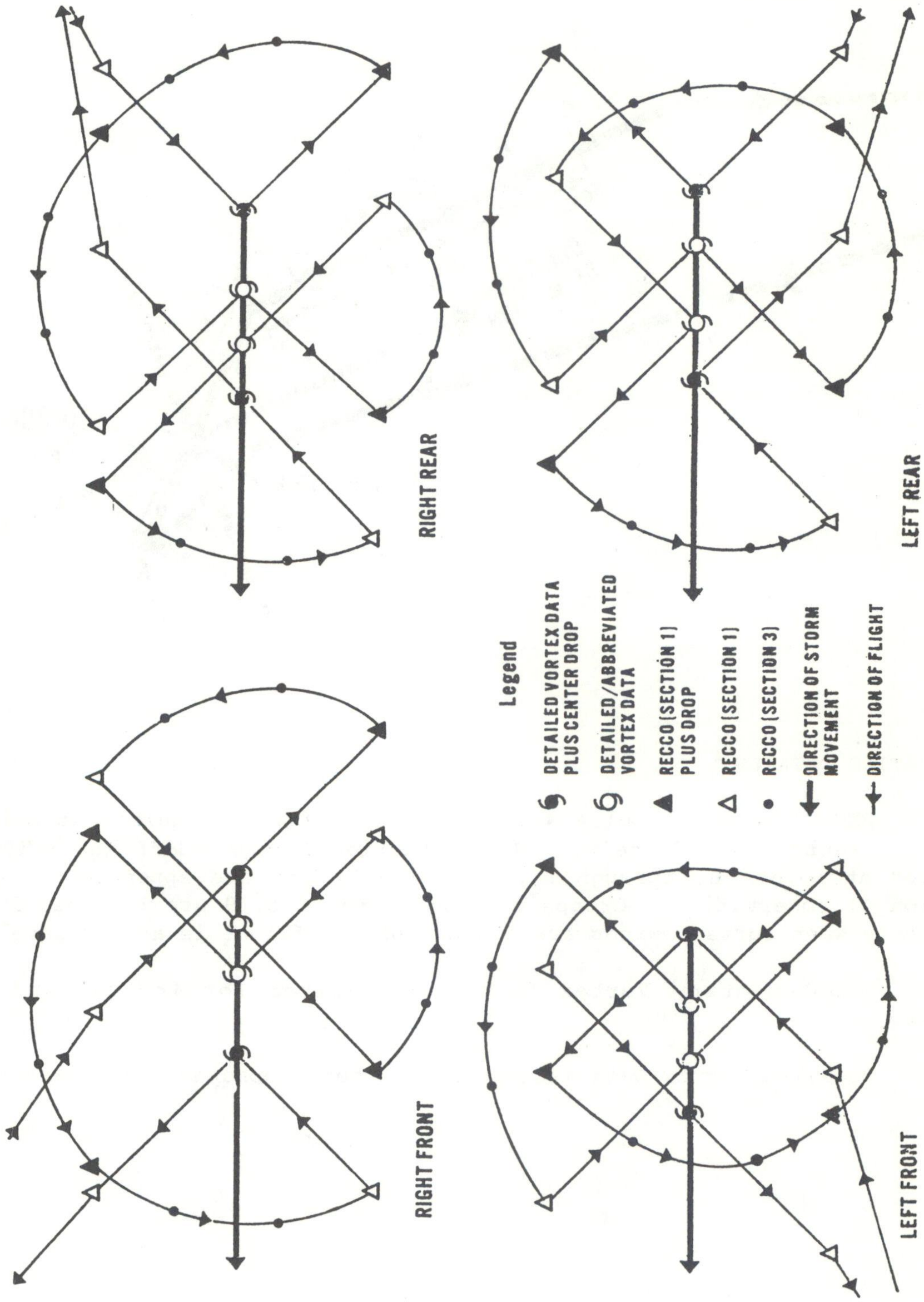
5. Dropsonde data are required in each quadrant at triangle positions once per mission.

6. Entry and exit headings are 45° off cyclone direction of motion as specified or its reciprocal [(dd $\pm$ 45) or (dd + 180 $\pm$ 45)]. These radial headings should be maintained within 20°.

7. Current weather reconnaissance capability may preclude complete and timely satisfaction of these requirements; peripheral dropsonde soundings will be attempted whenever deemed feasible by the flight meteorologist.

CHAPTER 4
APPENDIX A
ATTACHMENT 1A

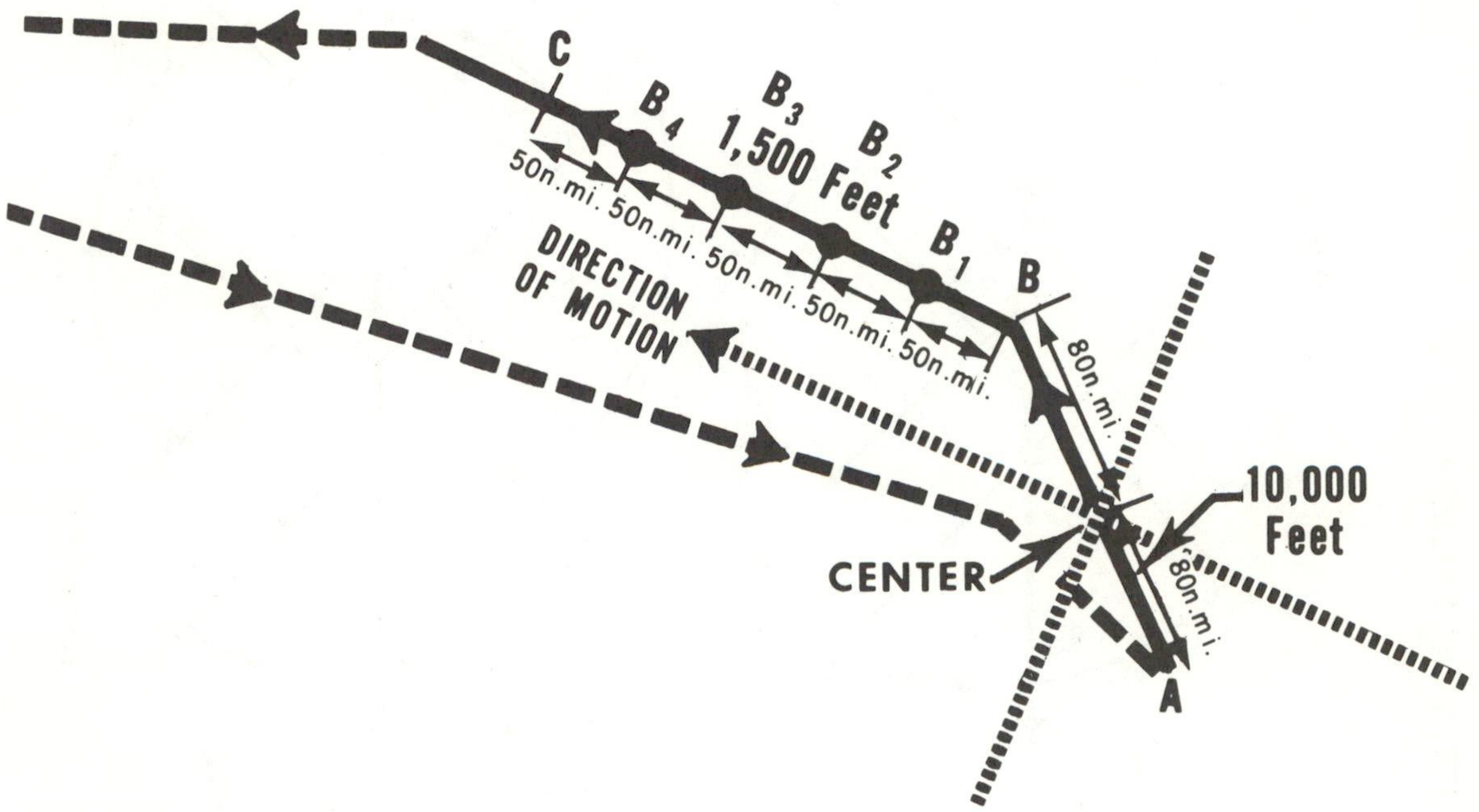
RECOMMENDED PATTERN "A" EXECUTION



CHAPTER 4
APPENDIX A
ATTACHMENT 2

OPERATIONAL FLIGHT PATTERN "B"

Provides vortex data on tropical and subtropical cyclones too distant for more than one vortex fix.



OBSERVATION DETAILS

1. RECCO (Section 1 plus 4ddff and 9ViTwTwTw) is required at points A, B, and C. Transmit immediately. RECCO (Section 3 plus 4ddff and 9ViTwTwTw) is required at points B_1 through B_4. 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.

2. Supplementary Vortex Data are required for inbound and outbound radials.

3. Detailed Vortex Data message and center dropsonde report are required.

CHAPTER 4
APPENDIX A
ATTACHMENT 3
FIGURE 1
OPERATIONAL FLIGHT PATTERNS C-1 THROUGH C-4
VORTEX AND PERIPHERAL DATA ON DIFFUSE TROPICAL OR SUBTROPICAL CYCLONES

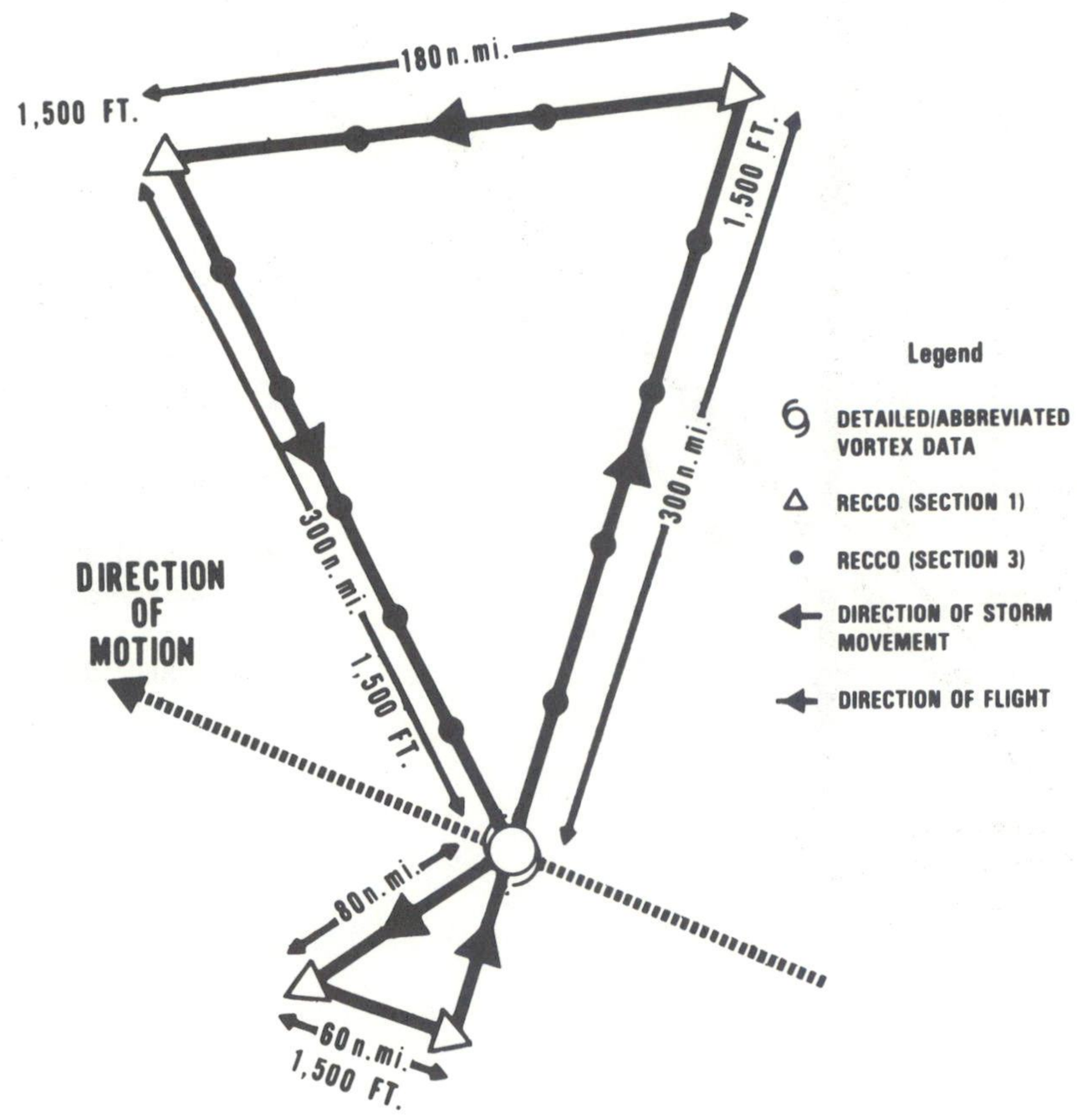
OBSERVATION DETAILS

1. RECCO (Section 1 plus 4ddff and 9ViTwTwTw) is required for each transit of a triangle position. 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 or Abbreviated/Detailed Vortex Message. Group 4 is included in observations only when surface winds are discernable.

2. Abbreviated/Detailed Vortex Data Message is required for each transit of the center when applicable.

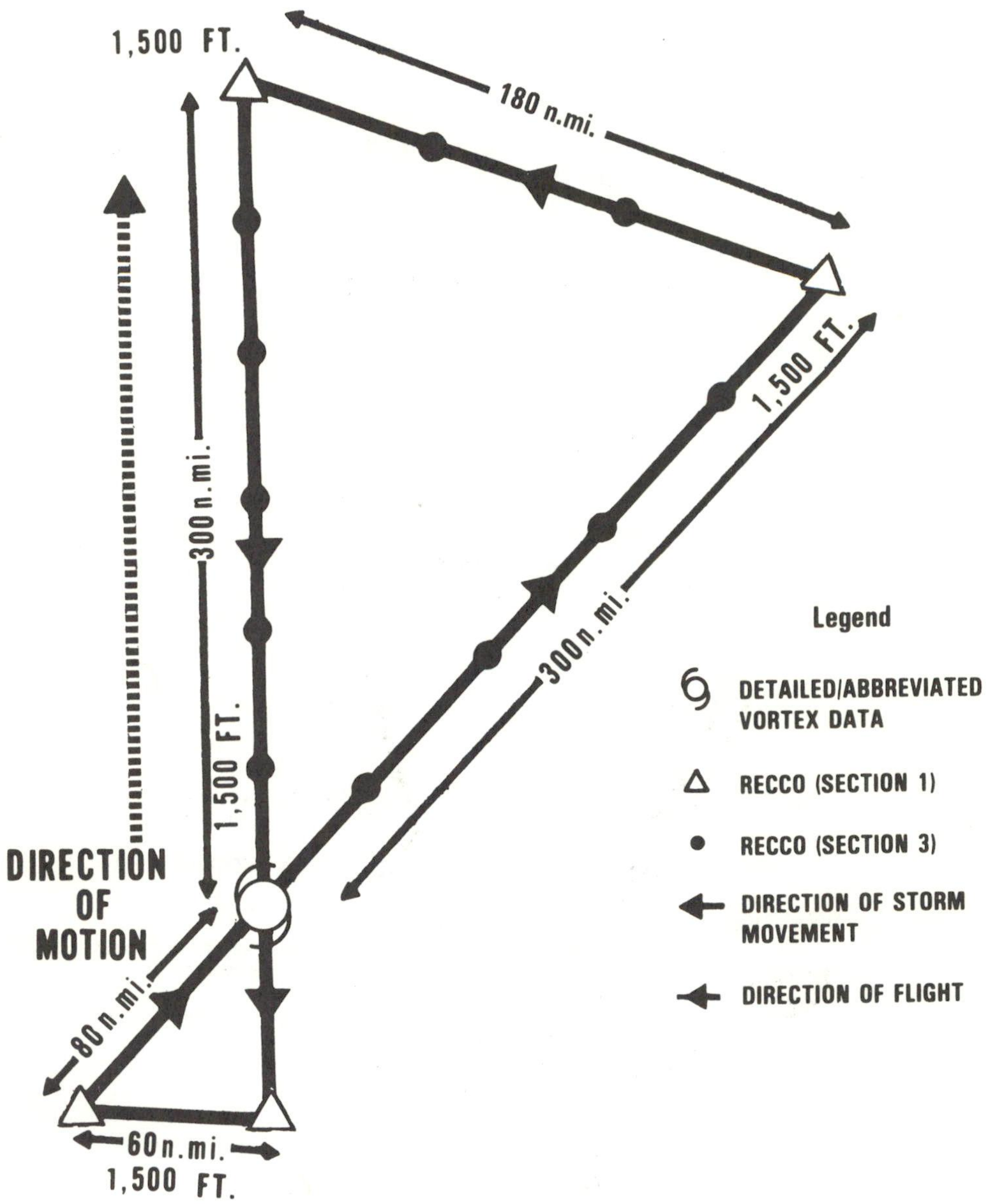
3. The maximum flight level wind observed on an outbound radial will be appended to the next RECCO observation.

OPERATIONAL FLIGHT PATTERN C-1



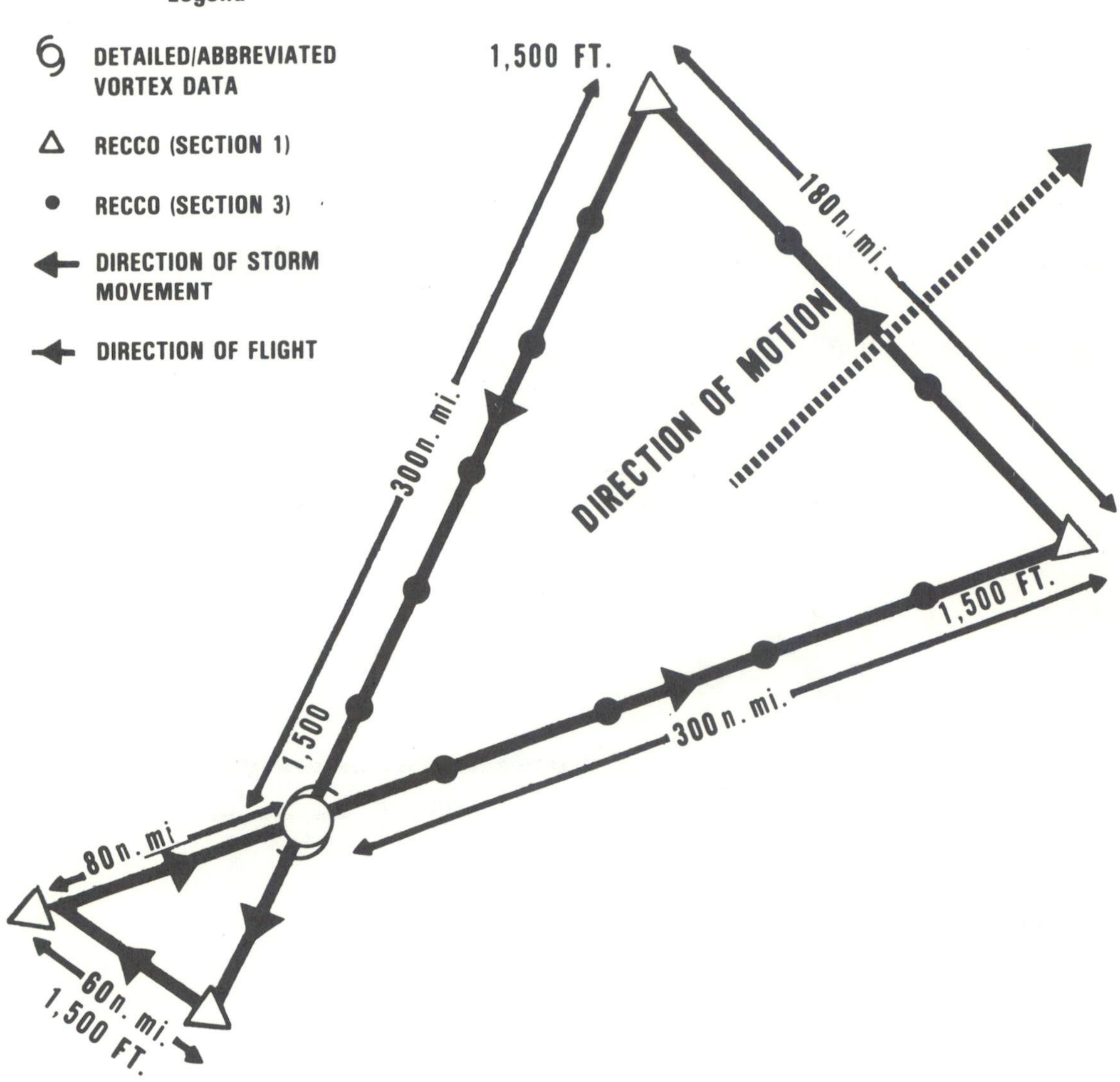
CHAPTER 4
APPENDIX A
ATTACHMENT 3
FIGURE 2

OPERATIONAL FLIGHT PATTERN C-2



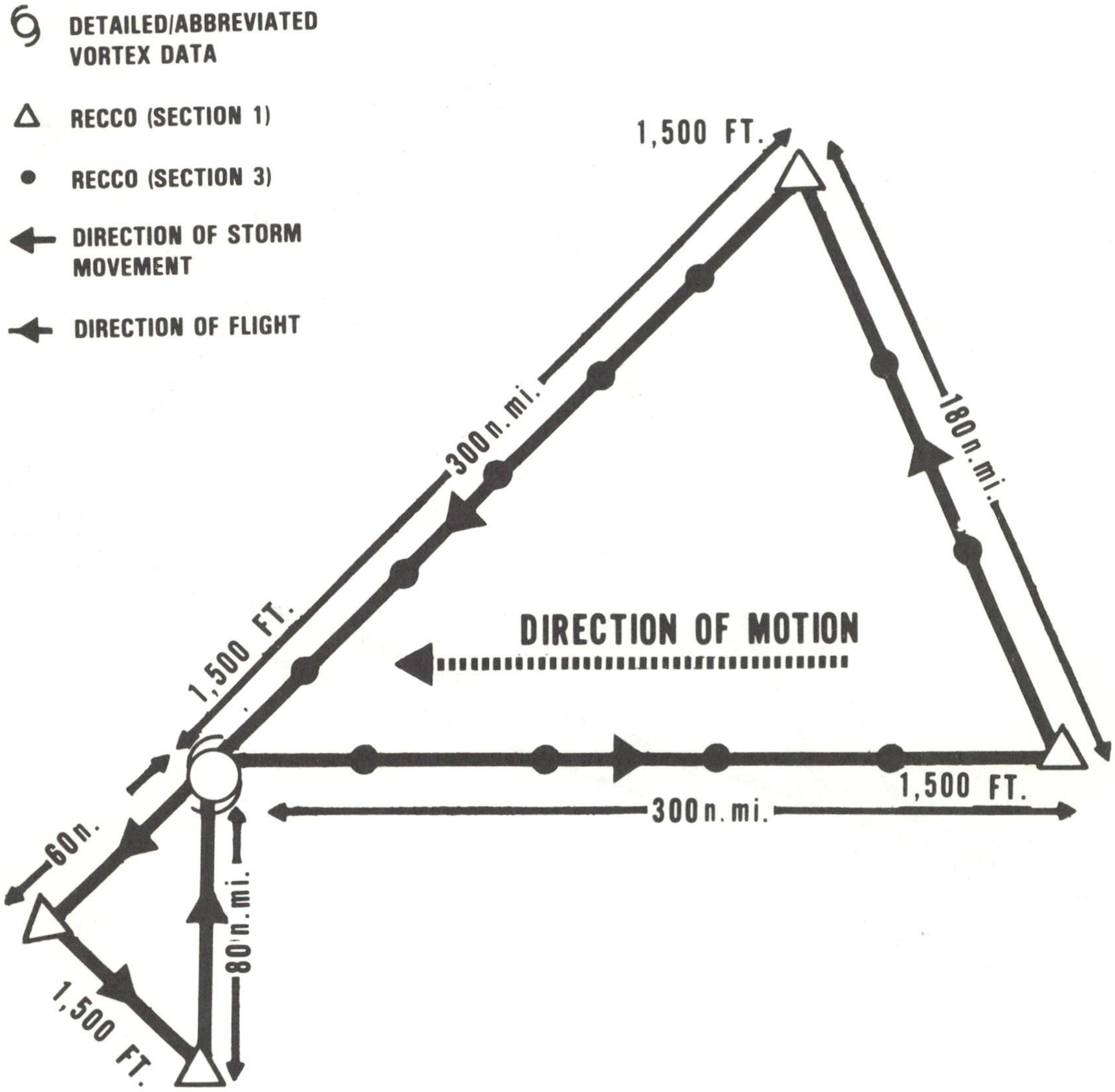
CHAPTER 4
APPENDIX A
ATTACHMENT 3
FIGURE 3

OPERATIONAL FLIGHT PATTERN C-3



CHAPTER 4
APPENDIX A
ATTACHMENT 3
FIGURE 4

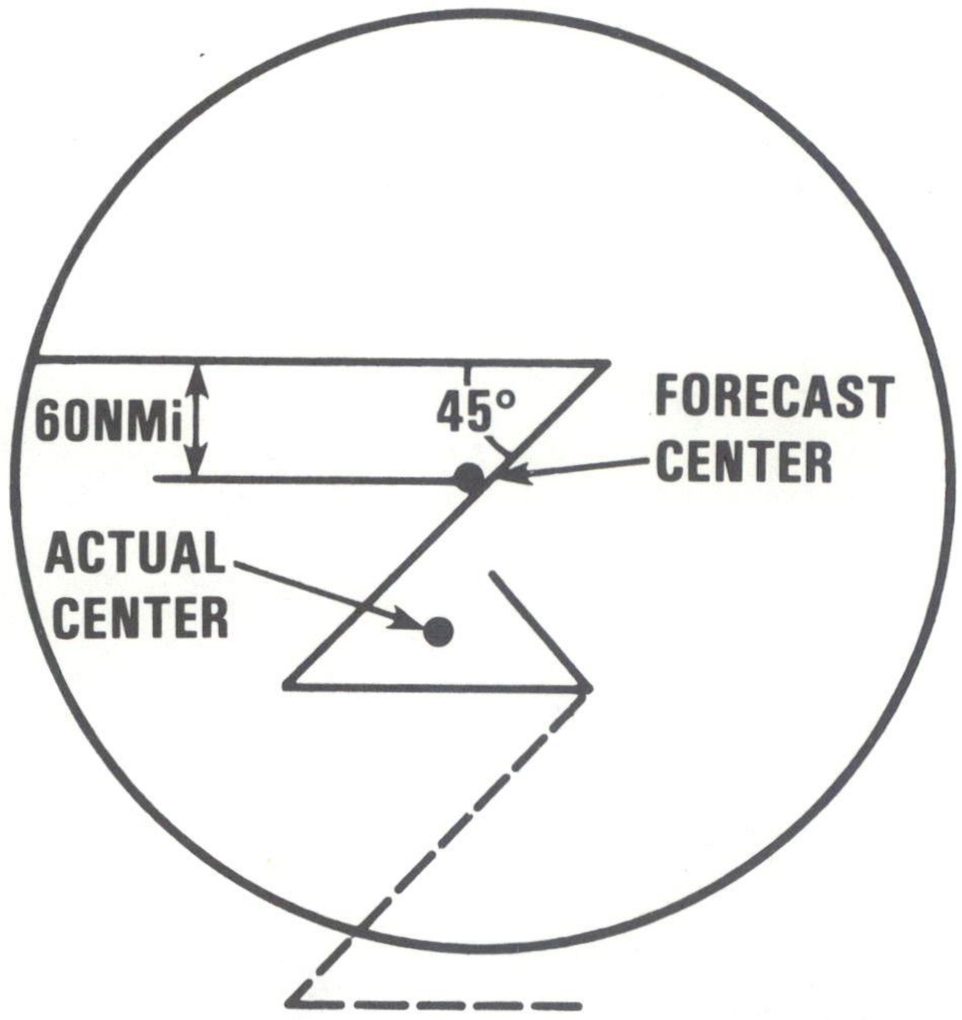
OPERATIONAL FLIGHT PATTERN C-4



CHAPTER 4
APPENDIX A
ATTACHMENT 4

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.

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.

WEATHER INSTRUMENTED USAF C-130 AIRCRAFT FLOWN FOR HURRICANE RECONNAISSANCE

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)

CHAPTER 4
APPENDIX B
FORM 3

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.

27085

SUPPLEMENTARY VORTEX DATA MESSAGE FORM

DATE	AIRCRAFT NUMBER	FLIGHT METEOROLOGIST
MANOP HEADING (PRECEDENCE IMMEDIATE)		
MISSION IDENTIFIER AND OBSERVATION NUMBER		

SUPPLEMENTARY VORTEX DATA MESSAGE

1 AZIMUTH	2 ddDEG DEG	3 FLZZZ FL					
4 LEFT RIGHT	5 FRONT REAR	6 QUAD					
7 DjHHH 8	8 DTTQQ 8	9 DjHHH 4	10 DTTQQ 4	11 DjHHH 3	12 DTTQQ 3	13 DjHHH 1	14 DTTQQ 1
15 DjHHH Ø	16 DTTQQ Ø	17 64RRR 64	18 50RRR 50	19 34RRR 34	20 MXFFF MX	21 BBBRR	22 hhhhh
23 LEFT RIGHT	24 FRONT REAR	25 QUAD					
26 DjHHH 8	27 DTTQQ 8	28 DjHHH 4	29 DTTQQ 4	30 DjHHH 3	31 DTTQQ 3	32 DjHHH 1	33 DTTQQ 1
34 DjHHH Ø	35 DTTQQ Ø	36 64RRR 64	37 50RRR 50	38 34RRR 34	39 MXFFF MX	40 BBBRR	41 hhhhh
42 LEFT RIGHT	43 FRONT REAR	44 QUAD					
45 DjHHH 8	46 DTTQQ 8	47 DjHHH 4	48 DTTQQ 4	49 DjHHH 3	50 DTTQQ 3	51 DjHHH 1	52 DTTQQ 1
53 DjHHH Ø	54 DTTQQ Ø	55 64RRR 64	56 50RRR 50	57 34RRR 34	58 MXFFF MX	59 BBBRR	60 hhhhh
61 LEFT RIGHT	62 FRONT REAR	63 QUAD					
64 DjHHH 8	65 DTTQQ 8	66 DjHHH 4	67 DTTQQ 4	68 DjHHH 3	69 DTTQQ 3	70 DjHHH 1	71 DTTQQ 1
72 DjHHH Ø	73 DTTQQ Ø	74 64RRR 64	75 50RRR 50	76 34RRR 34	77 MXFFF MX	78 BBBRR	79 hhhhh
Remarks							

CODE FIGURES	
dd	– True direction in tens of degrees (pattern orientation based on direction of storm motion).
zzz	– Flight level in hundreds of feet (absolute altitude below 5500 feet).
D	– Group indicator designating the distance from the center in nautical miles (8–80, 4–45, 3–30, 1–15, Ø–center).
hhhhh	– Height of the eyewall in feet.
jHHH	– Pressure height data in RECCO format.
TTQQ	– Temperature/dewpoint in degrees Celsius. Add 50 for negative values.
FFF	– Maximum observed wind speed in knots.
BBBRR	– Bearing and range from the center of MXFFF.
RRR	– Radial extent of 64 kt, 50 kt, and 34 kt winds from the center in nautical miles.
//	– Data are unknown or unobtainable.

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:

Premission Coordinates (As Updated Prior to TKO) _____ N _____ W

Flight Pattern _____

Mission Requirements Times _____

RECONNAISSANCE MISSION PERFORMANCE:

Flight Flown:	____Completely	____Partially	____Other
Horizontal Data Coverage:	____Complete	____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: _____

_____

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 and 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-NESS)
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-NESS) - Same as for 1 minute observation.
(Observation Manop Heading) (Date/Time)
URNT11 KMIA 281642
NOAA2 0401 ANA OB 03
(RECCO text)
97779 12428.....93///
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	RFC	RFC	
41C	42RF	43RF	
C130	P-3(A)	P-3(B)	

+20—— +25	+25—— +30	+30—— +35	+35—— +40
RADAR	RADAR	RFC	RFC
		41C	42RF
		C130	P-3(A)

+40—— +45	+45—— +50	+50—— +55	+55—— +60
RFC		RADAR	RADAR
43RF			
P-3(B)			

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 NESS 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.

CHAPTER 4

APPENDIX C

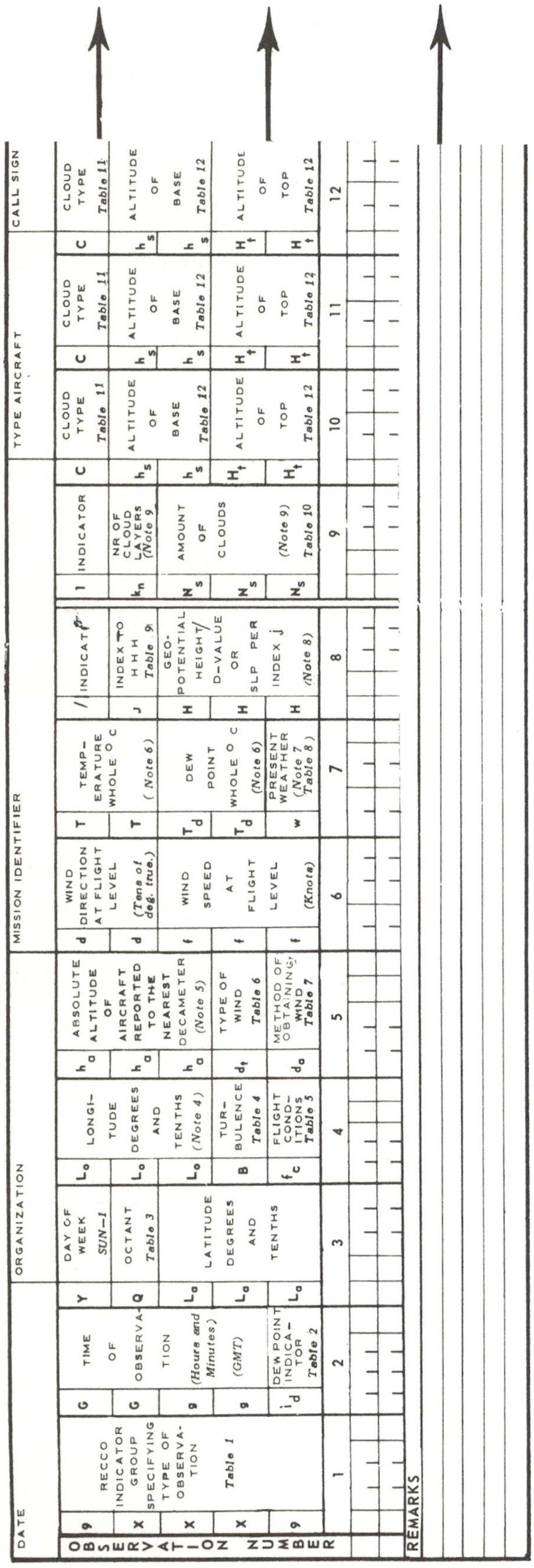
RECONNAISSANCE ORGANIZATION COMMUNICATION CAPABILITIES

STATION	ADDRESS	TELETYPE	TELEPHONE
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 808-836-3419
Naval Eastern Oceanography Center	NAVEASTOCEANCEN Norfolk, VA	B	AV 690-7750
Naval Western Oceanography Center	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 4
APPENDIX C

RECCO RECORDING FORM



CHAPTER 4
APPENDIX C

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. An intermediate observation is only reported at the specific request of a customer. The intermediate observation is reported following Section One (or Section Two if appended to Section One) in the order that it was taken. Section Three data are observed/measured at a flight lvl close to the flight lvl of the Section One data to which they are attached.

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. "Remarks 700MB FL TEMP" vice "700MB FL TEMP". Remarks may be abbreviated so long as the intended msg is not misunderstood. For instance, "700MB HSS 113" or "WND 40830" will not convey as much meaning as "700MB HSS 3113 METERS" or "SFC WND 080DEG 30KTS". 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^{o} to 180^{o}.

5. If the radar/radio altimeter is inoperative, the aircraft is overland, or if the geopotential system adjustment is not within established limits, the pressure altitude is entered for $h_ah_ah_a$ (in decameters) in lieu of absolute altitude.

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 $-50^{o}C$ is given as 00, the distinction between $-50^{o}C$ and $0^{o}C$ being made from i_d. Missing or unknown temperatures are reported as //. When the dew point is colder than $-49.4^{o}C$, the actual value will be reported as a plain language remark - E.G. DEW POINT $-52^{o}C$.

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

8. When j is reported as a 9, HHH is encoded as /// and pressure altitude is entered in $h_ah_ah_a$.

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. k_n will be reported as a solidus whenever it is impossible to determine that clouds exist due to darkness or other reasons. In those cases where a cloud layer(s) is discernible but a descriptive cloud picture of the observation circle is not possible, k_n will be encoded as a solidus. An appropriate remark should be included, i.e., clouds below . When clouds are present in indefinite layers (chaotic sky), 9 is reported for k_n and the total amount of cloud covering the sky is reported by the first N_s with /'s reported for the remainder. 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. When k_n is coded as a solidus, N_s are coded as 9. Remarks such as "Clear Above" or "As Below" will be made to indicate the presence or absence of cloud data when such data are not completely descriptive of cloud data within the observation circle.

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 or in the preceding hour (whichever period is shorter) along the track are reported for W_s.

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

CHAPTER 4
APPENDIX C

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 Clear
1 Clouds, tops less than 10,000 ft
2 Clouds, tops 10,000 ft to 18,000 ft
3 Clauds, tops over 18,000 ft
4 Clouds, bases less than 10,000 ft
5 Clouds, bases 10,000 ft to 18,000 ft
6 Clouds, bases above 18,000 ft
7 Between layers, no clouds flt lvl
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 (less than 1/8 cloud at any level)
1 Scattered (1/8 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 dark − ness

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 geopo− tential data not within ± 30 meters/4 mb accuracy requirements.

TABLE 10 N_s

0 None
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 or cloud amount can not be estimated

TABLE 11 C

0 Cirrus (Ci)
1 Cirrocululus (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
2 E
3 SE
4 S
5 SW
6 W
7 NW
8 N
9 all directions

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

CODE TABLES (CONTINUED)

TABLE 16 w_d

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

TABLE 17 I_r

7 Light
8 Moderate
9 Severe
/ Unknown or contrails

TABLE 18 I_t

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

TABLE 19 S_r, E_w, E_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

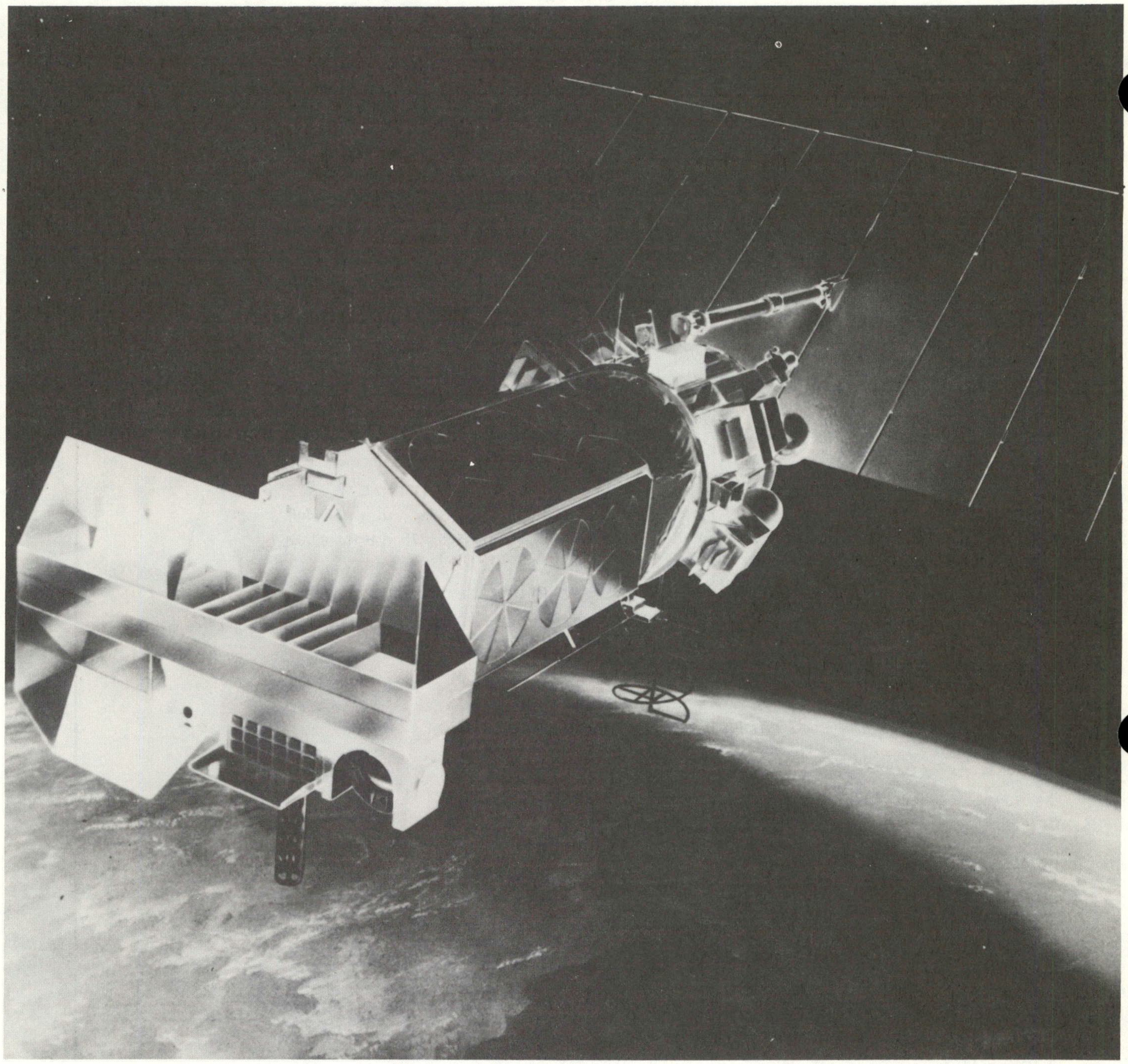
1 Inflight visibility 0 to and including 1 nautical mile
2 Inflight visibility greater than 1 and not exceeding 3 nautical miles
3 Inflight visibility greater than 3 nautical miles

RECCO SYMBOLIC FORM

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

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$_a$L$_a$L$_a$ L$_o$L$_o$L$_o$Bf$_c$ h$_a$h$_a$h$_a$d$_t$d$_a$
ddfff TTT$_d$T$_d$w /jHHH



NOAA'S POLAR ORBITING SATELLITES, TIROS-N AND NOAA-6, VIEW EVERY PORTION OF THE EARTH'S SURFACE FOUR TIMES DAILY, AND PROVIDE ENVIRONMENTAL INFORMATION NOT VIEWED BY THE GOES SATELLITES. THEY ARE AT AN ALTITUDE OF ABOUR 540 MILES.

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 resolution fixed standard sectors are produced. During the night (also available in daylight), the same geographical coverage standard sectors are produced with 9 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 Earth Satellite Service (NESS) 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 Service 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 reesponsible 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 9 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; FTS San Francisco Operator 556-0220; Honolulu 836-2776.

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

(5) New Orleans - 24 hours a day (summer of 1981)

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. NESS 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 (AFGWC) at Offutt AFB, NE; and locally at the direct readout site at Hickam AFB, HI.

a. Disturbance Observation. When numbered/named systems or disturbances suspect of development are observed in these DMSP readouts, and the National Hurricane Center (NHC) determines that coverage from available NESS satellites should be supplemented, teletype bulletins describing the location and intensity classification of the system will be transmitted in the format shown in Appendix B, Form 2. Units will respond to OL-G, AWS (Air Weather Service) telephonic requests (confirmation messages will be transmitted). Procedures are:

(1) Hickam readout will provide data directly to the Central Pacific Hurricane Center (CPHC).

(2) AFGWC will provide data in the NHOP area of responsibility not covered by the Hickam readout.

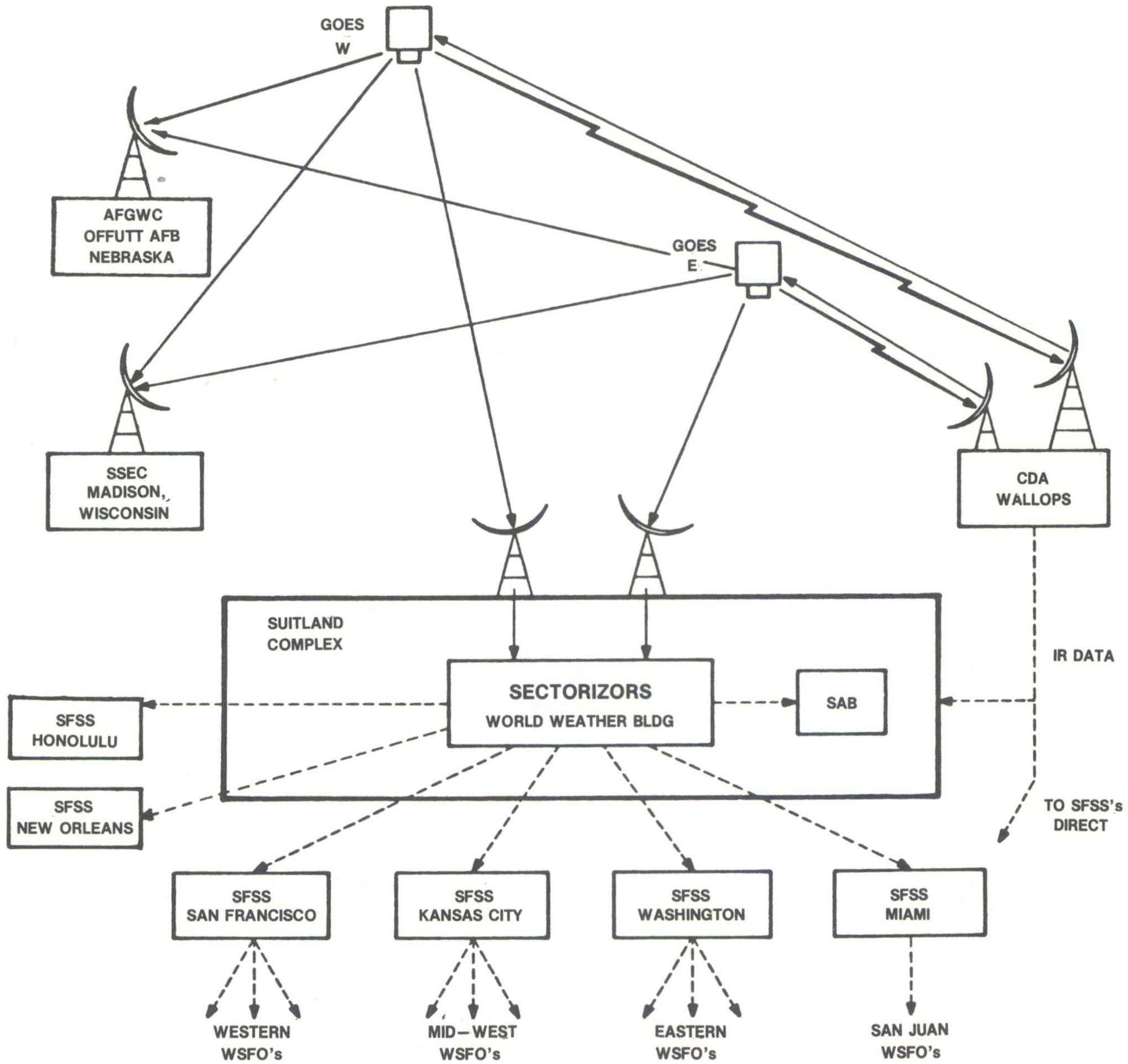
b. Northeast Atlantic Surveillance. AFGWC readouts will augment NESS surveillance for the region poleward of 30 degrees north and east of 35 degrees west. AFGWC will transmit teletype bulletins (paragraph 4.a. description) to NHC on organized disturbances evident at the Tropical Classification-1 (T-1) level or higher, until the system exits this boundary, becomes extratropical, or dissipates.

5. Satellites and Satellite Data Availability for the 1981 Hurricane Season. Appendix A, Attachment 2 of this chapter lists satellite capabilities for the 1981 hurricane season.

#CHAPTER 5
APPENDIX A
ATTACHMENT 1

GOES

OPERATIONAL DATA FLOW



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

Satellite	Type of Data	Local Time	Remarks
GOES East - 75.0°W GOES West - 135.0°W 4 Spacecraft (standby) limited operational capability	VISSR	Every 30 minutes (24 hr/day) (Limited scan for short-interval viewing available)	1. 1, 1, and 2 km resolution visible standard sectors covering Western United States, Midwest, and Eastern United States (daylight). 2. 9 resolution equivalent IR geographic 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 9 km). 5. Full disc IR (day and night). 6. Movie loops 7. Wind analysis 8. Cloud top heights
TIROS-N	TOVS ONLY	1545 /03450	1. Mapped digitalized data (cloud cover imagery) 2. Unmapped imagery (all data types) AF sites. 3. Sea-surface temperature analysis
NOAA 6	AVHRR GAC and LAC recorded HRPT and APT (direct) TOVS	0740 /1940	3. Moisture analysis 4. Soundings
NOAA 7	(PLANNED LAUNCH MAY 1981)	1430 /0230	
DMSP	LF LS	0700	1. Unmapped imager (all data types) 2. Mapped imagery (LS data only)

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
VISSR - Visible-Infrared Spin Scan Radiometer

LF - Light Fine (Visual Scanning Radiometer 0.3 nmi)
LS - Flight Smooth (Visual Scanning Radiometer 1.5 nmi)

CHAPTER 5
APPENDIX B
FORM 1

SAMPLE OF SATELLITE TROPICAL DISTURBANCE SUMMARY

ABXX 15 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)
*ABXX 15 KMIA	0700Z	Atlantic/Caribbean	IR NITE
*ABXX 11 KMIA	1900Z	Atlantic/Caribbeen	VIS/IR DAY
*ABXX 15 KSFO	0800Z	Eastern Pacific	IR NITE
*ABXX 11 KSFO	2000Z	Eastern Pacific	VIS/IR DAY
*ABXX 15 PHNL	1000Z	Central Pacific (N&S 140W-170E)	IR NITE
*ABXX 11 PHNL	2200Z	Central Pacific (N&S 140W-170E)	VIS/IR DAY
ABXX 12 KWBC	1100Z	Indian Ocean	IR NITE
ABXX 13 KWBC	0500Z	Western Pacific (N&S W of 170°E)	VIS
ABXX 14 KWBC	2300Z	Indian Ocean	VIS/IR DAY
ABXX 16 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/0
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 IWWP 105-10. 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 fluctuations in the cloud pattern occur. In practice, the C.I. number is not lowered until the T-number has shown weakening for 12 hours or more.

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).

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) #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 WSR-74C's may transmit only abbreviated special observations, defined in FMH-7, at H+35 and H+10.

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 an Aerospace Defense Command (ADCOM) radar facility, the ADCOM 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 ADCOM 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 ADCOM 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 Public Services Branch, Meteorological Services Division, NWS Headquarters, and will be strictly adhered to.

c. Air Weather Service Staff weather officers providing support to ADCOM units act as coordinators for visits. These coordinators are: Commander, Det. 41, 12 Weather Sq., 20th North American Air 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); 326 Air Division, Det. 4, 1WW, Hickam AFB, HI (AV 315-449-6262). Sites are listed in Appendix A of this chapter.

d. Appendix B lists FAA ARTCCs that may be visited.

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, 1 or 2 days, but will depend upon the progress of the hurricane under observation.

(1) NWS must notify the appropriate FAA facility coordinator by wire of the intent of weather service personnel to visit such a facility. This may be done by telephone in an emergency. Notification will normally be handled by the responsible NWS Regional Office or the Public Services Branch, Silver Spring, MD. This notification will include the name(s) of the individuals, site to be visited, and inclusive date(s) of visit.

(2) The permission to visit must be on file at the FAA facilities included in Appendix B. It will be the responsibility of the Public Services Branch, Meteorological Services Division (MSD), NWS Headquarters, Silver Spring, MD, to coordinate additions, changes, and/or deletions in the list of their personnel with the FAA facilities to be visited 2 weeks in advance of effective date of change. Coordinating correspondence should refer to this document.

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

(4) Only those personnel who have been identified by wire will be admitted to FAA facilities.

(5) NWS annually will update the list of personnel.

(6) 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	WSR057	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-81	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
**645 Radar Sq., Patrick AFB, FL	28°13'N	80°36'W
**660 Radar Sq., MacDill AFB, FL	27°50'N	82°28'W
671 Radar Sq., Key West AFS, FL	24°35'N	81°41'W
**678 Radar Sq., Tyndall AFB, FL	30°05'N	85°37'W
**679 Radar Sq., Jacksonville AFS, FL	30°13'N	81°41'W
701 Radar Sq., Ft. Fischer AFS, NC	33°59'N	77°55'W
702 Radar Sq., Hunter AAF, GA	32°01'N	81°10'W
770 Radar Sq., Ft. George G. Meade RSI, MD	39°07'N	76°44'W
**771 Radar Sq., Cape Charles AFS, VA	37°08'N	75°57'W
**792 Radar Sq., North Chalreston AFS, SC	32°54'N	80°01'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, NJ	39°49'N	74°57'W
773 Radar Sq., Montauk AFS, NY	41°04'N	71°52'W
**907 Radar Sq., 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

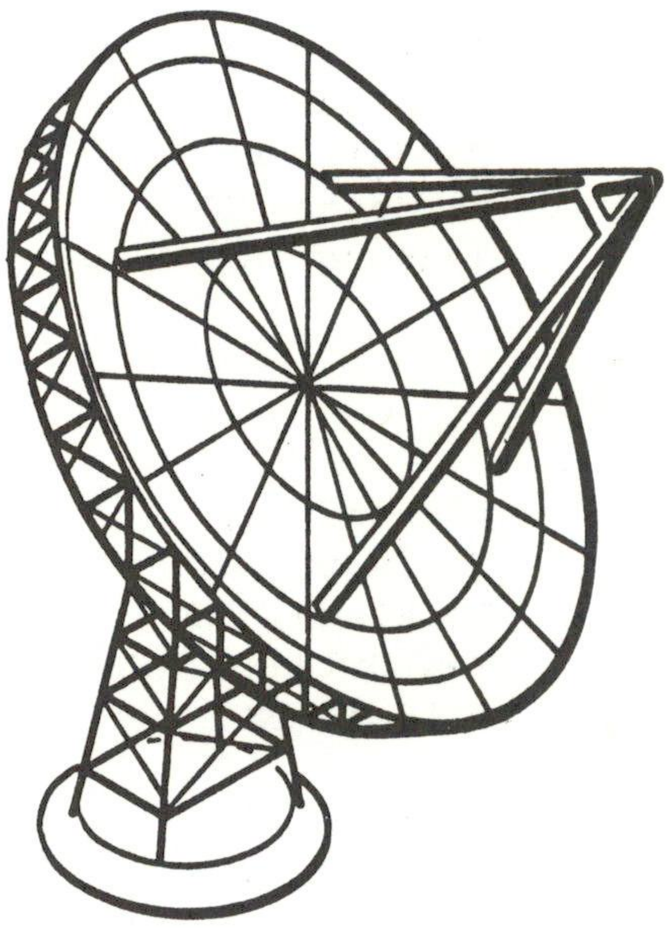
Radar used depends upon the location of the hurricane; the one in use will be properly identified.

CHAPTER 6
APPENDIX B

ADCOM and FAA Sites Remoted to ARTCC's

FAA--ARTCCs	FAA Radar Sites	Military Radar Sites
New York ARTCC (Islip NY) L.I. MacArthur Airport Ronkonkoma, LI, NY 11779 COM: 516-663-3401 FTS: 8-737-3401	New York, NY Trevose, PA Benton, PA	
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 Saratoga Springs, NY	907 Radar Sq., Bucks Harbor AFS, ME
Miami ARTCC 7500 N.W. 58th St. Miami, FL 33166 COM: 305-592-9770 FTS: 8-350-2678	MacDill, FL Patrick, FL Richmond, FL	644 Radar Sq., Richmond AFS, FL 645 Radar Sq., Patrick AFB, FL 660 Radar Sq., MacDill AFB, 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 Valdosta, GA Jedburg, SC	678 Radar Sq., Tyndall AFB, FL 679 Radar Sq., Jacksonville AFS, FL
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	Fallon, NV Oakland, CA Paso Robles, CA Red Bluff, CA Sacramento, CA	858 Radar Sq., Navy Aux. Air Sta., Fallon, NV

FAA--ARTCCs	FAA Radar Sites	Military Radar Sites
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 Mt. Laguna, CA Paso Robles, CA	751 Radar Sq., Mt. Laguna AFS, CA
Washington ARTCC Intersection Rts. 7 and 654 Leesburg, VA 22075 COM: 703-777-4400 FTS: 8-925-4400	Binns Hall, VA Raleigh (Benson), NC Washington, (Suitland), DC Roanoke (Bedford), VA	



CHAPTER 7

ENVIRONMENTAL DATA BUOY REPORTING

1. General. Environmental data buoys 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. Data buoy location and configuration are given in paragraph 4. The status and capability of data buoys can be obtained from the Data Systems Division, NOAA Data Buoy Office (NDBO), NSTL Station, MS 39529, telephone (601) 688-2836, FTS 494-2836.

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

3. Communications. Buoy data are transmitted by UHF communications via the GOES satellite to NESS and then are relayed on to NMC, Suitland, MD, for processing and dissemination. Data are formatted into WMO FM24V 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	26.0/86.0	10 m	10 m
42008*	28.7/95.3	Platform	15 m
42009*	29.3/87.5	5 m	5 m

b. Atlantic Ocean

Station ID	Location °N/°W	Buoy Size	Sensor Height
41001	34.7/72.3	12 m	10 m
41002	32.3/75.3	10 m	10 m
41003*	30.3/80.4	6 m	5 m
41004*	32.6/78.7	5 m	5 m
41005*	31.7/79.7	6 m	5 m
44003*	40.8/68.5	6 m	5 m
44004	39.0/70.0	12 m	10 m
44005	42.7/68.3	12 m	10 m
44006*	35.3/75.4	12 m	10 m

*Temporary sites established in support of other programs.

CHAPTER 7
ATTACHMENT 1

CODE FORM FM 24-V

Report of synoptic surface observation
from a sea station (AUTOMATIC weather station)

$M_i M_i M_j M_j$

$YYGGi_u \quad D_s v_s L_a L_a L_a \quad Q_c L_o L_o L_o L_o \quad s_t i_R N V^{+} h$

$0ddff \quad 1w^{+}w^{+}WW \quad 2s_n TTT \quad (3s_n T_d T_d T_d)$

$5PPPP \quad (6a^{+}p_v p_v p_v) \quad (7RRRT_R) \quad (8N_h C_L C_M C_H)$

$(91_{s} E_{s} E_{s} R_{s}^{+}) \quad (s_n T_w T_w T_w n_w \quad P_w P_w H_w H_w P_w \quad P_w H_w H_w d_w d_w$

$(P_w P_w H_w d_w d_w)) \quad A_1 b_w n_b n_b n_b$

This is the entire code form, including groups not included in U. S. EDB reports. 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
NMO8	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 (NAVWESTOCEANCEN will serve as secondary backup)
(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

Deputy Director for Operations (Environmental Services)
The Joint Chiefs of Staff
Washington, DC 20301

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
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
NAM	Navy Communications Area Master Station Atlantic
NASA	National Aeronautics and Space Administration

(continued)

#NAVEASTOCEANCEN	Naval Eastern Oceanography Center
#NAVWESTOCEANCEN	Naval Western Oceanography Center
NDBO	NOAA Data Buoy Office
NESS	National Earth Satellite 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
VHRR	Very High Resolution Radiometer
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)

METRIC CONVERSION FACTORS

LENGTH

From	Approximate Factor	To/From	Approximate Factor	To
inches	2.5	centimeters	0.4	inches
feet	30.5	centimeters	0.03	feet
feet	0.3	meters	3.3	feet
yards	0.9	meters	1.1	yards
st. miles	1.6	kilometers	0.6	st. miles
n. miles	1.85	kilometers	0.54	n. miles

AREA

sq. in.	6.5	sq. cm.	0.16	sq. in.
sq. ft.	0.09	sq. m.	11.1	sq. ft.
sq. ft.	0.8	sq. m.	1.2	sq. yd.
sq. st. mi.	2.6	sq. km.	0.4	sq. st. mi.
acres	0.4	hectares	2.4	acres

MASS

ounce	28.0	grams	0.035	ounce
pound	0.45	kilogram	2.2	kilogram
short ton	0.9	metric ton	1.1	short ton

VOLUME

fl. oz.	30.0	milliliter	0.03	fl. oz.
qt.	0.95	liters	1.06	qt.
cu. in.	16.0	milliliter	0.06	cu. in.
cu. ft.	0.03	cu. meters	35.0	cu. ft.
cu. yd.	0.76	cu. meters	1.3	cu. yd.

TEMPERATURE

Fahrenheit	0.56 after subtracting 32	Celsius	1.8 then add 32	Fahrenheit

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FEDERAL COORDINATOR FOR
METEOROLOGICAL SERVICES AND SUPPORTING RESEARCH

INTERDEPARTMENTAL COMMITTEE FOR
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- o Automated Weather Information Systems
- o Radiological, Gaseous and Particulate Transport Models
- o Weather Radar Systems

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- o Cooperative Backup Among Operational Processing Centers
- o Dissemination of NMC Products
- o Hurricane Operations
- o Marine Environmental Predictions
- o Meteorological Codes
- o Metric Implementation
- o Operational Processing Centers
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