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OFCM



OFFICE OF THE FEDERAL COORDINATOR FOR  
METEOROLOGICAL SERVICES AND SUPPORTING RESEARCH

# National Hurricane Operations Plan

FCM-P12-2007



*Hurricane Gordon - 18 September 2006 - GOES 12*

Washington, DC  
May 2007

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**NATIONAL HURRICANE OPERATIONS PLAN**

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## CHANGE AND REVIEW LOG

Use this page to record changes and notices of reviews.

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1	5-16 through 5-23	8/30/2007	RJD
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Changes are indicated by a vertical line in the margin next to the change or by shading and strikeouts.

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## FOREWORD

The Interdepartmental Hurricane Conference (IHC) is sponsored annually by the Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM) to provide a forum for the responsible Federal agencies, together with representatives from the user communities like emergency management, to review the Nation's hurricane forecast and warning program and to make recommendations on how to improve the program in the future. The major objective is to plan and prepare for the upcoming hurricane season. The 61<sup>st</sup> IHC was held in New Orleans, Louisiana, March 5-9, 2007, and the new procedures, procedural changes, and agreements reached at the conference were incorporated into this publication—the 45<sup>th</sup> edition of the *National Hurricane Operations Plan* (NHOP).

At the 61<sup>st</sup> IHC, the Working Group for Hurricane and Winter Storms Operations and Research (WG/HWSOR) addressed 15 action items. Of the 15, 11 will be closed through incorporation into the 2007 NHOP as approved recommendations and/or changes. One of the items was informational in nature, and one was withdrawn following further discussion. Detailed descriptions of the action items are available on the OFCM's web site at [http://www.ofcm.gov/homepage/text/spc\\_proj/ihc.html](http://www.ofcm.gov/homepage/text/spc_proj/ihc.html).

This edition includes a number of minor revisions and changes to Chapter 3, *General Operations and Procedures of the National Weather Service Hurricane Centers*, and Chapter 5, *Aircraft Reconnaissance*. In Chapter 5, the requirement for high-density/high-accuracy (HD/HA) data is updated to include surface wind and rain-rate data from the stepped frequency microwave radiometer, when available. Detailed information on the new HD/HA data message is contained in Appendix G. Additionally, Chapter 6, *Satellite Reconnaissance*, and Appendix A, *Local National Weather Service (NWS) Office Products* contain some important updates.

After the historic 2005 Atlantic tropical cyclone season, the 2006 season was rather calm. Ten tropical storms formed which was the fewest number since 1997. Of these ten storms, five became hurricanes, including two major hurricanes—the fewest since 2002 and close to the long-term averages of 11, 6, and 2. Of particular note, there were no landfalling U.S. hurricanes for the first time since 2001. The Northeast Pacific, however, had the most number of tropical storms (18) since 1992 and the most hurricanes (10) since 1993. Two hurricanes made landfall in Mexico, resulting in 13 deaths. The other tropical cyclone basins supported by the Joint Typhoon Warning Center and the Central Pacific Hurricane Center had average to slightly below-average years based on their 25-year average climatology.

Once again, the civilian and military organizations that make up our multiagency tropical cyclone forecast and warning system provided outstanding support to their customers. Due to their hard work and dedicated professionalism, the mission was accomplished.

Samuel P. Williamson  
Federal Coordinator for Meteorological  
Services and Supporting Research



**NATIONAL HURRICANE OPERATIONS PLAN**

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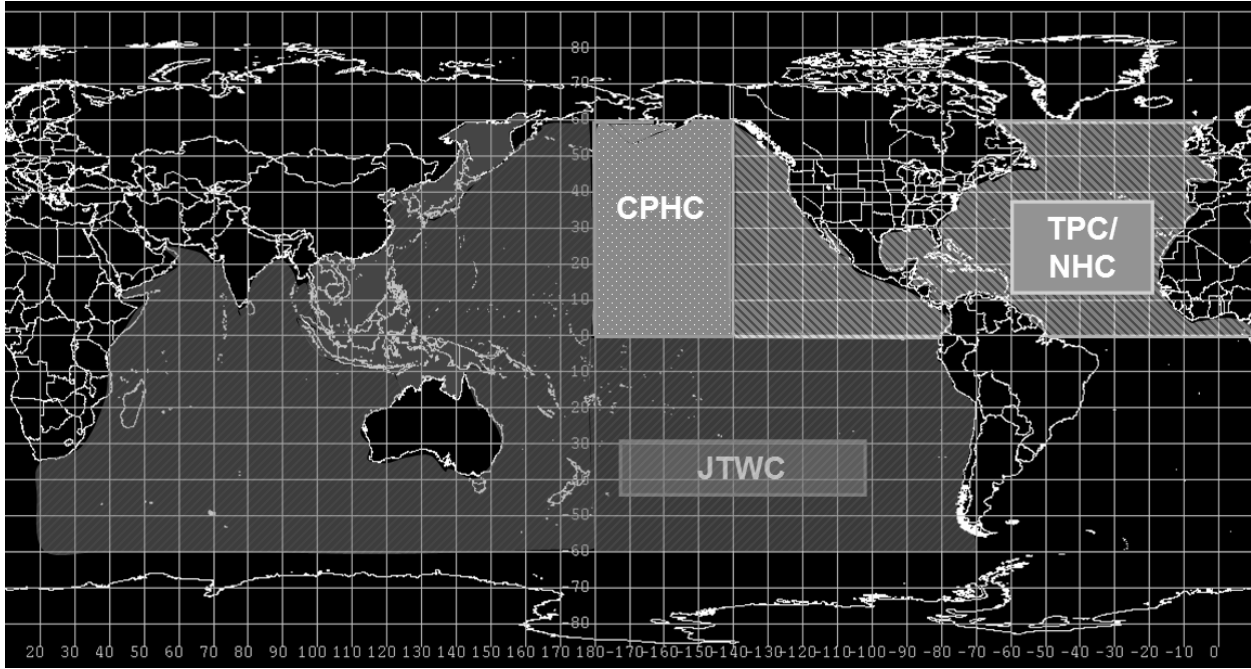


# CHAPTER 1

## INTRODUCTION

**1.1. General.** The tropical cyclone warning service is an interdepartmental effort to provide the United States and designated international recipients with forecasts, warnings, and assessments concerning tropical and subtropical weather systems. The National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce (DOC) is responsible for providing forecasts and warnings for the Atlantic and Eastern and Central Pacific Oceans while the Department of Defense (DOD) provides the same services for the Western Pacific and Indian Ocean (see Figure 1-1). NOAA, along with other Federal agencies such as the U.S. Navy and the National Aeronautics and Space Administration (NASA), also conducts supporting research efforts to improve tropical cyclone forecast and warning services. The bottom line--this interdepartmental cooperation achieves economy and efficiency in the provision of the tropical cyclone forecast and warning services to the Nation. The *National Hurricane Operations Plan* provides the basis for implementing agreements reached at the Interdepartmental Hurricane Conference (IHC), which is sponsored annually by the Office of the Federal Coordinator for Meteorological Services and Supporting Research. The goal of the IHC is to bring together the responsible Federal agencies to achieve agreement on items of mutual concern related to tropical cyclone forecast and warning services for the Atlantic and Pacific Oceans.

**1.2. Scope.** The procedures and agreements contained herein apply to the Atlantic Ocean, Gulf of Mexico, Caribbean Sea, and the Pacific Ocean. The plan defines the roles of individual agencies, participating in the tropical cyclone forecast and warning program when more than one agency is involved in the delivery of service in any specific area. When a single agency is involved in any specific area, that agency's procedures should be contained in internal documents and, to the extent possible, be consistent with NHOP practices and procedures. Please note that under the National Weather Service Modernization Plan, the former National Hurricane Center (NHC) was incorporated into the Tropical Prediction Center (TPC), one of the seven service-oriented centers and two central support activities that comprise the National Centers for Environmental Prediction (NCEP)—formerly the National Meteorological Center. The tropical cyclone warning mission still resides with the NHC (Hurricane Specialist Unit), which is a major component of the TPC. For completeness, the NHC will be referred to as TPC/NHC throughout the document.



**Figure 1-1. Tropical Cyclone Forecast Centers' Areas of Responsibility**

**Note: While the Joint Typhoon Warning Center (JTWC) has physically moved to Pearl Harbor, Hawaii, its area of responsibility remains unchanged.**

## CHAPTER 2

### RESPONSIBILITIES OF COOPERATING FEDERAL AGENCIES

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

#### **2.2. DOC Responsibilities.**

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

**2.2.2. Support to DOD.** Through NOAA's National Weather Service (NWS), the DOC will:

- Consult, as necessary, with the DOD regarding their day-to-day requirements for forecast/advisory services and attempt to meet these requirements within the capabilities of the tropical cyclone warning service.
- Provide, through the Tropical Prediction Center/National Hurricane Center (TPC/NHC), the coordinated DOC requirements for weather reconnaissance and other meteorological data to be acquired by the DOD on tropical or subtropical cyclones and disturbances.
- Provide facilities, administrative support, and the means to disseminate meteorological data for the Chief, Aerial Reconnaissance Coordination, All Hurricanes (CARCAH) as agreed to by the DOC and DOD.
- Provide the 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, including the adjacent states and possessions of the United States:

- ▶ Atlantic Ocean (north of the equator including the Caribbean Sea and Gulf of Mexico). Advisories are the responsibility of the Director, TPC/NHC, Miami, FL. The TPC/NHC will consult with the Naval Atlantic Meteorology and Oceanography Center (NAVLANTMETOCEN), Norfolk, VA, prior to issuing initial and final advisories and prior to issuing any advisory that indicates a significant change in forecast of intensity or track from the previous advisory. Exchange of information is encouraged on subsequent warnings when significant changes are made or otherwise required.
- ▶ Eastern Pacific Ocean (north of the equator and east of 140°W). Advisories are the responsibility of the Director, TPC/NHC, Miami, FL. The TPC/NHC will consult with the Joint Typhoon Warning Center (JTWC), Pearl Harbor, HI, prior to issuing initial and final advisories and prior to issuing any advisory that indicates a significant change in forecast of intensity or track from the previous advisory. Exchange of information is encouraged on subsequent warnings when significant changes are made or otherwise required.
- ▶ Central Pacific Ocean (north of the equator between 140°W and 180°). Advisories are the responsibility of the Director, Central Pacific Hurricane Center (CPHC), Honolulu, HI. The CPHC will consult with JTWC prior to issuing initial and final advisories and prior to issuing any advisory that indicates a significant change in forecast of intensity or track from the previous advisory. Exchange of information is encouraged on subsequent warnings when significant changes are made or otherwise required.
- ▶ West Pacific Ocean (Guam and Micronesia). Public advisories are prepared by the NWS Weather Forecast Office (WFO) Guam, using the tropical cyclone forecasts/advisories prepared by JTWC as guidance.

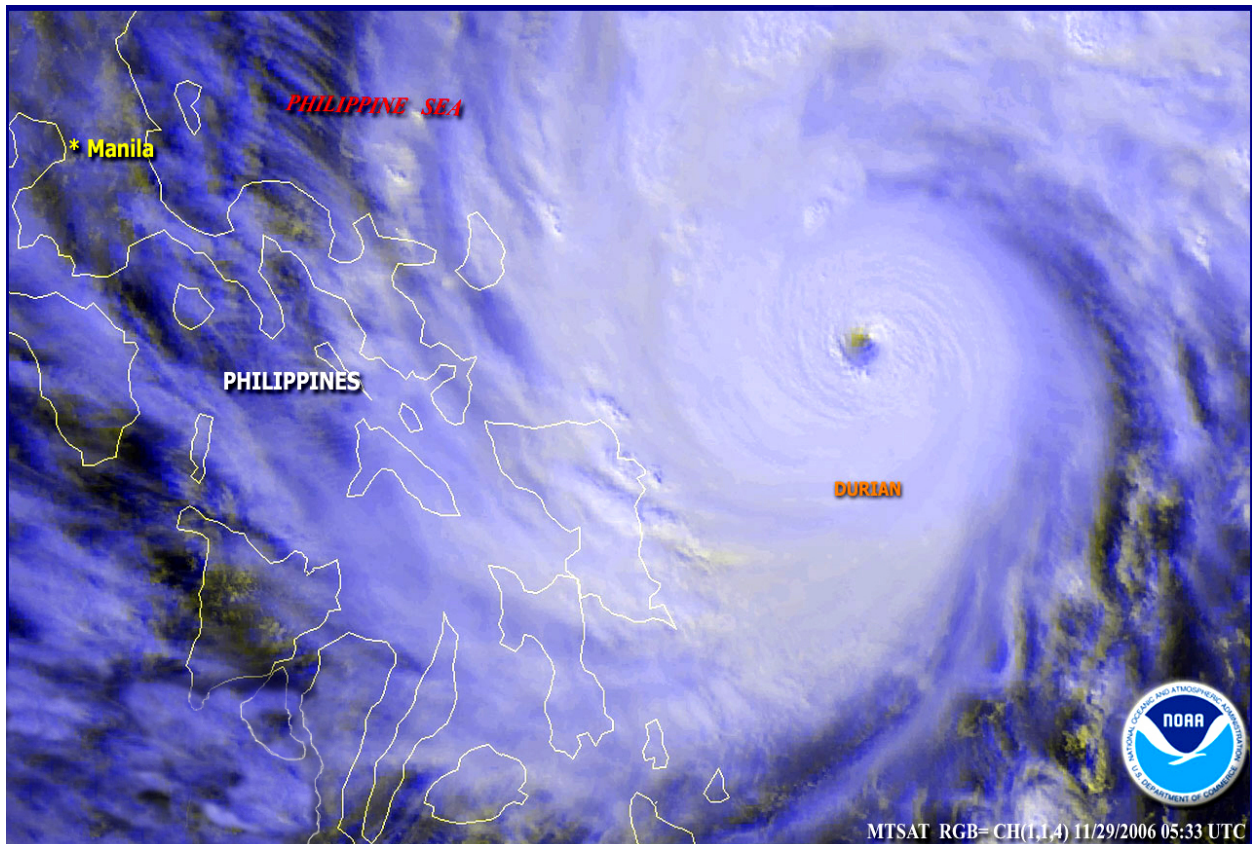
**2.2.3. Post Analysis of Tropical Cyclones.** The DOC, through NWS, will conduct an annual post analysis for all tropical cyclones in the Atlantic and the Pacific regions east of 180° and prepare an annual hurricane report for issue to interested agencies.

**2.2.4. Environmental Satellite Systems.** The National Environmental Satellite, Data, and Information Service (NESDIS) will:

- 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 Aeronautics and Space Administration (NASA) research and development satellite data and Defense Meteorological Satellite Program (DMSP) data for NWS operational use and to comply with TPC/NHC and CPHC satellite data requirements.



- Provide surveillance support with fixes and/or intensity estimates to the Joint Typhoon Warning Center (JTWC), TPC/NHC, and CPHC through analysis of all available satellite imagery.



**Figure 2-1. Typhoon Durian, November 29, 2006**

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

**2.2.6. Weather Reconnaissance.** Through the NOAA Office of Marine and Aviation Operations (OMAO), DOC will provide weather reconnaissance flights, including synoptic surveillance, as specified in Chapter 5, unless relieved of these responsibilities by the Administrator of NOAA.

**2.3. DOD Responsibilities.** The DOD will:

- Disseminate significant meteorological information on tropical and subtropical cyclones to the NWS in a timely manner.
- Provide TPC/NHC and CPHC current DOD requirements for tropical and subtropical cyclone advisories.
- Meet DOC requirements for aircraft reconnaissance and other special observations as agreed to by DOD and DOC (see Appendix F).
- Provide at TPC/NHC a 24-hour aircraft operations interface—Chief, Aerial Reconnaissance Coordination, All Hurricanes (CARCAH).
- Designate CARCAH as the liaison to TPC/NHC. CARCAH will serve as TPC/NHC's point of contact to request special DOD observations in support of this plan; i.e., DMSP fixes, additional upper-air observations, etc.
- Provide weather reconnaissance data monitor services to evaluate and disseminate reconnaissance reports.
- *Provide surveillance support with fixes and/or intensity estimates to the Central Pacific Hurricane Center through analysis of available satellite imagery. The support is provided by the 17th Operational Weather Squadron Meteorological Satellite Operations (SATOPS) Flight (17 OWS/WXJ), Joint Typhoon Warning Center, Pearl Harbor, HI, and is focused on the Indian Ocean and the Central, South, and Northwest Pacific Ocean..*
- Western Pacific Ocean (north of the equator): Provide NWS with basic meteorological information, forecasts, and associated prognostic reasoning, concerning location, intensity, wind distribution, and forecast movement of tropical cyclones for the Northwest Pacific west of 180°. JTWC will consult with WFO Guam, regarding all tropical cyclones affecting Micronesia and Guam. Consultation will occur prior to issuing initial and final advisories and prior to issuing any advisory that indicates a significant change in forecast intensity or track from the previous advisory.

- Initiate, monitor, and update satellite invest areas on the tropical cyclone satellite websites provided by the Fleet Numerical Meteorology and Oceanography Center (FNMOC) and the Naval Research Laboratory (NRL), Monterey, California. TPC/NHC and CPHC will coordinate with JTWC on the initiation of desired invest areas and will provide JTWC numbers for invest areas as required.
- Deploy, through the Naval Oceanographic Office (NAVOCEANO), drifting data buoys in support of Commander-in-Chief, Atlantic Fleet (CINCLANTFLT) requirements.

#### **2.4. DOT/DHS Responsibilities.**

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

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

**2.4.3. U. S. Coast Guard.** The Department of Homeland Security (DHS) will provide the following through the U.S. Coast Guard:

- Personnel, vessel, and communications support to the NDBC for development, deployment, and operation of moored environmental data buoy systems.
- Surface observations to NWS from *selected* coastal facilities and vessels.
- Communications circuits for relay of weather observations to NWS in selected areas.
- Coastal broadcast facilities at selected locations for tropical storm or hurricane forecasts and warnings.

**2.5. Annual Liaison with Other Nations.** The DOD, DOC, and DOT will cooperate in arranging an annual trip to the Caribbean and the Gulf of Mexico area to carry out a continuing and effective liaison with the directors of meteorological services, air traffic control agencies, and disaster preparedness agencies of nations in those areas, regarding the provision of tropical cyclone warning services. The Air Force Reserve Command (AFRC) and TPC/NHC jointly have the responsibility to plan and execute this mission. TPC/NHC will coordinate with the meteorological services in the countries to be visited. AFRC will fly the mission and will issue invitational travel orders (ITO) to the TPC/NHC Director and staff, other U.S. officials, and the media on a noninterference, non-reimbursable basis.

**2.6. Air Traffic Control/Flight Operations Coordination.** The operations officers of the principal flying units, the Assistant Manager, Operations, Air Traffic Control System Command Center, Herndon, VA, and the assistant managers for traffic management or assistant manager

for military operations, as appropriate, at key Air Route Traffic Control Centers (ARTCC) will maintain a close working relationship on a continuing basis to ensure mission success under actual tropical storm conditions. This will involve visits to each other's facilities, familiarization flights, and telephone and teletype communications to improve the understanding of each other's requirements and capabilities.

**2.6.1. Gulf of Mexico Weather Reconnaissance.** The 53rd Weather Reconnaissance Squadron and the NOAA Aircraft Operations Center operations officers will maintain a close working relationship with the Air Traffic Control System Command Center, the ARTCCs, and the Fleet Aerial Control and Surveillance Facility (FACSFAC) for the coordination of weather reconnaissance flights in the Gulf of Mexico and over the Caribbean Sea in particular, and in the United States in general. The operations officers will:

- Request the assistance of the appropriate ARTCC/FACSFAC in support of the *National Hurricane Operations Plan*.
- Provide the current operations officer's name and telephone number to the appropriate ARTCC and FACSFAC.
- Publish the unit's telephone numbers [Defense Switched Network (DSN)/Commercial] and teletype address code for Service B (Appendix I).

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

- Provide the current names and telephone numbers of points of contact to the flying units.
- Publish telephone numbers (DSN/Commercial) and teletype code for Service B (Appendix I).

## CHAPTER 3

### GENERAL OPERATIONS AND PROCEDURES OF THE NATIONAL WEATHER SERVICE HURRICANE CENTERS

**3.1. General.** This chapter describes the products, procedures, and communications headers used by the Tropical Prediction Center/National Hurricane Center (TPC/NHC) and the Central Pacific Hurricane Center (CPHC). See Appendix A for a description of local National Weather Service (NWS) office products which support the tropical cyclone forecast and warning program.

#### **3.2. Products.**

**3.2.1. Tropical Weather Outlook (TWO).** Tropical weather outlooks are prepared and issued by the TPC/NHC and CPHC during their respective hurricane seasons. The TPC/NHC writes TWOs for both the Atlantic and Eastern Pacific Basins. They are transmitted at 0530, 1130, 1730, and 2230 Eastern Local Time in the Atlantic and at 0400, 1000, 1600, and 2200 Pacific Local Time. In the Central Pacific, TWOs are transmitted by the CPHC at 0200, 0800, 1400, and 2000 UTC. The outlook briefly describes significant areas of disturbed weather and their potential for tropical cyclone development out to 48 hours. A tropical weather summary of Atlantic, Eastern Pacific, and Central Pacific tropical cyclone activity will be prepared and issued at the end of each month during the hurricane season.

**3.2.2. Tropical Cyclone Discussion.** The TPC/NHC and the CPHC will, as appropriate, issue tropical cyclone discussions on Atlantic, Eastern Pacific, and Central Pacific tropical cyclones at 0300, 0900, 1500, and 2100 UTC. Discussions will contain preliminary prognostic positions and maximum wind-speed forecasts up to 72 hours; will describe objective techniques, synoptic features, and climatology used; and will provide reasons for track changes.

**3.2.3. Tropical Cyclone Public Advisories.** Tropical cyclone public advisories are issued at 0300, 0900, 1500, and 2100 UTC, and they will be discontinued when (1) the tropical cyclone ceases to be a tropical cyclone (e.g., becomes extratropical, a remnant low, or dissipates); (2) the tropical cyclone is centered over land, is below tropical storm strength, and is not forecast to move back over water as a tropical cyclone; or (3) there are no coastal tropical cyclone watches or warnings in effect.

**3.2.3.1. Atlantic/Eastern Pacific.** Tropical cyclone public advisories are issued by the TPC/NHC for all tropical cyclones in the Atlantic. In the Eastern Pacific, tropical cyclone public advisories are issued by TPC/NHC for tropical cyclones that are expected to affect land within 48 hours. Watch and warning break points for the Atlantic are listed in Appendix B.

**3.2.3.2. Central Pacific.** In the Central Pacific, tropical cyclone public advisories are issued by CPHC for all tropical cyclones within its area of responsibility. *In addition to the main Hawaiian Islands, CPHC also issues watches and warnings for Johnston Atoll, Midway, and the northwest Hawaiian Islands (with designated break points listed in Appendix B.).*

**3.2.3.3. Western Pacific.** In the Western Pacific, WFO Guam issues public advisories, using the Joint Typhoon Warning Center's (JTWC) forecast products as guidance, for all tropical cyclones within the Territory of Guam and Micronesia. *Watches and warnings are issued for specific, designated sites in the Territory of Guam, the Commonwealth of the Northern Marianas, the Republic of Palau, the Federated States of Micronesia, and the Republic of the Marshall Islands.*

[NOTE: To further publicize local products, when a tropical cyclone threatens a land area, the following statement shall be included in the advisory...“For storm information specific to your area...please monitor products issued by your local weather office.” Tropical cyclone public advisories use statute miles for distance and miles per hour for speed. Nautical miles and knots may be added at the discretion of the centers. Atlantic advisories should include the metric units in kilometers and kilometers per hour following the equivalent English units except when the United States is the only country threatened.]

**3.2.4. Tropical Cyclone Forecast/Advisories.** Tropical cyclone forecast/advisories are issued by the TPC/NHC and the CPHC. See Section 4.3 for content and format of the advisories. In both the Atlantic and Pacific, the advisories are scheduled for 0300, 0900, 1500, and 2100 UTC. Pacific advisories should be transmitted 15 minutes before the effective time. In the Western Pacific, tropical cyclone forecasts/advisories are issued by the JTWC; Appendix C provides a listing of the abbreviated communications headings and titles for JTWC products. Information on the broadcast of tropical cyclone information to coastal and high-seas shipping can be found in Chapter 9, Marine Weather Broadcasts.

**3.2.5. Tropical Cyclone Surface Wind Speed Probabilities.** This product will be issued for all named tropical and subtropical cyclones in the Atlantic, East Pacific and Central Pacific basins and will be available no earlier than 15 minutes following the issuance deadlines for routine advisories (03, 09, 15, and 21 UTC) and after special advisories. Probabilities are statistically based on track, intensity, and wind structure uncertainties during recent years in the official tropical cyclone forecasts. They are computed for coastal and inland cities as well as offshore locations (e.g., buoys). The product provides probabilities for sustained wind speeds equal to or exceeding three wind speed thresholds: 34, 50 and 64 knots. Two types of probability values are produced: individual period and cumulative. Individual period probabilities are provided for each of the following time intervals: 0-12 hours, 12-24 hours, 24-36 hours, 36-48 hours, 48-72 hours, 72-96 hours, and 96-120 hours. These individual period probabilities indicate the chance the particular wind speed will start during each interval at each location. Cumulative probabilities are also produced for the following time periods: 0-12 hours, 0-24 hours, 0-36 hours, 0-48 hours, 0-72 hours, 0-96 hours, and 0-120 hours. These cumulative probabilities indicate the overall chance the particular wind speed will occur at each location during the period between hour 0 and the forecast hour.

**3.2.6. Tropical Cyclone Updates.** *Tropical cyclone updates (TCU) are issued by NHC and CPHC in lieu of or preceding special advisories to inform users of unexpected changes in tropical cyclones. The TCU may also be used to announce changes to international watches or warnings made by other countries, and to cancel U.S. watches or warnings.*

**3.2.7. Tropical Cyclone Position Estimates.** The hurricane centers and WFO Guam may issue a position estimate between 2-hourly intermediate public advisories whenever sufficient, reliable radar center fix information is available. Position estimates disseminated to the public, DOD, and other Federal agencies will provide geographical positions in two ways: by latitude and longitude and by distance and direction from a well-known point.

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

**3.2.9. HPC Public Advisories (TCP).** The National Centers for Environmental Prediction’s Hydrological Prediction Center (HPC) will issue public advisories after TPC/NHC discontinues its on subtropical and tropical cyclones that have moved inland in the United States or Mexico, but still pose a threat of heavy rain and flash floods in the conterminous United States or Mexico. The last NHC advisory will normally be issued when winds in an inland tropical cyclone drop below tropical storm strength, and the tropical depression is not forecast to regain tropical storm intensity or reemerge over water. The TCP is an alphanumeric product, and advisories are issued at 0300, 0900, 1500, and 2100 UTC. TCPs will continue to be numbered in sequence with tropical cyclone advisories by TPC/NHC and will reference the former storm’s name in the text. Content will refer to the decaying system’s position, intensity, general forecast trends, highlight impacts which occurred and are expected to occur (usually in relation to heavy rain/flooding and tornadoes), and indicate when the next summary will be issued. Advisories will terminate when the threat of flash flooding has ended or when the remnants of these storms can no longer be distinguished from other synoptic features capable of producing flash floods.

```

WTNT3i KWNH DDHHMM
TCPATc

PUBLIC ADVISORY NUMBER XX FOR (TROPICAL CYCLONE TYPE) (NAME)
NWS HYDROMETEOROLOGICAL PREDICTION CENTER CAMP SPRINGS MD BBCCYYYY
time am/pm time_zone day of week month DD YYYY

TEXT

SZATANEK/BANN

FORECAST POSITIONS

INITIAL    25/2100Z 29.0N 77.4W
12HR VT   26/0600Z 33.1N 72.6W
24HR VT   26/1800Z 39.4N 65.2W
36HR VT   27/0600Z 43.1N 58.2W
48HR VT   27/1800Z...DISSIPATED

$$

```

**Figure 3-1. HPC Public Advisory Product Format**

**3.2.10. Tropical Disturbance Rainfall Estimates.** As required, the TPC/NHC/CPHC will issue satellite-based rainfall estimates for tropical disturbances and tropical cyclones within 36 hours of forecasted landfall.

**3.2.11. Tropical Weather Summary (Monthly).** NHC and CPHC will prepare and issue these products each month during the hurricane season. The product will summarize the previous month's tropical cyclone activity. The last product issued at the end of the hurricane season will summarize November's activity plus the activity for the whole season.

**3.2.12. Tropical Cyclone Summary - Fixes.** CPHC will issue these products when a tropical cyclone is classifiable using the Dvorak technique. Fixes will be issued for the north central Pacific from 140°W to 180° and for the south central Pacific from 120°W to 160°E. After the initial tropical cyclone fix, succeeding fixes will be done at approximately 0000, 0600, 1200, and 1800 UTC as long as the system is classifiable using the Dvorak technique.

**3.2.13. Tropical Cyclone Danger Area Graphic.** The Tropical Cyclone Danger Area is a graphical marine product depicting a tropical cyclone's track (out to 72 hours) and shades in a danger area determined by adding 100, 200, and 300 nautical miles plus the 34-knot wind radii to the 24-, 48-, and 72- hour forecast position respectively in the Atlantic and east Pacific. For the central Pacific, the shaded danger area will vary in width dependent upon the hurricane specialist's confidence in the track and the length of the 34-knot wind radii. In addition, areas of possible tropical cyclone genesis (out to 36 hours) are included and depicted as either a circular, rectangle, oval, or polygon shaped area. The product is prepared by the TPC and covers the entire Atlantic north of the equator and the Pacific north of the equator from the Mexican and Central America coast west to 140°W. CPHC prepares a separate chart for 140°W to the International Dateline north of the equator. The product is disseminated four times per day during the hurricane season within 1 hour after the advisory package issuance. This would be at 0400, 1000, 1600 and 2200 UTC.

**3.2.14. Aviation Tropical Cyclone Advisory (TCA).** The TCA is intended to provide short-term tropical cyclone forecast guidance for international aviation safety and routing purposes. The product is prepared by TPC/NHC and CPHC for all ongoing tropical cyclone activity in their respective areas of responsibility. This requirement is stated in the World Meteorological Organization Region IV hurricane plan. TCAs list the current TC position, motion and intensity, and 6-, 12-, 18-, and 24-hour forecast positions and intensities. It is an alphanumeric text product produced by hurricane forecasters and consists of information extracted from the official forecasts. This forecast is produced from subjective evaluation of current meteorological and oceanographic data as well as output from numerical weather prediction models, and is coordinated with affected WFOs, the National Centers, and the Department of Defense. It is prepared four times daily and issued at 0300, 0900, 1500, and 2100 UTC.



FKaa2i CCCC DDHHMM TCAXXX  (TROPICAL CYCLONE TYPE) ICAO ADVISORY NUMBER ## ISSUING OFFICE CITY STATE BBCCYYYY time am/pm time_zone day mon DD YYYY  TEXT  \$\$
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**Figure 3-2. Aviation Tropical Cyclone Advisory Format**

### **3.3. Designation of Tropical and Subtropical Cyclones.**

**3.3.1. Numbering of Tropical and Subtropical Depressions.** The hurricane centers are responsible for numbering tropical and subtropical depressions in their areas of responsibility. Tropical depressions shall be numbered consecutively beginning each season with the spelled out number "ONE." For ease in differentiation, tropical depression numbers shall include the suffix "E" for Eastern Pacific, "C" for Central Pacific, or "W" for Western Pacific, after the number. In both the Atlantic and Pacific, once the depression has reached tropical storm intensity, it shall be named and the depression number dropped. The depression number will not be used again until the following year. Give tropical cyclones a name in the first advisory after intensifying to 34 knots (39 mph) or greater. In the Western Pacific, WFO Guam will use the JTWC cyclone number for all non-named systems. For Regional Specialized Meteorological Center (RSMC) Tokyo named systems, WFO Guam will use the RSMC Tokyo name with the associated JTWC number in parentheses.

The following rules apply for tropical cyclones passing from one basin to another: Retain the name if a tropical cyclone passes from one basin into another basin as a tropical cyclone; i.e., advisories are continuous. An unnamed tropical depression will also retain its number (e.g. Tropical Depression Six-E remains Tropical Depression Six-E) if it crosses into another area of responsibility. For unnamed tropical depressions moving from west to east across 180°, CPHC will use the associated Joint Typhoon Warning Center's (JTWC) number and indicate JTWC in parentheses following the number. For named systems, CPHC will use the associated (RSMC) Tokyo name and provide the associated JTWC number in parentheses.

Within a basin, if the remnant of a tropical cyclone redevelops into a tropical cyclone, it is assigned its original number or name. If the remnants of a former tropical cyclone regenerate in a new basin, the regenerated tropical cyclone will be given a new designation.

**3.3.1.1. Atlantic Basin.** Depression numbers, ONE, TWO, THREE, will be assigned by the TPC/NHC after advising the Naval Atlantic Meteorology and Oceanography Center (NAVLANTMETOCCEN) Norfolk.

**3.3.1.2. Pacific East of 140°W.** Depression numbers, with the suffix E, e.g., ONE-E, TWO-E, THREE-E, will be assigned by the TPC/NHC after advising JTWC, Pearl Harbor, HI. The assigned identifier shall be retained even if the depression passes into another warning area.

**3.3.1.3. Pacific West of 140°W and East of 180°.** Depression numbers, with suffix C; e.g., ONE-C, TWO-C, THREE-C, will be assigned by the CPHC after advising JTWC.

**3.3.1.4. Pacific West of 180° and North of 0°.** Depression numbers, with suffix W; e.g., ONE-W, TWO-W, THREE-W, are assigned by JTWC.

**3.3.1.5. Subtropical Depressions.** A single list of numbers and names will be used for all tropical and subtropical cyclones. Therefore, numbering of subtropical depressions will follow the same procedure as tropical depressions. For example, if the first subtropical depression follows the first tropical depression, the subtropical depression will be given the designation SUBTROPICAL DEPRESSION TWO. If a subtropical depression becomes a subtropical storm, it receives the next available name in the tropical cyclone naming sequence.

### **3.3.2. Numbering and Naming of Tropical and Subtropical Cyclones.**

**3.3.2.1. Numbering and Naming Tropical Cyclones.** Tropical cyclone centers will number tropical depressions in their areas of responsibility. Number tropical depressions consecutively beginning each season with the spelled out number “ONE.” In the north Pacific, for ease in differentiation, tropical depression numbers, assigned by NHC or CPHC, will include the suffix “E” for eastern (east of 140°W longitude) or “C,” for central (180° to 140°W longitude) respectively, after the number. In both the Atlantic and Pacific, once the depression reaches tropical storm intensity, name it and drop the depression number. The depression number will not be used again until the following year. Give tropical cyclones a name in the first advisory after intensifying to 34 knots (39 mph) or greater. In the Western Pacific, WFO Guam will use the JTWC cyclone number for all non-named systems. For RSMC Tokyo named systems, WFO Guam will use the RSMC Tokyo name with the associated JTWC number in parentheses.

The following rules apply for tropical cyclones passing from one basin to another: Retain the name if a tropical cyclone passes from one basin into another basin as a tropical cyclone; i.e. advisories are continuous. An unnamed tropical depression will also retain its number (e.g. Tropical Depression Six-E remains Tropical Depression Six-E) if it crosses into another area of responsibility. For unnamed tropical depressions moving from west to east across 180°, CPHC will use the associated Joint Typhoon Warning Center’s (JTWC) number and indicate JTWC in parentheses following the number. For named systems, CPHC will use the RSMC Tokyo name and provide the associated JTWC number in parentheses.

Within a basin, if the remnant of a tropical cyclone redevelops into a tropical cyclone, it is assigned its original number or name. If the remnants of a former tropical cyclone regenerate in a new basin, the regenerated tropical cyclone will be given a new designation.

**3.3.2.2. Numbering and Naming Subtropical Storms.** A single list of numbers and names will be used for all tropical and subtropical cyclones. Therefore, numbering of subtropical depressions will follow the same procedure as tropical depressions. For example, if the first subtropical depression follows the first tropical depression, the subtropical depression will be given the designation SUBTROPICAL DEPRESSION TWO. If a subtropical depression becomes a subtropical storm, it receives the next available name in the tropical cyclone naming sequence.

**3.3.2.3. Numbering Advisories and Tropical/Subtropical Cyclone Discussions.** Tropical and subtropical cyclone advisories and discussions in the Atlantic and the Pacific will be numbered similarly. Number scheduled and special advisories and TCDs consecutively beginning with the number 1 (not spelled out) for each new tropical or subtropical cyclone, and continue through the duration of the cyclone. In situations where only TCMs and TCDs are being written (tropical cyclones in the eastern Pacific not threatening land) and at a later time a public advisory is required, the public advisory number will match the corresponding TCM. In both the Atlantic and the Pacific, intermediate advisories and TCDs will retain the advisory number of the scheduled or special advisory they update and append an alphabetic designator (e.g., "HURRICANE ALLISON INTERMEDIATE ADVISORY NUMBER 20A").

#### **3.4. Transfer of Warning Responsibility.**

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

**3.4.2. CPHC to JTWC/(RSMC, Tokyo)/WFO Guam.** When a tropical or subtropical cyclone crosses 180° from east to west, the coordinated transfer of warning responsibility from CPHC to JTWC will be made and the appropriate advisory issued. At the same time, the CPHC will coordinate with the RSMC, Tokyo and WFO Guam so that they are aware that CPHC will be suspending the issuance of advisories.

**3.4.3. JTWC/RSMC, Tokyo to CPHC.** When a tropical or subtropical cyclone crosses 180° from west to east, the coordinated transfer of warning responsibility from JTWC to CPHC will be made. JTWC will append the statement, "Next advisory by CPHC-HNL" to their last advisory. At the same time, the CPHC will coordinate with RSMC, Tokyo so that they are aware that CPHC will be assuming the issuance of advisories.

### **3.5. Alternate Warning Responsibilities.**

**3.5.1. Transfer to Alternate.** In the event of impending or actual operational failure of a hurricane forecast center, tropical warning responsibilities will be transferred to an alternate facility in accordance with existing directives and retained there until resumption of responsibility can be made. Alternate facilities are as follows:

<u>PRIMARY</u>	<u>ALTERNATE</u>
TPC/NHC	National Centers for Environmental Prediction Hydrometeorological Prediction Center (HPC) Camp Springs, MD
CPHC	TPC/NHC
CARCAH	53rd Weather Reconnaissance Squadron (53 WRS)
JTWC	Fleet Numerical Meteorology and Oceanography Center (FLENUMETOCEN), Monterey, CA
WFO Guam	CPHC

**3.5.2. Notification.** The NAVLANTMETOCEN, Norfolk, and JTWC, Pearl Harbor, will be advised by TPC/NHC, CARCAH, and CPHC, as appropriate, of impending or actual transfer of responsibility by the most rapid means available. JTWC will advise CPHC, TPC/NHC, and WFO Guam of impending or actual transfer of JTWC responsibilities. In the event of a CARCAH operational failure, direct communication is authorized between the 53 WRS and the forecast facility. Contact 53 WRS at DSN 597-2409/601-377-2409 or through the Keesler AFB Command Post at DSN 597-4330/601-377-4330 (ask for the 53 WRS).

**Table 3-1. Atlantic Tropical Cyclone Names**

<u>2007</u>		<u>2008</u>		<u>2009</u>	
ANDREA		ARTHUR		ANA	
BARRY		BERTHA	BUR-tha	BILL	
CHANTAL	shan-TAHL	CRISTOBAL		CLAUDETTE	claw-DET
DEAN		DOLLY		DANNY	
ERIN	AIR-in	EDOUARD	eh-DWARD	ERIKA	ERR-ree-ka
FELIX	FEEL-ix	FAY		FRED	
GABRIELLE	ga-bree-EL	GUSTAV		GRACE	
HUMBERTO	oom-BAIR-to	HANNA		HENRI	ahn-REE
INGRID		IKE		IDA	
JERRY		JOSEPHINE	JO-ze-feen	JOAQUIN	
KAREN		KYLE		KATE	
LORENZO		LAURA		LARRY	
MELISSA		MARCO		MINDY	
NOEL		NANA		NICHOLAS	NIK-o-las
OLGA		OMAR		ODETTE	o-DET
PABLO	PA-blow	PALOMA	pa-LOW-ma	PETER	
REBEKAH		RENE	re-NAY	ROSE	
SEBASTIEN	say-BAS-tyan	SALLY		SAM	
TANYA	TAHN-ya	TEDDY		TERESA	te-REE-sa
VAN		VICKY		VICTOR	VIC-ter
WENDY		WILFRED		WANDA	
<u>2010</u>		<u>2011</u>		<u>2012</u>	
ALEX		ARLENE		ALBERTO	al-BAIR-toe
BONNIE		BRET		BERYL	BER-riI
COLIN		CINDY		CHRIS	
DANIELLE	dan-YELL	DON		DEBBY	
EARL		EMILY		ERNESTO	er-NES-toe
FIONA		FRANKLIN		FLORENCE	
GASTON		GERT		GORDON	
HERMINE	her-MEEN	HARVEY		HELENE	he-LEEN
IGOR	e-GOR	IRENE		ISAAC	EYE-zak
JULIA		JOSE	ho-ZAY	JOYCE	
KARL		KATIA	ka-TEE-ah	KIRK	
LISA	LEE-sa	LEE		LESLIE	
MATTHEW		MARIA	ma-REE-ah	MICHAEL	MIKE-el
NICOLE	ni-COLE	NATE		NADINE	nay-DEEN
OTTO		OPHELIA	o-FEEL-ya	OSCAR	
PAULA		PHILIPPE	fe-leep	PATTY	
RICHARD	RICH-erd	RINA		RAFAEL	ra-fa-EL
SHARY	SHA-ree	STAN		SANDY	
TOMAS	to-MAS	TAMMY		TONY	
VIRGINIE	vir-JIN-ee	VINCE		VALERIE	
WALTER		WHITNEY		WILLIAM	

If over 21 tropical cyclones occur in a year, the Greek alphabet will be used following the W-named cyclone.

**Table 3-2. Eastern Pacific Tropical Cyclone Names**

<b><u>2007</u></b>		<b><u>2008</u></b>		<b><u>2009</u></b>	
ALVIN		ALMA	AL mah	ANDRES	ahn DRASE
BARBARA		BORIS		BLANCA	BLAHN kah
COSME	COS may	CRISTINA		CARLOS	
DALILA		DOUGLAS		DOLORES	
ERICK		ELIDA	ELL ee dah	ENRIQUE	anh REE kay
FLOSSIE		FAUSTO	FOW sto	FELICIA	fa LEE sha
GIL		GENEVIEVE		GUILLERMO	gee YER mo
HENRIETTE	hen ree ETT	HERNAN	her NAHN	HILDA	
IVO		ISELLE	ee SELL	IGNACIO	eeg NAH cio
JULIETTE		JULIO	HOO lee o	JIMENA	he MAY na
KIKO	KEE ko	KARINA		KEVIN	
LORENA	low RAY na	LOWELL		LINDA	
MANUEL	mahn WELL	MARIE		MARTY	
NARDA		NORBERT		NORA	
OCTAVE	AHK tave	ODILE	oh DEAL	OLAF OH lahf	
PRISCILLA		POLO		PATRICIA	
RAYMOND		RACHEL		RICK	
SONIA	SONE yah	SIMON		SANDRA	
TICO	TEE koh	TRUDY		TERRY	
VELMA		VANCE		VIVIAN	
WALLIS		WINNIE		WALDO	
XINA	ZEE nah	XAVIER	ZAY vier	XINA ZEE nah	
YORK		YOLANDA	yo LAHN da	YORK	
ZELDA	ZEL dah	ZEKE		ZELDA	ZEL dah
<b><u>2010</u></b>		<b><u>2011</u></b>		<b><u>2012</u></b>	
AGATHA		ADRIAN		ALETTA	a LET ah
BLAS		BEATRIZ	BEE a triz	BUD	
CELIA		CALVIN		CARLOTTA	
DARBY		DORA		DANIEL	
ESTELLE		EUGENE		EMILIA	ee MILL ya
FRANK		FERNANDA	fer NAN dah	FABIO	FAH bee o
GEORGETTE		GREG		GILMA	GIL mah
HOWARD		HILARY		HECTOR	
ISIS		IRWIN		ILEANA	ill ay AH nah
JAVIER		JOVA	Ho vah	JOHN	
KAY		KENNETH		KRISTY	
LESTER		LIDIA		LANE	
MADLINE		MAX		MIRIAM	
NEWTON		NORMA		NORMAN	
ORLENE		OTIS		OLIVIA	
PAINE		PILAR		PAUL	
ROSLYN		RAMON	rah MONE	ROSA	
SEYMOUR		SELMA		SERGIO	SIR gee oh
TINA		TODD		TARA	
VIRGIL		VERONICA		VICENTE	vee CEN tay
WINIFRED		WILEY		WILLA	
XAVIER		XINA	ZEE nah	XAVIER	ZAY vier
YOLANDA	yo LAHN da	YORK		YOLANDA	yo LAHN da
ZEKE		ZELDA	ZEL dah	ZEKE	

**Table 3-3. Central Pacific Tropical Cyclone Names**

COLUMN 1		COLUMN 2	
<u>Name</u>	<u>Pronunciation</u>	<u>Name</u>	<u>Pronunciation</u>
AKONI	ah-KOH-nee	AKA	AH-kah
EMA	EH-mah	EKEKA	eh-KEH-kak
<i>HONE</i>	<i>HOH-neh</i>	<i>HENE</i>	<i>HEH-neh</i>
<i>IONA</i>	<i>ee-OH-nah</i>	IOLANA	ee-OH-lah-nah
KELI	KEH-lee	KEONI	keh-ON-nee
LALA	LAH-lah	LINO	LEE-noh
MOKE	MOH-keh	MELE	MEH-leh
<i>NOLO</i>	<i>NOH-loh</i>	NONA	NOH-nah
<i>OLANA</i>	<i>Oh-LAH-nah</i>	OLIWA	oh-LEE-vah
<i>PENA</i>	<i>PEH-nah</i>	<i>PAMA</i>	<i>PAH-mah</i>
<i>ULANA</i>	<i>oo-LAH-nah</i>	UPANA	oo-PAH-nah
<i>WALE</i>	<i>WAH-leh</i>	WENE	WEH-neh
COLUMN 3		COLUMN 4	
<u>Name</u>	<u>Pronunciation</u>	<u>Name</u>	<u>Pronunciation</u>
ALIKA	ah-LEE-kah	ANA	AH-nah
ELE	EH-leh	ELA	EH-lah
HUKO	HOO-koh	HALOLA	hah-LOH-lah
<i>IOPA</i>	<i>ee-OH-pah</i>	IUNE	ee-OO-neh
KIKA	KEE-kah	<i>KILO</i>	<i>KEE-lo</i>
LANA	LAH-nah	LOKE	LOH-keh
MAKA	MAH-kah	MALIA	mah-LEE-ah
NEKI	NEH-kee	NIALA	nee-AH-lah
<i>OMEKA</i>	<i>oh-MEH-kah</i>	<i>OHO</i>	<i>OH-hoh</i>
<i>PEWA</i>	<i>PEH-vah</i>	PALI	PAH-lee
<i>UNALA</i>	<i>oo-NAH-lah</i>	ULIKA	oo-LEE-kah
WALI	WAH-lee	WALAKA	wah-LAH-kah

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

**Table 3-4. International Tropical Cyclone Names  
for the Western Pacific and South China Sea**

	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	<b>V</b>
<b>Contributor</b>	<b>NAME</b>	<b>NAME</b>	<b>NAME</b>	<b>NAME</b>	<b>NAME</b>
<b>Cambodia</b>	Damrey	Kong-rey	Nakri	Krovanh	Sarika
<b>China</b>	Longwang	Yutu	Fengshen	Dujuan	Haima
<b>DPR Korea</b>	Kirogi	Toraji	Kalmaegi	Maemi	Meari
<b>HK, China</b>	Kai-tak	Man-yi	Fung-wong	Choi-wan	Ma-on
<b>Japan</b>	Tembin	Usagi	Kammuri	Koppu	Tokage
<b>Lao PDR</b>	Bolaven	Pabuk	Phanfone	Ketsana	Nock-ten
<b>Macau</b>	Chanchu	Wutip	Vongfong	Parma	Muifa
<b>Malaysia</b>	Jelawat	Sepat	Rusa	Melor	Merbok
<b>Micronesia</b>	Ewiniar	Fitow	Sinlaku	Nepartak	Nanmadol
<b>Philippines</b>	Billis	Danas	Hagupit	Lupit	Talas
<b>RO Korea</b>	Kaemi	Nari	Changmi	Sudal	Noru
<b>Thailand</b>	Prapiroon	Wipha	Mekkhala	Nida	Kulap
<b>U.S.A.</b>	Maria	Francisco	Higos	Omais	Roke
<b>Viet Nam</b>	Saomai	Lekima	Bavi	Conson	Sonca
<b>Cambodia</b>	Bopha	Krosa	Maysak	Chanthu	Nesat
<b>China</b>	Wukong	Haiyan	Haishen	Dianmu	Haitang
<b>DPR Korea</b>	Sonamu	Podul	Pongsona	Mindulle	Nalgae
<b>HK, China</b>	Shanshan	Lingling	Yanyan	Tingting	Banyan
<b>Japan</b>	Yagi	Kajiki	Kujira	Kompasu	Washi
<b>Lao PDR</b>	Xangsane	Faxai	Chan-hom	Namtheun	<i>Pakbar</i>
<b>Macau</b>	Bebinca	Vamei	Linha	Malou	Sanvu
<b>Malaysia</b>	Rumbia	Tapah	Nangka	Meranti	Mawar
<b>Micronesia</b>	Soulik	Mitag	Soudelor	Rananim	Guchol
<b>Philippines</b>	Cimaron	Hagibis	Imbudo	Malakas	Talim
<b>RO Korea</b>	Chebi	Noguri	Koni	Megi	<i>Doksuri</i>
<b>Thailand</b>	<i>Haikui</i>	Rammasun	Morakot	Chaba	Khanun
<b>U.S.A.</b>	Utor	Chataan	Etau	Aere	Vicente
<b>Viet Nam</b>	Trami	Halong	Vamco	Songda	Saola

**NOTE:** The official international name list was effective January 1, 2000. Names will be assigned in rotation starting with Damrey for the first tropical cyclone of the year 2000 which is of tropical storm strength or greater. When the last name in column 5 (Saola) is used, the sequence will begin again with the first name in column 1 (Damrey).



**3.6. Abbreviated Communications Headings.** Abbreviated communications headings are assigned to advisories on tropical and subtropical cyclones and other advisories based on depression numbers or storm name and standard communications procedures. An abbreviated heading consists of three groups with ONE space between each of the groups. The first group contains a data type indicator (e.g., WT for hurricane), a geographical indicator (e.g. NT for Atlantic Basin), and a number. The second group contains a location identifier of the message originator (e.g., KNHC for TPC/NHC). The third group is a date-time group in UTC. An example of a complete header is: WTNT61 KNHC 180400.

**3.6.1. Atlantic Headings (see paragraph 3.6.3 also).**

ABNT20 KNHC	Tropical Weather Outlook
ABNT30 KNHC	Tropical Weather Summary (monthly)
WTNT31 KNHC	Tropical Cyclone Public Advisory (Atlantic)
WTNT51 KNHC	Tropical Cyclone Position Estimate
WTNT61 KNHC	Tropical Cyclone Update
WONT41 KNHC	Special Tropical Disturbance Statement
FXUS01 KWBC	1-2 Day Discussion
FXUS02 KWBC	3-7 Day Discussion
FXUS04 KWBC	Precipitation Discussion

**3.6.2. Pacific Headings (see paragraph 3.6.3 also).**

ABPZ20 KNHC	Tropical Weather Outlook (Eastern Pacific)
ABPZ30 KNHC	Tropical Weather Summary (monthly)
ACPN50 PHFO	Tropical Weather Outlook (Central Pacific)
ACPN60 PHFO	Tropical Weather Summary (monthly)
TXPN40 PHFO	Northern Hemisphere Tropical Cyclone Summary (Fixes)
TXPS40 PHFO	Southern Hemisphere Tropical Cyclone Summary (Fixes)
WTPZ51 KNHC	Tropical Cyclone Position Estimate (Eastern Pacific)
WTPA51 PHFO	Tropical Cyclone Position Estimate (Central Pacific)
WTPQ51 PGUM	Tropical Cyclone Position Estimate (Western Pacific)
WTPZ61 KNHC	Tropical Cyclone Update (Eastern Pacific)
WTPA61 PHFO	Tropical Cyclone Update (Central Pacific)
WOPZ41 KNHC	Special Tropical Disturbance Statement (Eastern Pacific)
ACPA80 PHFO	Special Tropical Disturbance Statement (Central Pacific)

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

WTNT21-25 KNHC	Tropical Cyclone Forecast/Advisory (Atlantic)
WTNT31-35 KNHC	Tropical Cyclone Public Advisory (Atlantic)
WTNT31-35 KWNH	HPC Public Advisory (Atlantic)
WTNT41-45 KNHC	Tropical Cyclone Discussion (Atlantic)

WTNT51-55 KNHC	Tropical Cyclone Position Estimate (Atlantic)
WTNT61-65 KNHC	Tropical Cyclone Update (Atlantic)
WTNT71-75 KNHC	Tropical Cyclone Strike Probabilities (Atlantic)
WTPZ 21-25 KNHC	Tropical Cyclone Forecast/Advisory (Eastern Pacific)
WTPZ 31-35 KNHC	Tropical Cyclone Public Advisory (Eastern Pacific)
WTPZ41-45 KNHC	Tropical Cyclone Discussion (Eastern Pacific)
WTPZ51-55 KNHC	Tropical Cyclone Position Estimate (Eastern Pacific)
WTPZ61-65 KNHC	Tropical Cyclone Update (Eastern Pacific)
WTPA21-25 PHFO	Tropical Cyclone Forecast/Advisory (Central Pacific)
WTPA31-35 PHFO	Tropical Cyclone Public Advisory (Central Pacific)
WTPA41-45 PHFO	Tropical Cyclone Discussion (Central Pacific)
WTPA51-55 PHFO	Tropical Cyclone Position Estimate (Central Pacific)
WTPA61-65 PHFO	Tropical Cyclone Update (Central Pacific)
WTPQ31-35 PGUM	Tropical Cyclone Public Advisory (Western Pacific)
WTPQ51-55 PGUM	Tropical Cyclone Position Estimate (Western Pacific)

### **3.7. Hurricane Liaison Team (HLT).**

**3.7.1. National Weather Service (NWS) Responsibilities.** The NWS supports the HLT through use of Tropical Prediction Center (TPC) meteorologists, Weather Forecast Office (WFO) personnel (typically warning coordination meteorologists and service hydrologists), and River Forecast Center (RFC) hydrologists. Eastern and Southern Region Headquarters will maintain a list of their available HLT candidates.

After HLT deactivation, the Hydrometeorological Prediction Center (HPC) will assume the briefing duties provided the remnants of the tropical cyclone remain a threat to inland areas. TPC and HPC will coordinate prior to the transfer. During the inland event HPC will coordinate with the appropriate WFOs and RFCs and when needed, hydrologists from the RFCs will provide hydrological briefings.

**3.7.2. Activation.** The HLT may be activated when a tropical cyclone in the Atlantic, Gulf of Mexico, Caribbean or eastern Pacific threatens the United States or its territories, and the Director or Deputy Director of TPC deems HLT assistance is required. TPC makes the request for activation by contacting the Federal Emergency Management Agency (FEMA) Operations Center (FOC). Upon FEMA's approval, the FOC will activate the HLT. The TPC Director or Deputy Director will contact the appropriate NWS Regional Director requesting meteorologic and/or hydrologic support. NWS personnel should arrive at TPC within 24 hours. The HLT will remain active until the hurricane threat has passed, at which time HLT operations will be terminated by FEMA. However, if the storm moves inland and if significant rainfall is expected, the HLT may remain activated.

If the HLT is deactivated, the Hydrometeorological Prediction Center (HPC) will assume the briefing duties provided the remnants of the tropical cyclone remain a threat to inland areas. TPC and HPC will coordinate prior to the transfer. During the inland event, HPC will coordinate with the appropriate WFOs and RFCs and, when needed, hydrologists from the RFCs will provide hydrological briefings.

**3.7.3. Training.** Completing NWS/FEMA's distance learning training module, Community Hurricane Preparedness, is required by HLT members. The module can be taken via the Internet at: <http://meted.ucar.edu/hurricane/chp/index.htm>. Other training opportunities are strongly encouraged. They are: FEMA's "Introduction to Hurricane Preparedness" conducted at TPC for emergency managers and NWS personnel, and FEMA's annual HLT training session held at TPC.

**3.7.4. Meteorologic Duties.** The HLT meteorologist will:

- Establish and maintain contact with the impacted WFOs, RFCs, and the HPC.
- Facilitate participation of the impacted NWS offices in conference calls, briefings, and in preparation and distribution of graphics.
- Provide meteorological interpretations on National Hurricane Center advisories (NHC), WFO hurricane local statements, HURREVAC products, and storm surge forecasts for federal, state and local agencies on request.
- Provide storm briefings via video/audio teleconferences for federal, state and local organizations.
- Respond to meteorology-related incoming calls from federal, state, and local emergency managers, and as appropriate, refer meteorologic inquiries to the local WFO.

**3.7.5. Hydrologic Duties.** The HLT hydrologist will:

- Establish and maintain contact with the impacted local WFOs, RFCs, and the HPC.
- Facilitate participation of the impacted NWS offices in conference calls, briefings, and in preparation and distribution of graphics.
- Provide hydrologic interpretation on NHC advisories, WFO hurricane local statements, and WFO and RFC hydrologic products for federal, state and local agencies on request.
- Provide technical support for RFC lead during hydrologic portion of video teleconference. In absence of the RFC, lead the hydrologic portion of the video teleconference.
- Respond to hydrology-related incoming calls from federal, state, and local emergency managers and as appropriate, refer hydrologic inquiries to the local WFO.



## CHAPTER 4

### NATIONAL WEATHER SERVICE PRODUCTS FOR THE DEPARTMENT OF DEFENSE

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

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

#### **4.3. Tropical Cyclone Forecast/Advisories.**

**4.3.1. General.** The TPC/NHC and CPHC will provide to DOD forecasts and related information for tropical and subtropical weather disturbances of depression intensity or greater. Forecasts will include location, movement, intensity, and dimension of the disturbances. Tropical cyclone forecast/advisories will be disseminated through the National Weather Service (NWS) communications facility at Suitland, MD, to the Weather Product Management and Distribution System (WPMDS) at the Air Force Weather Agency, Offutt AFB, NE, for further relay to DOD agencies. The DOD forecasters, who must give advice concerning an imminent operational decision, may contact the appropriate hurricane center forecaster (see Chapter 2) when published tropical cyclone forecast/advisories require elaboration. Telephone numbers for the hurricane centers are in Appendix I.

**4.3.2. Tropical Cyclone Forecast/Advisory Issue Frequency.** The first tropical cyclone forecast/advisory will normally be issued when meteorological data indicate that a tropical or subtropical cyclone has formed. Subsequent advisories will be issued at 0300, 0900, 1500, and 2100 UTC from TPC/NHC and CPHC. The public advisories issued by the NWS Weather Forecast Office (WFO) Guam, are issued 1 hour after the JTWC guidance. Advisories will continue to be issued until the system is classified below the depression intensity level. In addition, special forecasts will be issued whenever the following criteria are met:

- A significant change has occurred, requiring the issuance of a revised forecast package.
- Conditions require a hurricane or tropical storm watch or warning to be issued.

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

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

**4.3.3. Tropical Cyclone Forecast/Advisory Content.** Tropical cyclone forecast/advisories issued by the TPC/NHC and CPHC will contain appropriate information as shown in Figure 4-1. The forecast will contain 12, 24, 36, 48, 72, 96, and 120-hour forecast positions. A code string called the storm identifier (<Storm ID>) is appended at the end of the line "NWS TPC/NATIONAL HURRICANE CENTER MIAMI FL." This is the Automated Tropical Cyclone Forecasting (ATCF) System Storm Identification Character String recognized by the WMO for tracking and verification of tropical cyclones. The ATCF <Storm ID> is three spaces after "FL" and uses the following format:

**NWS TPC/NATIONAL HURRICANE CENTER MIAMI FL BBCCYYYY**

where:

**BB = Ocean Basin**

**AL** - North Atlantic basin...north of the Equator

**SL** - South Atlantic basin...south of the Equator

**EP** - North East Pacific basin...eastward of 140°W

**CP** - North Central Pacific basin between the Dateline and 140°W

**WP** - North West Pacific basin...westward of the Dateline

**IO** - North Indian Ocean basin...north of the Equator between 40°E and 100°E

**SH** - South Pacific Ocean Basin and South Indian Ocean basin

**CC = Cyclone Number**

Numbers 01 through 49 are reserved for tropical and subtropical cyclones. A cyclone number is assigned to each tropical or subtropical cyclone in each basin as it develops. The numbers are assigned in chronological order.

Numbers 50 through 79 are reserved for internal use by operational forecast centers.

Numbers 80 through 89 are reserved for training, exercises and testing.

Numbers 90 through 99 are reserved for tropical disturbances which have the potential to become tropical or subtropical cyclones. Although not required, the 90's should be assigned sequentially and reused throughout the calendar year.

**YYYY = Four-digit year**

This is the calendar year for the Northern Hemisphere. For the Southern Hemisphere, the year begins July 1, with calendar year plus one.

Note: The <Storm ID> is also being added to the following Atlantic, East Pacific, and Central Pacific products for 2006:

- Tropical Cyclone Public Advisory
- Tropical Cyclone Discussion
- Tropical Cyclone Position Estimate
- Tropical Cyclone Update
- Tropical Cyclone Wind Probabilities
- Aviation Tropical Cyclone Advisory

Tropical cyclone public advisories issued by the WFO Guam, will contain appropriate information as shown in Figure 4-2.

**4.3.3.1. Definition of Wind Radii by Quadrant.** The working definition of the wind radius for a quadrant is: use the largest radius of that wind speed found in the quadrant. Example: TPC/NHC's quadrants are defined as NE (0°-90°), SE (90°-180°), SW (180°-270°), and NW (270°-360°). Given a maximum 34-knot radius of 150 nm at 0°, 90 nm at 120°, and 40 nm at 260°, the following line would be carried in the forecast/advisory: 150NE 90SE 40SW 150NW.

**4.3.3.2 Numbering of Tropical Cyclone Forecast/Advisories.** All tropical cyclone forecast/advisories will be numbered sequentially; for example,

- Tropical Depression ONE Forecast/Advisory Number 1
- Tropical Depression ONE Forecast/Advisory Number 2
- Tropical Storm Anita Forecast/Advisory Number 3
- Hurricane (Typhoon) Anita Forecast/Advisory Number 4
- Tropical Depression Anita Forecast/Advisory Number 5

```

WTNT25 KNHC 230300
TCMAT5

HURRICANE ISIDORE FORECAST/ADVISORY NUMBER 28
NWS TPC/NATIONAL HURRICANE CENTER MIAMI FL AL102002
0300Z MON SEP 23 2002

A HURRICANE WARNING REMAINS IN EFFECT ALONG THE GULF OF MEXICO AND
CARIBBEAN COASTS OF THE YUCATAN PENINSULA FROM CAMPECHE NORTH AND
EASTWARD TO TULUM...INCLUDING THE ISLAND OF COZUMEL.

HURRICANE CENTER LOCATED NEAR 20.8N 89.5W AT 23/0300Z
POSITION ACCURATE WITHIN 20 NM

PRESENT MOVEMENT TOWARD THE SOUTHWEST OR 220 DEGREES AT 4 KT

ESTIMATED MINIMUM CENTRAL PRESSURE 950 MB
MAX SUSTAINED WINDS 90 KT WITH GUSTS TO 110 KT.
64 KT..... 45NE 25SE 25SW 45NW.
50 KT..... 75NE 50SE 50SW 75NW.
34 KT.....200NE 130SE 100SW 150NW.
12 FT SEAS..300NE 200SE 150SW 300NW.
WINDS AND SEAS VARY GREATLY IN EACH QUADRANT. RADII IN NAUTICAL
MILES ARE THE LARGEST RADII EXPECTED ANYWHERE IN THAT QUADRANT.

REPEAT...CENTER LOCATED NEAR 20.8N 89.5W AT 23/0300Z
AT 23/0000Z CENTER WAS LOCATED NEAR 21.0N 89.4W

FORECAST VALID 23/1200Z 20.7N 90.3W
MAX WIND 80 KT...GUSTS 100 KT.
64 KT... 40NE 20SE 25SW 40NW.
50 KT... 60NE 40SE 40SW 60NW.
34 KT...180NE 60SE 60SW 150NW.

FORECAST VALID 24/0000Z 21.0N 91.0W
MAX WIND 95 KT...GUSTS 115 KT.
64 KT... 45NE 25SE 25SW 45NW.
50 KT... 75NE 50SE 50SW 75NW.
34 KT...200NE 150SE 100SW 150NW.

FORECAST VALID 24/1200Z 21.8N 92.0W
MAX WIND 115 KT...GUSTS 140 KT.
64 KT... 60NE 45SE 45SW 60NW.
50 KT...100NE 75SE 75SW 100NW.
34 KT...200NE 150SE 125SW 180NW.

FORECAST VALID 25/0000Z 22.8N 92.5W
MAX WIND 125 KT...GUSTS 155 KT.
50 KT...100NE 100SE 75SW 100NW.
34 KT...200NE 200SE 150SW 200NW.

FORECAST VALID 26/0000Z 25.0N 93.0W
MAX WIND 125 KT...GUSTS 155 KT.
50 KT...100NE 100SE 75SW 100NW.
34 KT...200NE 200SE 150SW 200NW.

EXTENDED OUTLOOK. NOTE...ERRORS FOR TRACK HAVE AVERAGED NEAR 275 NM
ON DAY 4 AND 375 NM ON DAY 5...AND FOR INTENSITY NEAR 20 KT EACH DAY

OUTLOOK VALID 27/0000Z 22.8N 92.5W
MAX WIND 100 KT...GUSTS 120 KT.

OUTLOOK VALID 28/0000Z 25.0N 93.0W
MAX WIND 90 KT...GUSTS 110 KT.

REQUEST FOR 3 HOURLY SHIP REPORTS WITHIN 300 MILES OF 20.8N 89.5W

NEXT ADVISORY AT 23/0900Z

FORECASTER PASCH

$$
NNNN

```

**Figure 4-1. Tropical Cyclone Forecast/Advisory Format**



WTPQ31 PGUM 210931  
TCPPQ1

BULLETIN  
TROPICAL DEPRESSION 03W ADVISORY NUMBER 4  
8 PM GUAM LST THU APR 21 2005

...TROPICAL DEPRESSION 03W CONTINUES MOVING SLOWLY TOWARD YAP...

A TROPICAL STORM WATCH REMAINS IN EFFECT FOR YAP...FAIS...ULITHI AND NGULU.

TROPICAL STORM CONDITIONS...INCLUDING DAMAGING WINDS OF 39 MPH TO 73 MPH...ARE POSSIBLE. IF TROPICAL DEPRESSION 03W STRENGTHENS MORE THAN FORECAST...A TROPICAL STORM WARNING COULD BE REQUIRED WITH LITTLE ADVANCE NOTICE.

RESIDENTS OF YAP STATE SHOULD CONTINUE TO CLOSELY MONITOR THIS TROPICAL DEPRESSION FOR ANY CHANGES OVER-NIGHT.

AT 7 PM GUAM LST...0900Z...THE CENTER OF TROPICAL DEPRESSION 03W WAS LOCATED NEAR LATITUDE 8.4 DEGREES NORTH AND LONGITUDE 140.3 DEGREES EAST. THIS IS ABOUT

- 95 MILES SOUTH OF FAIS
- 115 MILES SOUTH-SOUTHEAST OF ULITHI
- 170 MILES EAST-SOUTHEAST OF YAP
- 190 MILES EAST OF NGULU

TROPICAL DEPRESSION 03W IS MOVING WEST-NORTHWEST AT 5 MPH. OVER THE NEXT 12 HOURS...TROPICAL DEPRESSION 03W IS EXPECTED TO INCREASE ITS FORWARD SPEED OF MOTION. THE TROPICAL DEPRESSION IS STILL ORGANIZING AND ERRATIC MOVEMENT OF THE CENTER IS POSSIBLE UNTIL THE SYSTEM BECOMES BETTER ORGANIZED. IF TROPICAL DEPRESSION 03W MAINTAINS THE CURRENT FORECAST TRACK...WARNINGS WILL NOT BE NEEDED AND THE TROPICAL STORM WATCH WILL LIKELY BE DROPPED TOMORROW.

MAXIMUM SUSTAINED WINDS ARE 30 MPH. TROPICAL DEPRESSION 03W IS EXPECTED TO SLOWLY INTENSIFY...BUT WILL LIKELY REMAIN A TROPICAL DEPRESSION OVER THE NEXT 24 HOURS.

REPEATING THE 7 PM POSITION...8.4 DEGREES NORTH AND 140.3 DEGREES EAST...MOVING WEST-NORTHWEST AT 5 MPH WITH MAXIMUM SUSTAINED WINDS OF 30 MPH.

FOR STORM INFORMATION SPECIFIC TO YOUR LOCAL AREA...REFER TO TROPICAL DEPRESSION 03W LOCAL STATEMENT /WTPQ81 PGUM/ AND OTHER PRODUCTS FROM YOUR LOCAL WEATHER OFFICE.

AN INTERMEDIATE ADVISORY WILL BE ISSUED AT 11 PM TONIGHT...FOLLOWED BY THE NEXT SCHEDULED ADVISORY AT 2 AM FRIDAY MORNING.

\$\$

GUARD/AHN

**Figure 4-2. Tropical Cyclone Public Advisory Format**



## CHAPTER 5

### AIRCRAFT RECONNAISSANCE

**5.1. General.** All Department of Commerce (DOC) tropical and subtropical cyclone aircraft reconnaissance needs will be requested and provided in accordance with the procedures of this chapter. As outlined in the Air Force Reserve Command (AFRC)/National Oceanic and Atmospheric Administration (NOAA) Memorandum of Agreement (see Appendix F), DOC has identified a requirement for, and the Department of Defense (DOD) maintains aircraft to support, up to five sorties per day. Requirements exceeding five sorties will be accomplished on a "resources-permitting" basis. In times of national emergency or war, some or all DOD reconnaissance resources may not be available to fulfill DOC needs. The Global Decision Support System (GDSS) JCS Priority Code for tasked, operational weather reconnaissance is **1A3** (IAW DOD Regulation 4500.9-R and Joint Publications 4-01 and 4-04). The Force Activity Designator (FAD)/Urgency of Need Designator (UND) Supply Priority Designator Determination code is **IIA2** (IAW Joint Publication 4-01 and Air Force Manual 23-110, Volume 2, Part 13, Attachment 3A-2.)

**5.2. Responsibilities.** The DOD, through the AFRC's 53rd Weather Reconnaissance Squadron (53 WRS), and DOC, through NOAA's Aircraft Operations Center (AOC), operate a complementary fleet of aircraft to conduct hurricane/tropical cyclone reconnaissance, synoptic surveillance, and research missions.

**5.2.1. DOD.** The DOD is responsible for:

- Providing operational aircraft for vortex fixes and data, synoptic surveillance missions, and investigative flights in response to DOC needs (*see Figure 5-1*).
- Developing operational procedures and deploying data buoys to satisfy DOC needs.

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

- Provide synoptic surveillance soundings (*see Figure 5-2*).
- Augment AFRC aircraft reconnaissance when DOC needs exceed the capabilities of DOD resources (*see Figure 5-3*).
- Assume responsibility for hurricane reconnaissance over foreign airspace that may be restricted for military operations.
- Conduct research flights.



**Figure 5-1. WC-130J Weather Reconnaissance Aircraft**



**Figure 5-2. G-IV Weather Surveillance Aircraft**



**Figure 5-3. NOAA P-3 Weather Surveillance Aircraft**

**5.2.3. DOT.** The DOT is responsible for providing air traffic control services to aircraft when within airspace controlled by the FAA. This includes offshore oceanic airspace. Procedures for the expeditious handling of reconnaissance aircraft are documented in paragraph 5.5.4, *Aircraft Operations—Pre-mission Coordination* and paragraph 5.5.5, *Aircraft Operations—Mission Execution*.

**5.3. Control of Aircraft.** Operational control of aircraft flying tropical and subtropical cyclone reconnaissance will remain with the operating agencies which own the aircraft.

**5.4. Reconnaissance Requirements.**

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

- Geographical position of the flight level vortex center (vortex fix) and relative position of the surface center, if known.
- Center sea-level pressure determined by dropsonde or extrapolation from within 1,500 ft of the sea surface or from the computed 925 hPa or 850 hPa height.

- Minimum 700, 850 or 925 hPa height, if available.
- Wind data (continuous observations along the flight track) for surface and flight level.
- High density three-dimensional Doppler radial velocities of the tropical cyclone core circulation
- Temperature at flight level.
- Sea-surface temperature.
- Dew-point temperature at flight level.

## **5.4.2. Accuracy.**

### **5.4.2.1. Geographic Position.**

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

### **5.4.2.2. Wind Direction.**

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

### **5.4.2.3. Wind Speed.**

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

### **5.4.2.4. Pressure Height.**

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

### **5.4.2.5. Temperature.**

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

### **5.4.2.6. Dew-Point Temperature.**

- From -20°C to +40°C: within 1°C.
- Less than -20°C: within 3°C.

### **5.4.2.7. Absolute Altitude:** Within 10 m.

#### **5.4.2.8. Vertical Sounding.**

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

#### **5.4.2.9. Core Doppler Radar.**

- Horizontal resolution along aircraft track: 1.5 km
- Radar beam width: 3 degrees.
- Radar radial resolution (gate length): 150 m.
- Error in radar radial velocity: 1 m/s.
- Range: 50 km.

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

**5.4.3. High-Density/High-Accuracy (HD/HA) Data Requirements.** *The HD/HA data include UTC time, aircraft latitude, longitude, static pressure, geopotential height, extrapolated sea level pressure, air temperature, dew point temperature, flight-level (FL) wind direction, FL wind speed, peak 10-second average FL wind speed, peak 10-second average surface wind speed from the stepped frequency microwave radiometer (SFMR), SFMR-derived rain rate, and quality control flags.* Except for the peak values noted above, all data provided in HDOB messages are 30-second averages, regardless of the interval at which the HDOB messages are reported. See Appendix G for HDOB message formats. The DOC requires rapid acquisition and transmission of tropical cyclone data, especially within the 24-hour period prior to landfall. If HD/HA capability is lost on an operational mission, the airborne meteorologist will immediately contact Chief, Aerial Reconnaissance Coordination, All Hurricanes (CARCAH) to determine data requirements for the remainder of the mission.

**5.4.4. Synoptic Surveillance Data Requirements.** When required, TPC/NHC will request mid- and/or upper-tropospheric sounding data on the periphery of systems approaching the United States. TPC/NHC and NOAA's Hurricane Research Division (HRD) will coordinate to provide specific tracks including control points, control times and dropwindsonde frequency allocations to CARCAH for coordination with the reconnaissance units.

**5.4.5. Core Doppler Radar Requirements.** When required, TPC/NHC and the Environmental Modeling Center (EMC) will coordinate to request high-density three-dimensional Doppler radial velocities in the tropical cyclone core for potential storms impacting the United States. EMC, TPC/NHC, and HRD will coordinate to provide specific flight plans to CARCAH for coordination with the reconnaissance units.

**Table 5-1. Requirements for Aircraft Reconnaissance Data**

	RECCO Section 1 plus 4ddff and 9VTTT as applicable	Vortex Data Message (VDM)	Vertical Data WMO Temp Drop Code (FM37-VII)	High Density Observation (HDOB)
En route	Approx. every 30 minutes over water not to exceed 200 nm	NA	Every 400 nm over water	30-sec interval
Invest area	Every 15 minutes and at major turn points	After closing a circulation	NA	30-sec interval
Fix pattern	End points of Alpha pattern legs.  When necessary with radar fix information.	Each fix.	Each tasked fix at or above 850 mb. Intermediate fixes and eyewall modules as requested.	30-sec interval

**5.4.6. Required Frequency and Content of Observations.** Observation requirements are summarized in Table 5-1. Deviations to these requirements will be coordinated through CARCAH. The Vortex message format and information are shown in Figure 5-4, Figure 5-5, Figure 5-6, and Table 5-2. Other data message formats and code breakdowns can be found in Appendix G.

**5.4.7. WP-3D Configuration.** The minimum operational configuration of the WP-3D will include the stepped frequency microwave radiometer (SFMR) and the advanced vertical atmospheric profiling system (AVAPS).

**5.5. Reconnaissance Planning and Flight Notification.**

**5.5.1. DOC Requests for Aircraft Reconnaissance Data.**

**5.5.1.1. Coordination.** The Tropical Prediction/National Hurricane Center (TPC/NHC) will coordinate with the Central Pacific Hurricane Center (CPHC) to determine a list of the total DOC requirements for data on tropical and subtropical cyclones or disturbances for the next 24-hour period (1100 to 1100 UTC) 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 1630 UTC each day in the format of Figure 5-7. Amendments will be provided as required.

**5.5.1.2. Tropical Cyclone Plan of the Day.** From the coordinated DOC request, CARCAH will publish the Tropical Cyclone Plan of the Day (TCPOD). The format for the TCPOD is shown in Figure 5-8. When DOC reconnaissance needs exceed DOD and DOC resources, CARCAH will coordinate with the TPC/NHC to establish priorities of requirements.



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

- For the Atlantic, Gulf of Mexico, Caribbean, and Central Pacific areas, the requests can be:
  - < Up to four 6-hourly fixes per day when a storm is within 500 nm of landfall and west of 55°W in the Atlantic.
  - < Up to eight 3-hourly fixes per day when a storm is forecast to be within 300 nm of the U.S. coast, Hawaiian Islands, Puerto Rico, Virgin Islands, DOD installations, and other DOD assets when specified.
  - < Up to two synoptic surveillance missions per 24-hour period for potentially landfalling storms.
- In the Eastern Pacific, reconnaissance missions may be tasked when necessary to carry out warning responsibilities.
- Investigative flights may be requested for disturbances in areas defined above, i.e., one or two flights per day dependent upon proximity of landfall and upon known or suspected stage of development.
- Exceptions may be made when additional reconnaissance is essential to carry out warning responsibilities.

DATE	SCHEDULED FIX TIME	AIRCRAFT NUMBER	ARWO
WX MISSION IDENTIFICATION		STORM NUMBER IDENTIFIER	
		OB	
<b>VORTEX DATA MESSAGE</b>			
A		DATE AND TIME OF FIX	
	DEG MIN N S	LATITUDE OF VORTEX FIX	
B	DEG MIN E W	LONGITUDE OF VORTEX FIX	
C		MINIMUM HEIGHT AT STANDARD LEVEL	
D		ESTIMATE OF MAXIMUM SURFACE WIND OBSERVED	
E		BEARING AND RANGE FROM CENTER OF MAXIMUM SURFACE WIND	
F		MAXIMUM FLIGHT LEVEL WIND NEAR CENTER	
G		BEARING AND RANGE FROM CENTER OF MAXIMUM FLIGHT LEVEL WIND	
H		MINIMUM SEA LEVEL PRESSURE COMPUTED FROM DROPSONDE OR EXTRAPOLATED FROM FLIGHT LEVEL. IF EXTRAPOLATED, CLARIFY IN REMARKS.	
I		MAXIMUM FLIGHT LEVEL TEMP/PRESSURE ALTITUDE OUTSIDE EYE	
J		MAXIMUM FLIGHT LEVEL TEMP/PRESSURE ALTITUDE INSIDE EYE	
K		DEWPOINT TEMP/SEA SURFACE TEMP INSIDE EYE	
L		EYE CHARACTER: Closed wall, poorly defined, open SW, etc.	
M		EYE SHAPE/ORIENTATION/DIAMETER. Code eye shape as: C -Circular; CO - Concentric; E - Elliptical. Transmit orientation of major axis in tens of degree, i.e., 01-010 to 190; 17-170 to 350. Transmit diameter in nautical miles. <i>Examples:</i> C8 - Circular eye 8 miles in diameter. EO9/15/5 - 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	↑	FIX DETERMINED BY/FIX LEVEL. FIX DETERMINED BY: 1 - Penetration; 2 - Radar; 3 - Wind; 4 - Pressure; 5 - Temperature. FIX LEVEL (Indicate surface center if visible; indicate both surface and flight level centers only when same): 0 - Surface; 1 - 1500ft; 9-925mb; 8 - 850 mb; 7 - 700 mb; 5 - 500 mb; 4 - 400 mb; 3 - 300 mb; 2 - 200 mb; NA - Other.	
O	↔	NAVIGATION FIX ACCURACY/METEOROLOGICAL ACCURACY	
p	REMARKS		
	MAX FL WIND _____ KT _____ QUAD _____ Z MAX OUTBOUND FL WIND _____ KT _____ QUAD _____ Z SLP EXTRAP FROM (Below 1500 FT/ 925 MB/ 850 MB/ DROPSONDE) SFC CNTR _____ / _____ NM FROM FL CNTR MAX FL TEMP _____ C _____ / _____ NM FROM FL CNTR		
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.			

**Figure 5-4. Vortex Data Message Worksheet**

**Table 5-2. Vortex Data Message Entry Explanation**

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<b>DATA ITEM</b>	<b>ENTRY</b>
MISSION IDENTIFIER	As determined in Chapter 5, paragraph 5.7.6.
STORM IDENTIFIER	As determined in Chapter 4, paragraph 4.3.3.
OBSERVATION NUMBER	A two digit number determined by the sequential order in which the observation is transmitted from the aircraft.
A (ALPHA)	Date and time (UTC) of the flight level center fix. If the flight level center cannot be fixed and the surface center is visible, enter the time of the surface center fix.
B (BRAVO)	The latitude and longitude of the center fix associated with item ALPHA. NOTE: If the surface center is fixable, enter bearing and range from the <i>FL</i> center in <i>Remarks</i> ; e.g., SFC CNTR 270/15 nm, if the centers are separated by over 5 nm.
C (CHARLIE)	Indicate the standard atmospheric surface e.g. 925, 850 or 700 hPa.  The minimum height of the standard surface observed inside the center. If at 1,500 ft or below or not within 1,500 ft of a standard surface, enter NA.
D (DELTA)	The maximum surface wind observed during the inbound leg associated with this fix.
E (ECHO)	Bearing and range of the maximum surface wind observed (item DELTA) from the coordinates reported in item BRAVO.
F (FOXTROT)	The maximum flight level wind observed during the inbound leg associated with this fix. If a significant secondary maximum wind is observed, report it in remarks.

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**Table 5-2. Vortex Data Message Entry Explanation (continued)**

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

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**Table 5-2. Vortex Data Message Entry Explanation (continued)**

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L (LIMA)	<p>Only report if at least 50 percent of the center has an eyewall, otherwise enter NA.</p> <p>Closed wall--if the center has 100 percent coverage with no eyewall weakness.</p> <p>Open XX--if the center has 50 percent or more but less than 100 percent coverage. State the direction of the eyewall weakness.</p>
M (MIKE)	<p>Self explanatory. Report only if item LIMA is reported, otherwise enter NA.</p>
N (NOVEMBER)	<p>Fix determined by: Always report 1. Report 2 if radar indicates curvature or banding consistent with fix location. Report 3 if recorded or observed winds indicate a closed center. Report 4 if the fix pressure is lower than all reported on the inbound leg. Report 5 if the fix temperature is at least higher than any reported on the inbound leg.</p> <p>Fix level: Report 0 alone if fix is made solely on surface winds. Report 0 and the flight-level code if the centers are within 5 nm of each other.</p>
O (OSCAR)	<p>Navigational and meteorological accuracy are reported as the upper limit of probable error. Meteorological accuracy is normally reported as one-half of the diameter of the light and variable wind center.</p>
P (PAPA)	<p>Remarks to enhance the data reported above. Required remarks include: (1) mission identifier and observation number; (2) the maximum flight level wind observed, time of observation, and the relative quadrant of the storm of the observed wind on the latest pass through any portion of the storm; (3) <i>the maximum flight-level wind observed on the outbound leg following the center fix just obtained, if it is higher than the inbound maximum reported in item F. Include time of observation and the relative quadrant of the storm of the qualifying outbound max wind. If, after the transmission of the vortex message but prior to the aircraft reaching the cross-leg turn point, a higher qualifying outbound wind is observed, then the vortex message will be amended with the higher outbound wind reported;</i> (4) the method of deriving the central SLP when extrapolated; and (5) the bearing and range of the surface center and/or maximum flight level temperature if not within 5 nm of the flight level center.</p>

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URNT12 KNHC 162129  
VORTEX DATA MESSAGE <Storm ID>  
A. 16/21:16:20Z  
B. 15 DEG 41 MIN N  
   068 DEG 07 MIN W  
C. NA MB 2743 M  
D. NA KT  
E. NA DEG NM  
F. 121 DEG 087 KT  
G. 034 DEG 010 NM  
H. EXTRAP 957 MB  
I. 7 C/ 3056 M  
J. 16 C/ 3040 M  
K. 10 C/ NA  
L. OPEN W  
M. E270/30/20  
N. 12345/07  
O. 0.02 / 3 NM  
P. AF301 WXWXA LENNYTEST1 OB 05  
MAX FL WIND 87 KT NE QUAD 21:13:30Z  
SLP EXTRAP FROM 700 MB

---

**Figure 5-5. Example Vortex Data Message (VDM) for the WC-130J**

**NHOP COORDINATED REQUEST FOR AIRCRAFT RECONNAISSANCE**

Original  
 Amendment  
(Check One)

**I. ATLANTIC REQUIREMENTS**

STORMNAME DEPRESSION # SUSPECT AREA	FIX OR ON STATION TIME	COORDINATES	FLIGHT PATTERN	FCST MVMT	NHC PRIORITY
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
GULFSTREAM _____					
SUCCEEDING DAY OUTLOOK _____					
_____					
REMARKS _____					
_____					

**II. PACIFIC REQUIREMENTS**

STORMNAME DEPRESSION # SUSPECT AREA	FIX OR ON STATION TIME	COORDINATES	FLIGHT PATTERN	FCST MVMT	NHC PRIORITY
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
SUCCEEDING DAY OUTLOOK _____					
_____					
REMARKS _____					
_____					

**III. DISTRIBUTION**

- A. TO CARCAH BY 1630Z OR AMEND AT ANY TIME
- B. Date \_\_\_\_\_ Time \_\_\_\_\_ FCSTR INITIAL \_\_\_\_\_
- C. 53 WRS \_\_\_\_\_ AOC \_\_\_\_\_ Other \_\_\_\_\_

**Figure 5-6. NHOP Coordinated Request for Aircraft Reconnaissance**

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

FM: CARCAH, NATIONAL HURRICANE CENTER, MIAMI, FL

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

-----  
SUBJECT: THE TROPICAL CYCLONE PLAN OF THE DAY  
VALID \_\_\_\_Z (MONTH) TO \_\_\_\_Z (MONTH) (YEAR)  
TCPOD NUMBER.....(YR)-\_\_\_\_\_

I. ATLANTIC REQUIREMENTS

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

FLIGHT ONE (NHC PRIORITY, if applicable)

A. \_\_\_\_\_ Z            FIX/INVEST TIME

\_\_\_\_\_ Z

B. \_\_\_\_\_            MISSION IDENTIFIER

C. \_\_\_\_\_ Z            DEPARTURE TIME

D. \_\_\_\_\_            FORECAST POSITION

E. \_\_\_\_\_ Z            TIME ON STATION

F. \_\_\_\_\_            ALTITUDE(S) ON STATION

G. \_\_\_\_\_            REMARKS (if needed)

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. PACIFIC REQUIREMENTS (Same as in ATLANTIC)

**Figure 5-7. Tropical Cyclone Plan of the Day Format**



## **5.5.2. DOD and DOC Reconnaissance Aircraft Responsiveness.**

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

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

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

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

**5.5.2.5. NOAA WP-3D Availability.** At least one WP-3D will be operationally configured (per paragraph 5.4.6) and available to respond to requirements within 24 hours from June 1<sup>st</sup> through November 30<sup>th</sup> annually.

## **5.5.3. Reconnaissance Tropical Cyclone Plan of the Day.**

**5.5.3.1. Preparation.** CARCAH will coordinate the TCPOD (Figure 5-8) daily during the period from June 1 to November 30 and at other times during the year as required. Transmitted TCPODs will be serially numbered each season.

- CARCAH will coordinate the TCPOD with TPC/NHC, the 53 WRS, and NOAA AOC before publication.
- The TCPOD will list all DOC and DOD required tropical and subtropical cyclone operational reconnaissance. Research missions will be listed in remarks when available by transmission time.
- The DOD-required tropical or subtropical cyclone reconnaissance missions in the Atlantic or the Pacific west to 180° will be identified in the TCPOD as USN or USAF requirements.
- Amendments to the TCPOD will be published only when requirements change. When amended, the impact on each listed flight will be identified; i.e., No Change, Change Added, or Cancel.

**5.5.3.2. Dissemination.** The TCPOD will be made available to appropriate agencies, such as FAA, DOD, and NOAA, that provide support to or control of reconnaissance aircraft or are a part of the tropical cyclone warning service. Under normal circumstances, the TCPOD will be disseminated by 1900 UTC each day including weekends and holidays. If there are no current day or succeeding-day reconnaissance requirements, a negative report, which covers the appropriate time frame, will be disseminated. Amendments will be disseminated as required.

*[NOTE: The TCPOD is disseminated under the header “MIAREPRPD” for AWIPS users and “NOUS42 KNHC” for AWDS users. The TCPOD can be accessed via the Internet at [www.hurricanehunters.com/wxdata.htm](http://www.hurricanehunters.com/wxdata.htm), then click on Plan of the Day or via the Tropical Prediction Center/National Hurricane Center homepage at [www.nhc.noaa.gov](http://www.nhc.noaa.gov), then click on aircraft reconnaissance and then on Plan of the Day.]*

#### **5.5.4. Aircraft Operations—Pre-mission Coordination.**

##### **5.5.4.1. Federal Aviation Administration (FAA) Coordination.**

**5.5.4.1.1. Responsibilities.** *The Air Traffic Control System Command Center (ATCSCC) and Air Route Traffic Control Centers (ARTCC) are responsible for coordination in support of the NHOP.*

##### **5.5.4.1.2. ATCSCC Procedures.**

a. *Review the NOAA/National Hurricane Center Aircraft Reconnaissance TCPOD at <http://www.nhc.noaa.gov/reconlist.shtml>, by 1200 Eastern Time.*

b. *Activate the Hurricane Desk or the Crisis Management Center, when required.*

c. *Prepare a public Flow Evaluation Area (FEA) based on the latitude/longitude points specified in the TCPOD when a mission is scheduled to be flown. The FEA naming convention is the three-letter identifier of the primary ARTCC and the two (2) digits of the mission aircraft call sign (ex. ZNY71 or with multiple aircraft in the same FEA ZNY71/42). Modify the FEA when requested by the primary ARTCC.*

d. *Designate a primary ARTCC when the Operations Area includes multiple ARTCCs.*

e. *Coordinate, as necessary, with the Air Force Reserve Command’s 53rd Weather Reconnaissance Squadron (53 WRS), the National Oceanic and Atmospheric Administration Aircraft Operations Center (NOAA AOC), the National Aeronautics and Space Administration (NASA), the Naval Research Laboratory (NRL), and the affected ARTCCs.*

f. *Discuss the mission profile with the unit’s operations center or aircraft commander approximately two (2) hours prior to the flight departure time. The unit’s operations center or aircraft commander will initiate the discussion. This discussion will include, at a minimum, the flight time, geographic location, flight track, and altitudes (AGL). Modify the FEA as required and coordinate with the impacted ARTCCs.*

*g. Assist ARTCCs with traffic flow priorities if the hurricane reconnaissance flight will impact air traffic. If required, ensure the hurricane reconnaissance flight receives priority for the specified period of time.*

*h. Conduct hurricane and customer conferences, as required.*

#### **5.5.4.1.3. ARTCC Procedures.**

*a. Coordinate with all impacted military facilities (ex. FACSFAC) and entities within their area of operations and responsibility to ensure all offshore airspace that is released to the military is protected for NHOP flights, when required.*

*b. Coordinate with all impacted terminal facilities.*

*c. If mission profile changes, coordinate with ATCSCC for FEA modifications.*

*d. Prepare a Notice to Airmen (NOTAM) based on the latitude/longitude points specified in the TCPOD and update as required.*

*e. Assign each aircraft the designated reserved NORAD transponder code associated with that call sign.*

**5.5.4.2. Flight Operations Coordination (Aircraft and Unmanned Aerial Systems (UAS)).** Normally notification to the ATCSCC of planned reconnaissance or buoy deployment flights by the 53 WRS and NOAA aircraft is accomplished through the TCPOD (1 June through 30 November). If for any reason a flight is planned that was not included in the TCPOD, then these units operations centers will notify the ATCSCC National Operations Manager (NOM) or International Operations Manager (IOM) directly at (703) 904-4525 prior to the scheduled time of departure.

When flights are scheduled on the TCPOD, the operations centers for the units flying those missions will contact the NOM for coordination. This call should happen as soon as practical after the TCPOD is published to enable the NOM to coordinate and activate their hurricane operations. NASA, NRL, or any other agency planning operations into or around the forecast or actual storm location will notify the ATCSCC NOM at (703) 904-4525 and the Chief, Aerial Reconnaissance Coordination, All Hurricanes (CARCAH) at (305) 229-4474, as soon as possible prior to an NHOP reconnaissance, surveillance, or research mission.

All missions must provide the following information:

- Mission call sign.
- Departure point and estimated time of departure.
- Approximate route to be flown.
- Requested AGL or MSL altitude(s).
- Any special requests.

The following aircraft call signs will be used:

- 53 WRS – “TEAL 70 through 79”
- NOAA AOC – “NOAA 42 through 44”
- NASA – “NASA ##”
- NRL – “WARLOCK 587”

Each aircraft will have a designated reserved NORAD transponder code associated with that call sign. This code is assigned by ARTCC.

**5.5.4.3. Flight Plan Filing Procedures.** Flight plans for reconnaissance and research flights must be filed with the FAA as soon as practicable before departure time. Include delay time in the Route portion of the International Flight Plan. This will keep the IFR flight plan active throughout the delay. Due to limited information that is displayed on controller screens, it is recommended that only the following remarks be included in the “Other Information” block: “EET” to FIR boundaries, “STS” with storm delay information, and “RMK/MDCN” diplomatic clearance information.

**5.5.4.4. Mission Coordination.** The aircraft commander *or operations center* must contact the NOM at (703) 904-4525 or (703) 708-5140/5144 approximately 2 hours prior to scheduled takeoff time, or as soon as possible. If required, the NOM or the IOM initiates a conference call with all ATC and military facilities affected by the flight operations area to ensure flight information and proposed operations area information is up to date.

**5.5.4.5. Mission Cancellation.** When a mission is cancelled or delayed, the unit flying the mission must notify the NOM/IOM as soon as possible.

## **5.5.5. Aircraft Operations—Mission Execution**

### **5.5.5.1. NHOP Missions (Surface to FL150).**

**5.5.5.1.1. Priority Handling.** *When requested by the aircrew, ATC will provide TEAL and NOAA aircraft priority handling. The aircraft commander will only ask for priority handling when necessary to accomplish the mission.*

**5.5.5.1.2. Operations Area.** Missions will be flown 100 percent under IFR criteria, and the IFR clearance will remain active throughout the flight. Even though rules for flying in Controlled and Uncontrolled Airspace are different, aircrews *will* not differentiate between these two while in the Operations Area and *will* follow normal Controlled Airspace procedures *or procedures specified in this section*. Regardless of the Designated Class of airspace (A through G), the following rules apply.

**5.5.5.1.3. IFR Procedures and Clearance.** ATC facilities will provide Air Traffic Control Services to all participating aircraft in the area of operations. All aircraft operating in this area *will* file their flight plan and fly according to IFR procedures. 53WRS crews *will* not conduct flight operations under the military provisions of "Due Regard" or declare

“Operational” in FAA controlled or uncontrolled airspace. However, this does not preclude the aircraft commander from exercising their authority in the interest of safety or during an aircraft emergency.

**5.5.5.1.4. Altitude Assignment (AGL).** *Authorized aircraft may request to operate at a single altitude or within a block of altitudes defined by radar altitude (AGL). Multiple aircraft may operate in the same vicinity but at different altitudes at the same time.*

**5.5.5.1.4.1. Operations in Controlled Airspace.** *ATC will assign an altitude or a block of altitudes and provide standard vertical separation between all participating and all other known aircraft. ATC will use the following phraseology; “Teal 70 maintain block (altitude) through (altitude).”*

**5.5.5.1.4.2. Operations in Uncontrolled Airspace.** *ATC can neither assign altitudes in, nor provide separation between aircraft in uncontrolled airspace, but will issue safety alerts. While in uncontrolled airspace, aircrews will advise ATC of their planned altitudes. Aircrews are responsible for maintaining their own separation from the surface of the sea, obstacles, and oil platforms while operating below the Minimum IFR Altitude (MIA).*

**NOTE:** *When an aircrew requests a block altitude that includes altitudes outside of controlled airspace, ATC will assign the altitudes that are in controlled airspace and clear the aircraft to exit controlled airspace.*

**EXAMPLE:** *Teal 70 requests the block altitude surface to FL100. The airspace below FL055 is uncontrolled. ATC will clear Teal 70, “Teal 70, maintain block flight level 055 through flight level 100, cleared to exit controlled airspace.”*

**5.5.5.1.5. Delay Area.** *This area is defined as an area of airspace at and below FL150 with a radius of 150 nm around a set of center coordinates. This airspace excludes the terminal areas (as shown on the NHOP operational maps) until radio contact is established with the ATC facility controlling the terminal airspace. If not in radar contact within the area as shown on the NHOP Operational Maps, the aircrew will make position reports in relation to designated navigational aids as requested by ATC along the coast, and will be allowed flight up to the coast, traffic permitting. When several aircraft are participating in NHOP missions they may have different center coordinates or delay areas. Any changes to the operating area will be coordinated with ATC.*

**5.5.5.1.6. Communications.** *The aircrew maintains communications with only the primary ARTCC. Normally UHF or VHF radios will be used for communications with ATC, when within range. When out of UHF or VHF range, use Satellite Phone to communicate directly to ATC Centers. IFR aircraft flying in airspace under the control of FAA facilities are required to maintain continuous two-way communications with ATC even while flying in class F or G designated airspace. Due to quick ATC clearance approvals needed by the aircrew to maintain safety and execute the mission, direct contact with the ARTCC is required. Crews will make hourly “ops normal” calls to the primary ARTCC if not in radar contact, and*

*no radio transmissions have been made within the previous hour. Relaying clearance requests through AIRINC, other aircraft, or SATCOM Data Link is not desired as this will delay receiving updated clearances or requests.*

**NOTE:** *At this time, TEAL aircraft do not have satellite phone capability although the FAA and the Transportation Security Administration (TSA) Operations Center (TSOC) have identified a security, tracking, communications, and search and rescue requirement for their use on TEAL aircraft whenever a mission is flown.*

**5.5.5.1.7. Interim Procedures.** *The following procedure is implemented as a short-term interim measure through May 2008. TEAL aircraft will send their requests by SATCOM data link to the 53 WRS operations center. The operations center will print this message and fax it directly to the primary ARTCC Missions Desk providing mission clearance. The operations center will also phone the Mission Desk. The ARTCC will issue a revised clearance. The 53 WRS operations center will transmit the approval via SATCOM back to the aircraft.*

a. When 53 WRS or NOAA flights are unable to contact ATC to request a revised or en route clearance, a clearance request may also be relayed through CARCAH.

b. The 53WRS, CARCAH, NOAA, NASA, and NRL operation centers are responsible for ensuring that air traffic clearances and messages *relayed by them to/from the FAA are relayed* in an accurate manner.

**5.5.5.1.8. Air Traffic Control (ATC).** *The FAA will provide ATC services between Participating Aircraft, Non-Participating instrument flight rules (IFR) aircraft and known Visual Flight Rule (VFR) aircraft to the 53 WRS, NOAA, NASA, and NRL aircraft operating in the area of interest. Aircraft not following IFR or operating in Class G airspace may be operating near or in the storm environment; therefore, adherence to ATC clearances is mandatory for safety.*

a. It is understood by the FAA, the 53 WRS, and NOAA AOC that there is no practical method at this time to provide separation from any nonparticipating aircraft that is flying VFR, flying in Class G airspace, not in radar contact, not squawking, and/or not in communication with ATC. Aircrews must use “see and avoid” and TCAS to avoid these aircraft when possible.

b. If Air Traffic Advisory Service knows that an aircraft is operating VFR or is operating in uncontrolled airspace in the Area of Operations, then ATC will inform all Participating Aircraft so the Participating Aircraft can contact the Non-Participating Aircraft to de-conflict routing.

c. Coordination for aircraft operations will be at the ARTCC level. The ATC *Military Operations* desk will coordinate with all agencies for flight operations in Warning Areas, *Special Use Airspace* (SUA), and Approach Control airspace.

**5.5.5.1.9. Participating Aircraft.** *During the aircraft commander’s or UAS operator’s mission call to the NOM, the NOM or the IOM will advise them whenever more than one Participating Aircraft will be in the area of interest at the same time and must brief the*

other aircraft's call sign and mission information. If CARCAH is aware that there will be another aircraft or UAS in the operations area then they must also advise the affected flight crew. The following actions will be taken by the aircrews to de-conflict operations and enhance situational awareness with the other Participating Aircraft:

- a. Set 29.92 (inches Hg) in at least one pressure altimeter.
- b. Contact the other Participating Aircraft and confirm (as a minimum) the other aircraft's pressure altitude, geographic position, true heading, *and operating Altitude or Block Altitude (AGL)*.
- c. Crews will not fly within 2,000 feet (vertical) of other participants operating in the same area of interest without concurrence of the other Participating Aircraft.
- d. *While in uncontrolled airspace TEAL and NOAA aircraft may use the same block altitudes and will provide separation from each other and any weather instrument being released. To maintain separation, these aircraft use separate altitudes and airplane-to-airplane communication to maintain situational awareness of the other aircraft's location in addition to using air-to-air TACAN, and TCAS.*
- e. The following frequencies will be used for airplane-to-airplane communications and coordination unless otherwise directed by ATC:
  - Primary: VHF 123.05 MHZ
  - Secondary: UHF 304.8 MHZ
  - Back-up: HF 4701 KHz USB

**5.5.5.1.10. UAS Operations.** *When a UAS requires a block altitude conflicting with a Participating Aircraft then the Participating Aircraft will coordinate with each other and then coordinate with ATC for altitude changes. If both aircraft require the same block altitude then contact CARCAH to determine which mission has priority.*

**5.5.5.1.11. Weather Dropsonde Instrument Release.** The aircraft commander is the sole responsible party for all dropsonde releases or sensor activations. Aircraft commanders *will* ensure coordination with other Participating Aircraft prior to release or activation. *(Examples of weather instruments are dropwindsondes and Airborne Expendable Bathythermographs (AXBT)).*

**5.5.5.2. Buoy Deployment Mission (Surface to FL050).** Regardless of the Designated Class of airspace (A through G) the following rules apply.

**5.5.5.2.1. Flight Plan.** A normal IFR flight plan will be filed for this mission. The coordinates for some of the planned deployments may need to be changed while en route to adjust to the forecast track of the storm. The aircraft routing will not be altered by ATC because the buoys must exit the aircraft in a specified order and they cannot be rearranged in flight.

**5.5.5.2.2. IFR Procedures and Clearance.** It is preferred that these missions be filed and flown using IFR procedures in either controlled or uncontrolled airspace.

However, with the concurrence of the aircraft commander, they may be flown VFR. If this change is made en route, then ATC flight following and traffic advisories will be requested by the aircrew, and any changes to the route of flight must be relayed to ATC by the aircrew.

**5.5.5.2.3. Altitude.** These missions will be flown from 1000' AGL up to FL050. Aircrews are responsible for maintaining their own clearance from the surface of the sea, obstacles, and oil platforms while operating below the Minimum IFR Altitude (MIA).

**5.5.5.2.4. Communications.** Normally use UHF or VHF radios for communications with ATC when within range. If out of range, then use the procedures for SATCOM relay through TEAL operations (ref. Communications paragraph under 5.5.5.1.6. above).

**5.5.5.2.5. Participating Aircraft.** If there are two or more TEAL aircraft deploying buoys in the same area at the same time, then they can accept MARSA operations with each other and must relay that to ATC. This will not cancel their IFR clearance but will allow ATC to no longer be responsible for providing aircraft separation between TEAL aircraft. The TEAL aircraft must be in communication with each other and have operating TCAS on at least one of the aircraft. At least one of these aircraft will have SATCOM data relay capability on board.

**5.5.5.2.6. Priority Handling.** ATC *will* provide TEAL aircraft priority handling to and from the deployment area only when specifically requested by the aircrew. The aircraft commander will only ask for priority handling when necessary to accomplish the mission.

### **5.5.5.3. High Altitude Synoptic Track Missions.**

**5.5.5.3.1. Flight Plan.** A normal IFR flight plan will be filed for this mission. *An Altitude Reservation (ALTRAV) request is not required.*

**5.5.5.3.2. NOTAM.** A NOTAM *will* be submitted by the 53 WRS, NOAA AOC, NASA, or NRL for any High Altitude Synoptic Track mission that will be releasing weather instruments. The NOTAM must contain coordinates for all releases. Submit NOTAM request per Appendix D procedures.

**5.5.5.3.3. Priority Handling.** ATC must provide priority handling during Synoptic Track Missions only when specifically requested by the aircrew. TEAL aircraft are not certified for RVSM operations but must be allowed to operate in RVSM designated airspace, *if traffic permits.*

**5.5.5.3.4. Release of Dropsondes.** During NHOP missions and when operationally feasible, dropsonde instrument releases from FL 190 or higher and sensor activation must be coordinated with the appropriate ARTCC/CERAP (Center En Route Approach Control) by advising of a pending drop or sensor activation at least 10 minutes prior to the event when in direct radio contact with ATC. When ATC has radar contact with the aircraft,



they *will* notify the aircrew of any traffic below them that might be affected. The aircraft commander is solely responsible for release of the instrument after clearing the area by all means available.

a. When contact with ATC is via ARINC, event coordination must be included with the position report prior to the point where the action will take place, unless all instrument release points have been previously relayed to the affected ATC center(s). Example: “TEAL 100, SLATN at 1215, FL290 block 310, estimating FLANN at 1250, CHAMP next; Weather instrument release at FLANN.” Contact between participating aircraft must be made using the frequencies listed in *paragraph 5.5.5.1.9.e*.

b. During NHOP missions, commencing five (5) minutes prior to release from FL190 or higher, the aircrew *will* broadcast in the blind on radio frequencies 121.5 MHZ and 243.0 MHZ to advise any traffic in the area of the impending drop. Pilots must not make these broadcasts if they will interfere with routine ATC communications, such as in the vicinity of an ATC facility. The aircraft commander is responsible for determining the content and duration of a broadcast, concerning the release or sensor activation.

## **5.6. Reconnaissance Effectiveness Criteria.**

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

### **5.6.1.1. Tropical Cyclone Fix Mission.**

- **ON-TIME.** The fix is made not earlier than 1 hour before nor later than ½ hour after scheduled fix time.
- **EARLY.** The 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.
- **LATE.** The fix is made within the interval from ½ hour after scheduled fix time to one-half of the time interval to the succeeding scheduled fix, not to exceed 3 hours.
- **MISSED.** Data are not obtained within the parameters specified for on-time, early, or late.

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

### **5.6.1.2. Tropical Cyclone Investigative Missions.**

- **ON-TIME.** An observation must be taken within 250 nm of the specified coordinates by the scheduled time.
- **LATE.** An observation is taken within 250 nm of the specified coordinates after the scheduled time but not later than the scheduled time plus 2 hours.
- **MISSED.** When the aircraft fails to be within the 250 nm of the specific coordinates by the scheduled time plus 2 hours or is unable to provide meaningful data.

### **5.6.1.3. Synoptic Surveillance Missions.**

- **SATISFIED.** Requirements are considered satisfied upon completion of the assigned track and the acquired dropwindsonde data are transmitted from the aircraft prior to the HPC/MPC deadline for synoptic analysis.
- **MISSED.** When the requirements listed above are not satisfied.

**5.6.2. Mission Assessment.** The TPC/NHC or CPHC will provide CARCAH a written assessment of the reconnaissance mission anytime its timeliness or quality is outstanding or substandard (see Figure 5-9). Mission requirements levied as "resources permitting" will not be assessed for timeliness but may be assessed for quality of data gathered.

**5.6.3. Summaries.** CARCAH will maintain monthly and seasonal reconnaissance summaries, detailing requirements tasked by TPC/NHC and CPHC and missions accomplished.

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

**5.7.1. Vortex Data.** A vortex data message (Figure 5-4) will be prepared for all fixes, using all observed vortex fix information, each time the aircraft penetrates the center.

**5.7.2. Center Fix Data.** When proximity to land, air traffic control restriction, or other factors prevent actual penetration of the vortex by the reconnaissance aircraft, it is permissible to fix the cyclone by radar. Radar fixes may be reported in a vortex data message using available observed information or as a remark appended to a RECCO observation taken at fix time. The remark stating the type of radar fix and quality of the radar presentation is in accordance with Chapter 7, paragraph 7.3.2; e.g., RADAR CENTER FIX 21.5N 83.0W, POOR RADAR PRESENTATION, NAV ACCURACY 5NM.

**5.7.3. Peripheral Data.** Storm penetration and collection of peripheral data will normally begin at the operational altitude approximately 105 nm from the center as determined by the flight meteorologist. The Supplementary Vortex Data Message (Figure 5-5) will be

encoded and reported as specified in Table 5-1.

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

MISSION EVALUATION FORM

MEMORANDUM FOR: OL-A, 53WRS/CARCAH

FROM: \_\_\_\_\_ (Director, NHC, CPHC)

SUBJECT: Mission \_\_\_\_\_ Evaluation  
(Mission Identifier)

PUBLISHED REQUIREMENTS:

Prepermission Coordinates (As Updated Prior to TKO) \_\_\_\_\_ N \_\_\_\_\_ W

Flight Pattern \_\_\_\_\_

Mission Requirements Times \_\_\_\_\_

RECONNAISSANCE MISSION PERFORMANCE:

Flight Flown:	<input type="checkbox"/> Completely	<input type="checkbox"/> Partially	<input type="checkbox"/> Other
Horizontal Data Coverage:	<input type="checkbox"/> Complete	<input type="checkbox"/> Timely	<input type="checkbox"/> Accurate
	<input type="checkbox"/> Incomplete	<input type="checkbox"/> Untimely	<input type="checkbox"/> Inaccurate
Vertical Data Coverage:	<input type="checkbox"/> Complete	<input type="checkbox"/> Timely	<input type="checkbox"/> Accurate
	<input type="checkbox"/> Incomplete	<input type="checkbox"/> Untimely	<input type="checkbox"/> Inaccurate
Requirements Accomplished:	<input type="checkbox"/> On Time	<input type="checkbox"/> Early	<input type="checkbox"/> Late
	<input type="checkbox"/> Missed		

OVERALL MISSION EVALUATION:

OUTSTANDING \_\_\_\_\_

UNSATISFACTORY \_\_\_\_\_ FOR:

COMPLETENESS _____	TIMELINESS _____	ACCURACY _____
EQUIPMENT _____	PROCEDURES _____	OTHER _____

REMARKS: (Brief but specific)

\_\_\_\_\_  
FORECASTER'S SIGNATURE

**Figure 5-8. Mission Evaluation Form**

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

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

Agency/Aircraft	Mission Storm System Indicator			
Agency + Aircraft Number <sup>1,2</sup>	Sequential number of mission in this storm	Two-digit depression number or two-letter identifier if not a depression or greater <sup>3</sup>	Location A,E,C,or W <sup>4</sup>	Storm name or mission type (i.e., CYCLONE or INVEST)

For non-tasked missions, WXWX, or for a numbered depression or stronger, WX+ depression number.

**-EXAMPLES-**

AF966 0201C CYCLONE	(USAF aircraft 966 on the second mission on tropical depression number 1 in the Central Pacific. Invest or fix as specified in the TCPOD.)
AF984 0403E CARLOS	(USAF aircraft 984 on the fourth mission on tropical depression 3 which formed in the Eastern Pacific and acquired the name Carlos.)
NOAA2 01BBA INVEST	(NOAA aircraft 42RF on the first mission to investigate the second suspect area in the Atlantic, Gulf of Mexico or Caribbean.)
NOAA3 WX01A AGNES	(NOAA aircraft 43RF on a non-tasked mission into AGNES.)

**5.7.7. Storm Identifier <Storm ID>.** To facilitate the automatic ingest into the TPC/NHC, CPHC, and DOD tropical cyclone forecast computing systems, the storm identifier will be added 3 spaces after the Vortex Data Message title (see Figure 5-5) in the following format: **Vortex Data Message BBCCYYYY**. For the definition of BBCCYYYY, see Chapter 4, paragraph 4.3.3., page 4-2.

**5.7.8. Observation Numbering and Content.** Air Force aircraft movement information (i.e., departure time and location, and ETA's to locations) will not be included in observation remarks. That information should be passed to CARCAH via SATCOM administrative messages. The mission identifier will be the first mandatory remark followed by the observation number. All observations (RECCO, vortex, supplemental, and dropsonde) from the first to the last will be numbered sequentially. HDOBs will be automatically numbered sequentially but separately from other observations. When an aircraft is diverted from its original mission to fulfill TPC/NHC requirements, conclude the original mission by using the last report remark.

<sup>1</sup> AF plus last 3 digits of tail number

<sup>2</sup> NOAA, plus last digit of aircraft registration number

<sup>3</sup> The letters CC should not be used in an invest identifier

<sup>4</sup> A=Atlantic, Caribbean, or Gulf of Mexico, E=Eastern Pacific, C=Central Pacific, W=Western Pacific

The next observation from the diverted aircraft will use the CARCAH-assigned mission identifier, will be numbered OB 01, and will include the time of diversion.

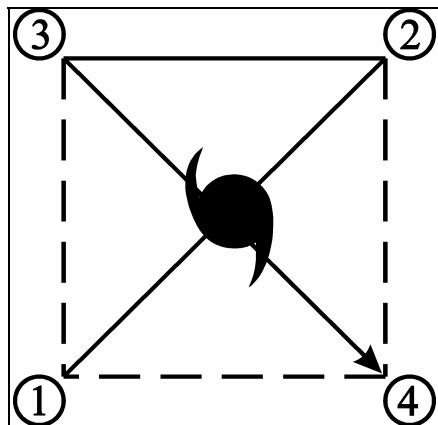
-EXAMPLE-

RMK AF987 01BBA INVEST OB 01 DPTD AF987 WXWXA AT 05/1235Z

**5.8. Operational Flight Patterns.** This section details the operational flight patterns that provide vortex and peripheral data on tropical and subtropical cyclones.

**5.8.1. Flight Pattern ALPHA Operational Details.**

**5.8.1.1. Flight Levels and Sequence.** Flight levels will normally be 1,500 ft, 925 hPa, 850 hPa, or 700 hPa, depending on data requirements and flight safety. Legs will normally be 105 nm long and flown on intercardinal tracks (45 degrees off cardinal tracks). The flight sequence is shown in Figure 5-10. The pattern can be started at any intercardinal point and then repeated throughout the mission. Prior to starting an inbound or outbound track the aircrew should evaluate all available data, e.g., radar presentation, satellite photo, for flight safety. Once started on course, every effort should be made to maintain a straight track and the tasked altitude. A horizontal observation is required at each leg end point. This data is transmitted immediately. The ALPHA pattern may be modified to satisfy unique customer requirements (such as extending legs to examine the wind profile of a strong storm) or because of proximity of land or warning areas.



**Figure 5-9. Flight Pattern ALPHA**

**5.8.1.2. Vortex fix data.** On each transit of the center a fix will be made and a vortex data message completed, using data gathered on the inbound track since the previous fix and will be transmitted immediately. Center dropsonde data will also be provided for scheduled fixes made at 850 hPa or above. The dropsonde will be released at the flight-level center coordinates (item BRAVO of the vortex data message). For fixes when dropsonde-measured SLP is not available, an extrapolated SLP will be computed and reported.

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

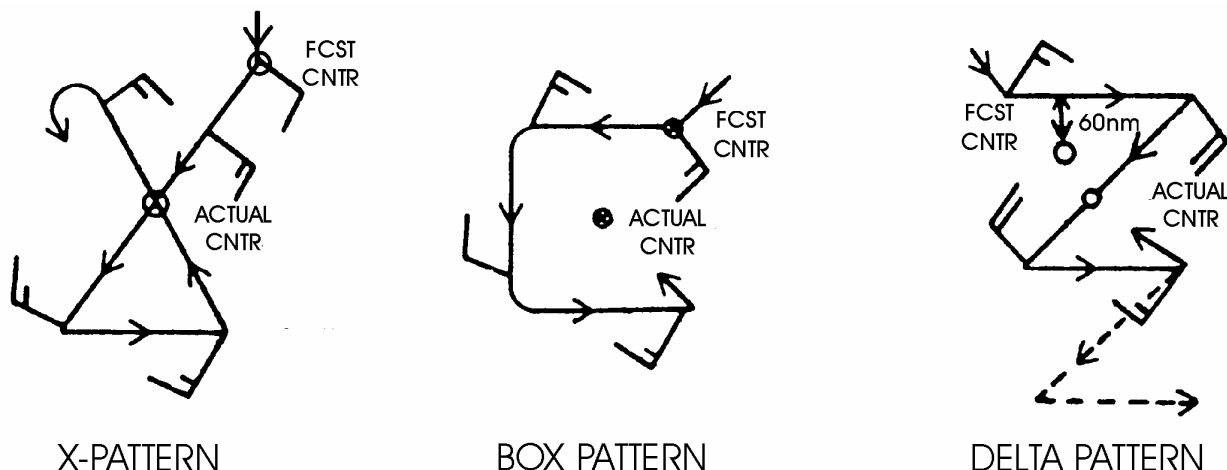
**5.8.2.1. Flight Levels.** Flight level will normally be at or below 1,500 ft absolute altitude but may be adjusted as dictated by data requirements, meteorological conditions, or flying safety factors.

**5.8.2.2. Vortex Fix.** A vortex data message is required if a vortex fix is made.

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

**5.8.2.4. Flight Pattern.** The preferred approach is to fly to the tasked coordinates of the forecasted center and then execute a pattern as observed conditions dictate. Suggested patterns are the X, Box, or Delta patterns, but the flight meteorologist may choose any approach. See Figure 5-11. Turns are usually made to take advantage of tailwinds whenever possible. *Note: The depicted pattern may be converted to a mirror image if entry is made from a different direction.*

**Figure 5-10. Suggested Patterns for Investigative Missions**



- On the X pattern, the aircraft is turned to head directly towards the center, as indicated by the surface or flight level winds. The aircraft is flown through the calm center until winds from the opposite direction occur (second quadrant). The aircraft is then turned to a cardinal heading until a wind shift occurs (third quadrant). Finally, the aircraft is turned towards the center and flown straight through the center to the last quadrant.
- On the Box pattern, the aircraft is flown on cardinal headings around the suspected center. The track resembles three sides of a square.
- On the Delta pattern, the aircraft is flown on a cardinal heading to pass 60 nm from the forecasted center. After observing a wind shift (second quadrant) the aircraft is

turned to pass through the center until winds from the opposite direction occur (third quadrant). Finally, the aircraft is turned on a cardinal heading (parallel to the initial heading) to pick up the fourth quadrant winds. If data indicate that the aircraft is far north of any existing circulation, the pattern is extended as shown by the dashed lines.

**5.8.3. Synoptic Surveillance Missions.** A synoptic surveillance mission is tasked to measure the large-scale wind and thermodynamic fields within approximately 800 nautical miles of tropical cyclones. Specific flight tracks will vary depending on storm location and synoptic situation, and multiple aircraft may be required to satisfy surveillance mission requirements.

**5.8.4. Eyewall and Outer-Wind Field Sampling Modules.** These are patterns of dropwindsonde releases designed to measure the maximum surface wind, as well as the extent of hurricane and tropical storm force surface winds. They are meant to be flown using the operational alpha pattern. Dropwindsonde releases in these modules are in addition to any other releases required by Table 5-1.

**5.8.4.1. Eyewall Module.** While executing a standard alpha pattern to satisfy a fix requirement, one sounding will be taken during each inbound and outbound passage through the eyewall (except as noted below), for a total of four soundings. The releases should be made at or just inward (within 1-2 km) of the flight-level radius of maximum wind (RMW). If the radar presentation is suitable, the inner edge of the radar eyewall may be used to identify the release point. If possible, and when resources and safety permit, two dropwindsondes, spaced less than 30 seconds apart, should be deployed on the inbound leg on the side of the storm believed to have the highest surface winds (normally the right-hand side). In this case, the outer of the two releases should be made at the RMW, with the second release following as soon as possible. Typically, the eyewall module will be tasked within 48 hours of a forecasted hurricane landfall.

**5.8.4.2 Outer-Wind Field Module.** On an alpha pattern, deploy dropwindsondes at 50 nm intervals from the center on each of two successive inbound and outbound legs, outward to 200 nm. A release should also be made at the midpoint of the cross (downwind) leg, for a total of 17 soundings. The length of the legs and the sounding interval may be adjusted, depending on the size of the storm.

## **5.9. Aircraft Reconnaissance Communications.**

**5.9.1. General.** The 53 WRS WC-130 and NOAA WP-3D aircraft will normally transmit reconnaissance observations via the Air Force Satellite Communications System (AFSATCOM), commercial SATCOM or high frequency (HF) radio phone patch. Figures 5-12 and 5-13 depict the ASDL and AFSATCOM communications links. The NOAA G-IV will normally transmit WMO Temp Drop messages via commercial SATCOM. Flight meteorologists should contact CARCAH following the first fix, and periodically throughout the mission.

**5.9.2. Air-to-Ground Communications (HF Radio).** The weather reconnaissance crew may relay weather data via direct telephone patch to the weather data monitor. Monitors will evaluate these reports and disseminate them through the Air Force's Automated Weather

Network (AWN) or to the weather communications facility at Suitland, Maryland. When requested, aeronautical stations will provide a discrete frequency for mission use, if possible. Specific radio procedures and terminology will comply with Allied Communications Publication 125, Standard Telephone and Radio Procedures. The use of IMMEDIATE precedence for transmission of hurricane reconnaissance data is authorized because of the perishable nature and potential operational impact of weather data. Data will be routed by direct phone patch between the aircraft and CARCAH.

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

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

**5.9.4. Aircraft-to-Satellite Data Link (ASDL) Equipped Aircraft.** Aircraft equipped with ASDL have the option to utilize the ASDL system. Prior to the beginning of the hurricane season, each ASDL-equipped aircraft will perform a ground or airborne test of the equipment and data ground handling procedures to determine the equipment reliability, transmission errors, and time lapse between transmission of the data from the aircraft and receipt of the data by the hurricane forecaster. Test data will be forwarded to the Chairman, Working Group for Hurricane and Winter Storms Operations and Research.

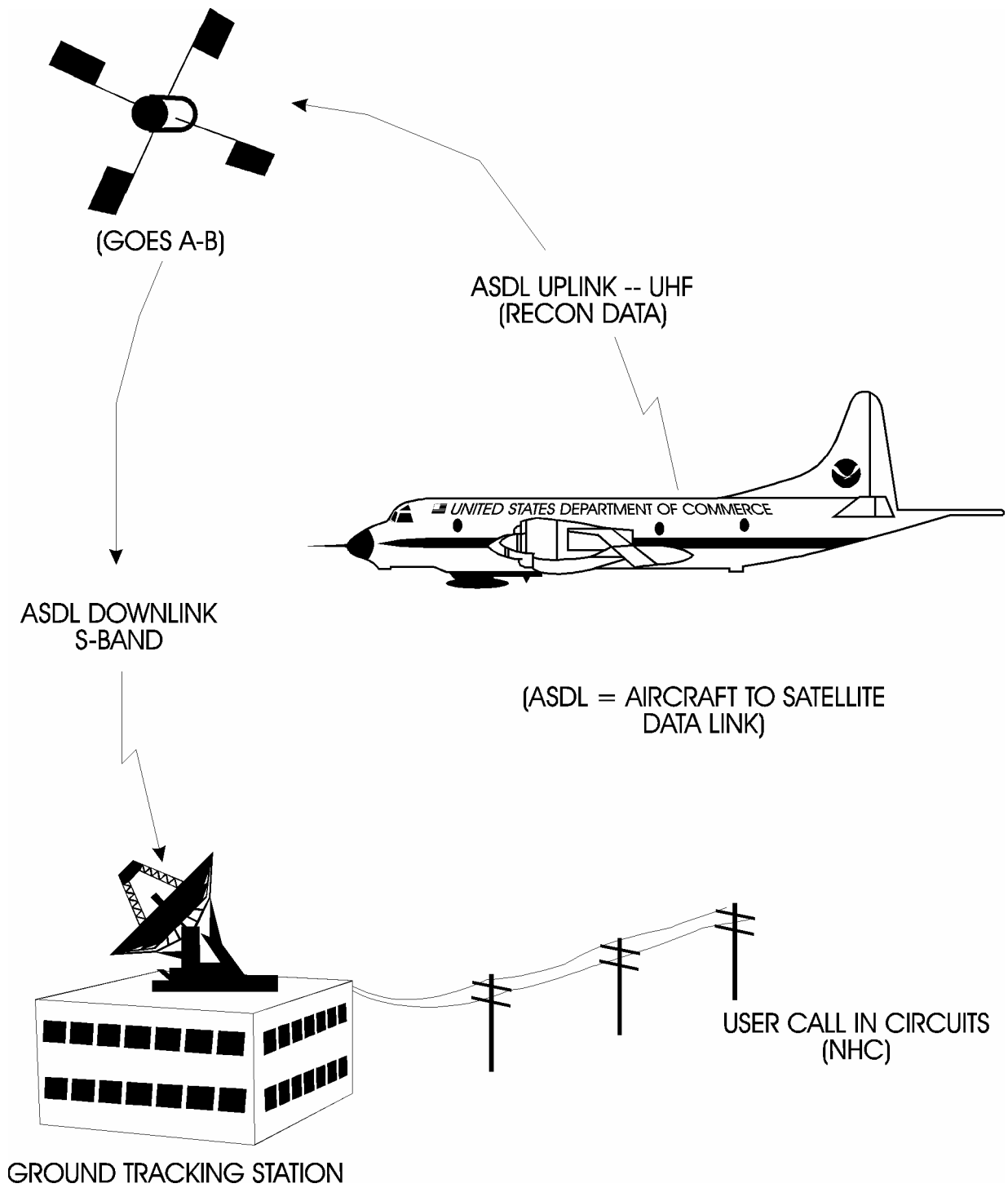
**5.9.5 Backup CARCAH Procedures.** *Satellite ground stations, which are used to receive and process data from AFRC reconnaissance aircraft, are installed at CARCAH and the 53 WRS. The 53 WRS ground station has a similar configuration and communications capability as the satellite ground station installed at CARCAH (located within TPC/NHC), except that the CARCAH ground station has additional capability to stream data using serial RS-232 communications to TPC/NHC local servers. The ground station at the 53 WRS can fully transmit data using SATCOM and land line to the CARCAH ground station. Both ground stations can send data to AFWA's Weather Product Management and Distribution System (WPMDS)—WPMDS then relays all AFRC/53 WRS reconnaissance data to the NWS Gateway for world-wide distribution. In the event that backup procedures are required due to severe communications failures, severe weather conditions, or other extreme events affecting TPC/NHC, all CARCAH responsibility will be transferred to the 53 WRS to ensure reconnaissance service is uninterrupted.*

- *Satellite antenna communications failure at NHC: CARCAH will coordinate with the 53 WRS to have a temporary operator man the ground station located at the backup site. The backup site ground station will be configured to relay aircraft data to the CARCAH ground station. If the outage at CARCAH is expected to be temporary, the 53WRS will provide operators to man the ground*

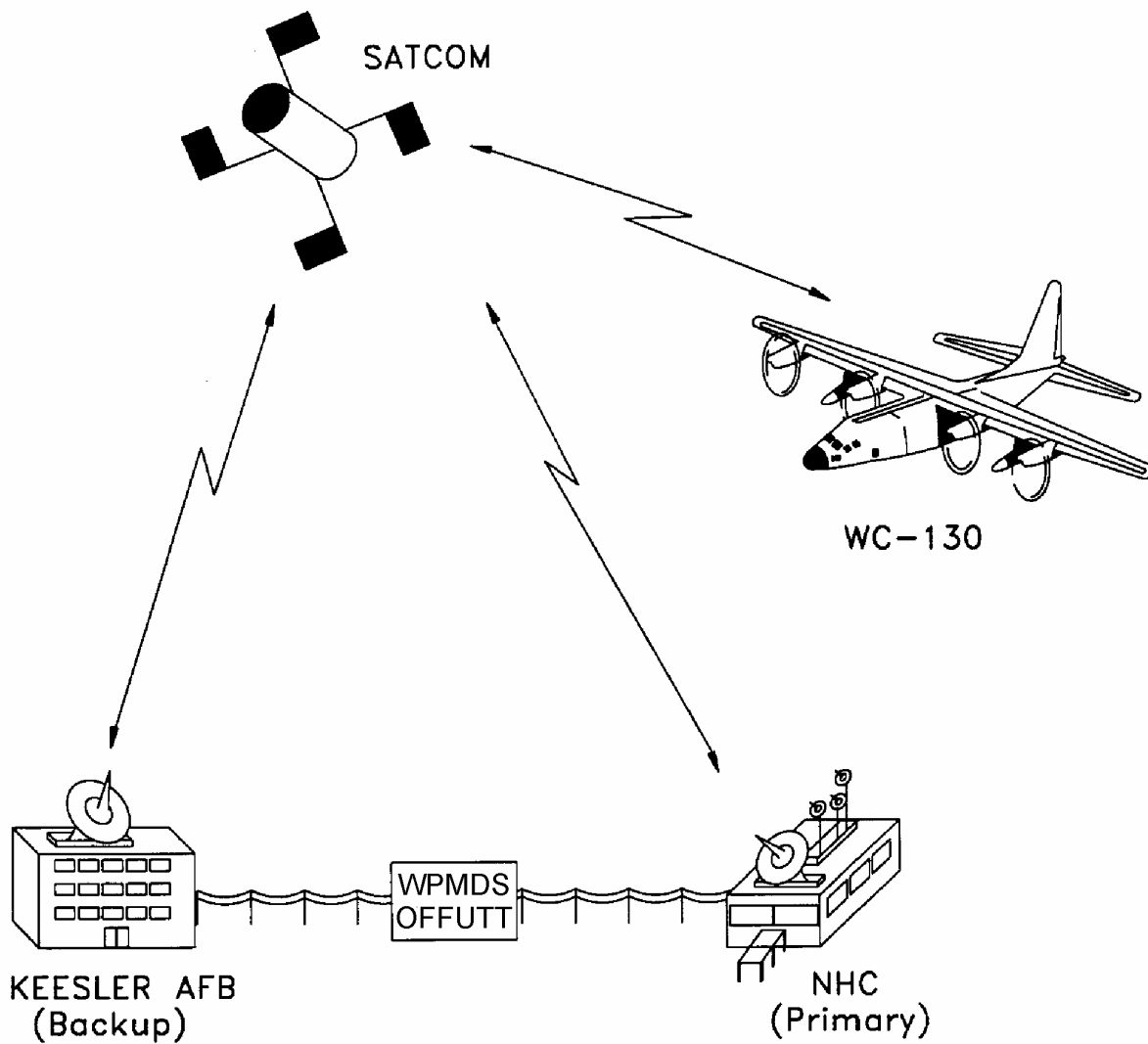


*station. For long-term outages, CARCAH will send operators to the 53 WRS, and those operators will ensure the aircraft data are transmitted to the WPMDS and transmitted to the NWS servers and external users via the NWS Gateway.*

- *In the event communications lines between the 53 WRS and NHC are severed, the ground station at the 53 WRS will be configured to transmit data directly to the WPMDS at AFWA. The current version of ground station software does not have the capability to directly send data to HPC (NHC's COOP backup site); consequently, all data or observations will need to be accessed from the WPMDS or obtained from the NWS Gateway.*
- *TPC/NHC emergency backup plan: In the event that TPC/NHC activates the HPC COOP backup plan, the designated CARCAH individual will deploy to the 53WRS to operate the ground station system. The HPC COOP site will obtain the reconnaissance data through either the WPMDS or the NWS Gateway.*



**Figure 5-11. Schematic of Aircraft-To-Satellite Data Link for NOAA P-3 Aircraft**



**Figure 5-12. Schematic of Aircraft-To-Satellite Data Link for AFRC WC-130 Aircraft**



## CHAPTER 6

### SATELLITE SURVEILLANCE OF TROPICAL AND SUBTROPICAL CYCLONES

#### 6.1. Satellites.

**6.1.1. Geostationary Operational Environmental Satellite (GOES).** Using modern 3-axis stabilization for orbit control, GOES-12 at 75°W and GOES-11 at 135°W support the operational two-GOES constellation. Independent imager and sounder instruments eliminate the need to time share, yielding an increase in spatial coverage of image and sounder data at more frequent scanning intervals. The GOES also provides higher resolution and additional spectral channels than its predecessor, affording the hydrometeorological community improvements in detection, monitoring, and analysis of developing tropical cyclones. From 135°W and 75°W, routine GOES satellite data coverage is extensive, stretching from the central Pacific through the Americas to the eastern Atlantic, including the vital breeding grounds for tropical cyclones.

Routinely, each GOES schedule provides two views of the CONUS (GOES-11 view is termed PACUS) every 15 minutes. More frequent interval scans can be employed to support NOAA's warning programs, including the tracking of tropical and subtropical cyclones. Government agencies and the private sector have access to digital data transmissions directly from NOAAPORT or directly from GOES.

The current series of GOES satellites provide satellite data generated from full resolution, and imager and sounder data. Imagery at 1, 4, and 8 km resolution is available for daytime and nighttime applications. The increased resolution of the satellite imagery is a vast improvement from previous satellites. Visible data are available at 1 km, "shortwave" infrared (channel 2 data) as well as the infrared channels 4 and 5 are available at 4 km resolution, and water vapor (channel 3) is available at 8 km resolution on GOES-11 and 4 km resolution on GOES-12. Channel 2 data are valuable for the detection of low clouds, fog, stratus, and surface hot spots; channel 5 data, available on GOES-11, in combination with data from channels 2 and/or 4 are useful for detecting volcanic ash in the atmosphere. On GOES-12, channel 6 is a 13.3  $\mu\text{m}$  band that detects the presence of CO<sub>2</sub>. Channel 6 improves the measurement of the height of clouds and volcanic ash, thus improving computer model forecasts and ash warnings to the aviation community. The digital data may be enhanced to emphasize different features as desired. A suite of digital data and products is available to users in the National Weather Service (NWS), the National Environmental Satellite, Data, and Information Service (NESDIS), other Federal agencies, the academic community, and many private agencies, both national and international. These data are made available through NOAAPORT, RAMSDIS, the Internet, and other means such as local networks.

**6.1.1.1. GOES-12.** GOES-12, launched July 23, 2001, supports the GOES-East station at 75°W and serves NOAA operations, to include the TPC/NHC, other Federal agencies, and the private sector. Various imager channels at higher resolutions are being utilized to monitor the intensification and movement of tropical cyclones over the Atlantic Ocean and a

portion of the East Pacific. In particular, greater detail in the imagery facilitates tropical cyclone monitoring and analysis, and the use of the GOES imager channel 2 has vastly improved the detection of low-level circulation centers at night to assist in storm positioning. Retrievals from the GOES sounder are now being incorporated into NCEP's numerical models to improve model output. In addition, sounder data are being exploited to generate derived product imagery such as total precipitable water, atmospheric stability indices, surface temperatures and cloud heights.

During the 1996 hurricane season, NESDIS instituted a specialized GOES-East sounder schedule consisting of four sectors covering distinct areas of the Atlantic Ocean. Of the four sounder sectors, the CONUS sector is scanned every hour and covers the northern Gulf of Mexico and the east coast of the United States. During routine scanning operations, of the other 3 sounder sectors (the Gulf of Mexico, North Atlantic, and the East Caribbean) the Gulf of Mexico sector is designated as the "primary OCONUS" (off CONUS) sector and is scanned 4 times in a 6 hour period, while the other two sectors are only scanned once in every 6 hour period. Event driven, this "primary OCONUS" sounder sector can be changed by the TPC/NHC. The "primary" OCONUS sector provides frequent scans over the area of interest to generate experimental sounder winds (identifies steering currents) and provide moisture and temperature retrievals. Sounder winds are made available to TPC/NHC as a forecasting tool by the Cooperative Institute for Meteorological Satellite Studies (CIMSS), University of Wisconsin.

**6.1.1.2. GOES-11.** GOES-11 was launched on May 3, 2000, and supports the GOES-West station at 135°W. The routine scanning mode of GOES-11 provides coverage of the Northern and Southern Hemisphere eastern Pacific Ocean as well as the western United States. The GOES-West satellite also supports the missions of both the TPC/NHC and the CPHC, and provides coverage of developing tropical cyclones over the East and Central Pacific. The DOD and other Federal agencies are also supported.

**6.1.1.3. GOES-13.** GOES-13 was launched on May 24, 2006. GOES-13 carries the same imager and instrumentation capabilities as GOES-12. GOES-13 is stored on orbit at 105°W until required to replace either of the older operational satellites.

**(NOTE: For GOES imager/sounding schedules go to <http://www.ssd.noaa.gov/PS/SATS/>)**

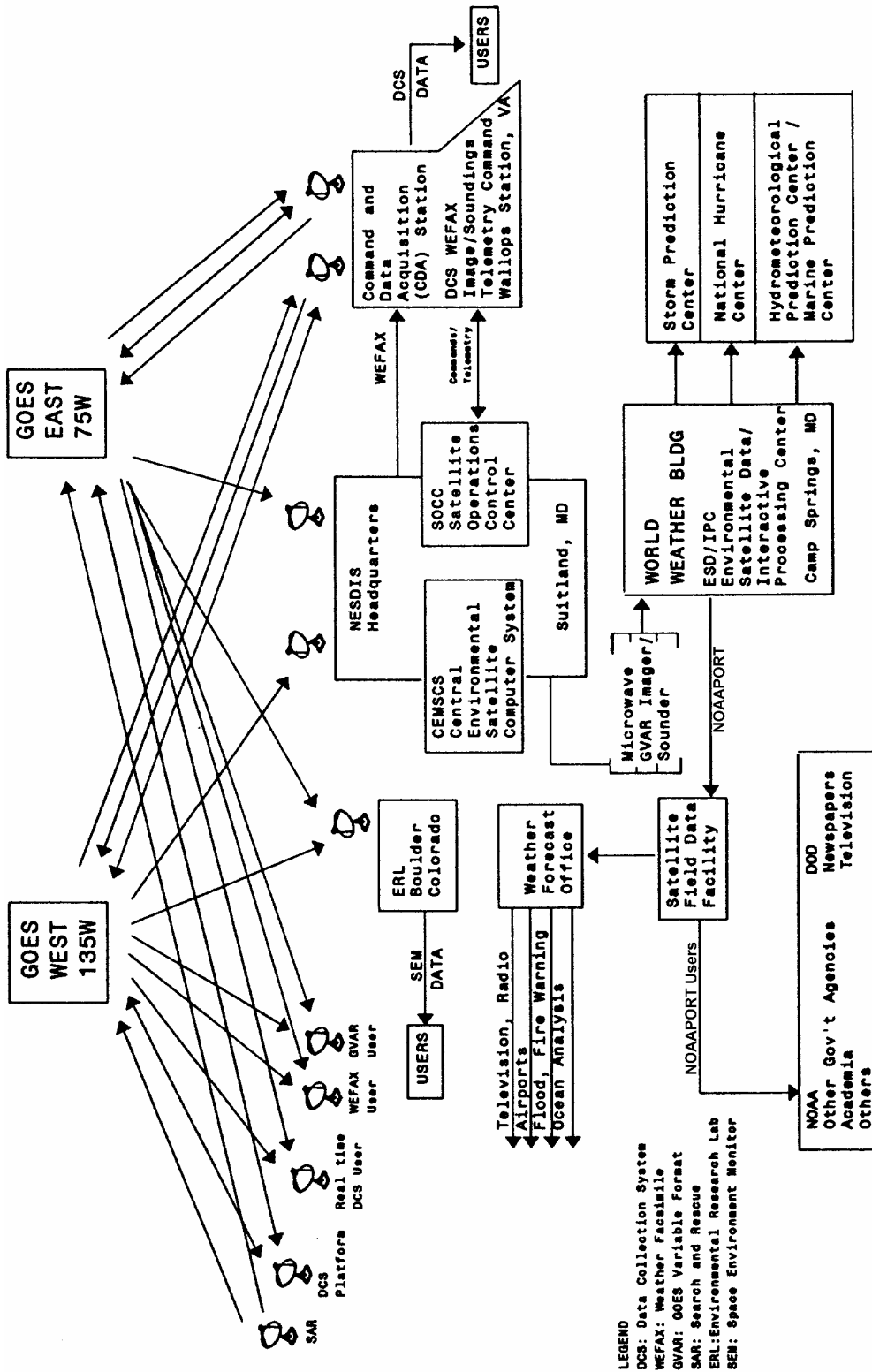


Figure 6-1. The GOES Satellite System

**6.1.2. EUMETSAT Meteosat Geostationary Satellites.** Meteosat-9, launched December 21, 2005, replaced Meteosat-8 on April 11, 2007, and provides vital coverage of developing tropical waves off the African Coast and eastern Atlantic Ocean. Conventionally, the full disk IR, visible (VIS), and water vapor imagery have a 3 km resolution whereas a specialized VIS sector provides a maximum 1 km resolution. This visible sector has a limited scan, and will shift from the West Indian Ocean to the East Atlantic Ocean from 14:00 UTC to 01:00 UTC every day during hurricane season. This shift will ensure interests monitoring for tropical activity in the North Indian Ocean (Meteo-France) as well as the East Atlantic (TPC) will be satisfied. The digital data are transmitted to NESDIS and NCEP at the NOAA Science Center (NSC) in Camp Springs, MD, every 15 minutes. They are also available to the TPC and the Storm Prediction Center (SPC) through central processing at the NSC. Meteosat WEFAX data are also available and distributed via the GOES WEFAX system and through NOAAPORT as part of a northern hemisphere composite image.

In December 1995, EUMETSAT, the program administrator, began encrypting digital Meteosat data 24 hours per day to regulate use within Europe. Based on international data policy agreements, U.S. non-government users are allowed access via a domestic satellite to non-encrypted Meteosat data 8 times per day at synoptic times; at other times, the data are encrypted. Hence, if half-hourly transmissions are required to support operational requirements, it is necessary for users to register with EUMETSAT to acquire decryption devices for installation at their local site (NOAA/DOD and other U.S. government agencies are registered).

**6.1.3. MTSAT-1R.** The Multifunctional Transport Satellite-1 Replacement (MTSAT-1R) was launched for the Japanese Meteorological Agency (JMA) on February 26, 2005. MTSAT-1R is located at 140° East, covering the West Pacific Ocean, East Asia, and the East Indian Ocean. MTSAT-1R is similar to GOES as it carries a 5-channel imager (one visible channel at 1 km plus four IR channels at 5 km, to include a new low-light IR channel). MTSAT-1R provides imagery for the Northern Hemisphere every 30 minutes, and JMA makes the data available to 27 countries and territories in the region. Data from MTSAT-1R is available to CONUS users via the DOMestic SATellite (DOMSAT) or from the NOAA Science Center and available to Pacific OCONUS users directly via downlinks in Hawaii and Guam.

**6.1.4. Initial Joint Polar System (IJPS).** *Two primary operational polar orbiting satellites, NOAA's NOAA-18 and EUMETSAT's MetOp-A, provide image coverage four times a day over a respective area in 6 spectral channels (however only 5 channels can be supported at one time; channel switching is used to support the 6th channel).* These satellites cross the U.S. twice per day at 12-hour intervals for each geographical area near the Equatorial crossing times listed in Table 6-1. NOAA-18 and MetOp-A provide the same capabilities as previous NOAA satellites, except that the Advanced Microwave Sounding Unit-B (AMSU-B) sensor flown aboard NOAA-17 and previous polar orbiters has been replaced by the Microwave Humidity Sounder (MHS) on NOAA-18. Data are available via direct readout—high-resolution picture transmission (HRPT) or automatic picture transmission (APT)—or via central processing. Data from the Advanced Very High Resolution Radiometer (AVHRR) on NOAA-18 and the corresponding Visible Infrared Imaging Radiometer (VIIRS) on board MetOp-A are available on a limited basis through the GOES distribution system (Figure 6-1). The Air Force Weather



Agency (AFWA), Offutt AFB, NE, receives global NOAA imagery data direct from central readout sites on a pass-by-pass basis. The Command and Data Acquisition (CDA) stations at Fairbanks, AK, and Wallops, VA, acquire recorded global area coverage data sub-sampled to a 4 km spatial resolution, and then route the data to NESDIS computer facilities in Suitland, MD, where the data are processed and distributed to the NOAA, the DOD, and private communities. Ground equipment installed at various NWS regions including Kansas City, Miami (TPC), and Monterey enable direct readout and data processing of 1.1 km resolution AVHRR and VIIRS data from NOAA-18 and MetOp-A. The high resolution polar data and products generated at TPC complement other satellite data sources to support tropical mission objectives.

## **6.2. National Weather Service (NWS) Support.**

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

**6.2.2. Products.** In addition to the satellite-related products listed in paragraphs 3.6.1, 3.6.2, and 3.6.3, there are two additional satellite products issued by the centers and their alternates.

**6.2.2.1. Satellite Tropical Weather Discussions.** TPC/NHC issues these discussions four times a day. They describe significant features from the latest surface analysis and significant weather areas for the Gulf of Mexico, the Caribbean, and between the equator and 32°N in both the Atlantic and eastern Pacific east of 140°W.

**6.2.2.2. Satellite Interpretation Messages.** CPHC issues these messages four times a day to describe synoptic features and significant weather areas in the vicinity of the Hawaiian Islands. FAA contractions are used. WFO Guam issues these messages two times a day to describe synoptic features and significant weather over the Micronesian waters.

**6.3. NESDIS Satellite Analysis Branch (SAB).** The SAB operates 24 hours a day to provide satellite support to the HPC/OPC, TPC, CPHC, JTWC, and other worldwide users. In addition to providing high quality imagery from geostationary and polar-orbiting satellites and coordinating the execution of GOES Rapid Scan Operations (RSO) requests, SAB provides pertinent information on global tropical cyclone development, including location and intensity analysis based on the Dvorak technique. For numerical model input and forecasting applications, data from high density cloud motion wind vectors, high density water vapor wind vectors, four layers of derived precipitable water from sounder moisture retrievals, and tropical rainfall estimates are provided to HPC and TPC. In addition, estimates of cumulative rainfall expected over coastal areas derived using the Tropical Rainfall Potential (TRaP) methodology are provided for tropical storms within 24 hours of landfall and posted to a web site in support of CPHC, HPC, TPC, forecast offices in U.S. territories, and international customers. Telephone numbers for the SAB are located in Appendix H.

**6.4. Air Force Support and the Defense Meteorological Satellite Program (DMSP).** Data covering the National Hurricane Operations Plan areas of interest are received centrally at the Air Force Weather Agency (AFWA) and *distributed to the Air Force's Operational Weather Squadrons (OWS) and the Navy's Fleet Numerical Meteorology and Oceanography Center (FNMOC) at Monterey, CA. Satellite data covering the Central Pacific area are received at or shipped to the 17th OWS Meteorological Satellite Operations (SATOPS) Flight (17 OWS/WXJ), Joint Typhoon Warning Center, Pearl Harbor, HI. The 17 OWS/WXJ uses all available meteorological satellite data when providing fix and or intensity information to Central Pacific Hurricane Center forecasters.*

**6.4.1. Central Pacific Surveillance.** The 17 OWS/WXJ (JTWC Satellite Operations) will provide, *resources permitting*, fix and intensity information to the CPHC on systems upon request.

**Table 6-1. Communications Headings for Satellite Tropical Weather Discussion Summaries**

WMO HEADING	TIME ISSUED	OCEANIC AREA	TYPE OF DATA
ATHW40 PHFO	0030, 0530, 1230, 1830 UTC	Vicinity of the Hawaiian Islands	VIS/IR
ATPQ40 PGUM	0300, 1500 UTC	Over Micronesia, West North Pacific Equator to 25°N from 130°E to 180	VIS/IR
AXNT20 KNHC	0000, 0600, 1200, 1800 UTC	Atlantic Ocean South of 32°N to Equator.... Caribbean, Gulf of Mexico	VIS/IR
AXPZ20 KNHC	0135, 0735 1335, 1935 UTC	Eastern Pacific South of 32°N to the Equator.... east of 140° W	VIS/IR

**6.5. Satellites and Satellite Data Availability for the Current Hurricane Season.** Table 6-2 lists satellite capabilities for the current hurricane season.

**Table 6-2. Satellite and Satellite Data Availability for the Current Hurricane Season**

SATELLITE	TYPE OF DATA	LOCAL TIME	PRODUCTS
GOES-11 at 135°W	Multispectral Imager and Sounder	GOES-12 and GOES-10: Every 30 min, in Routine Scan Mode, provides 3 sectors with prescribed coverages: Northern Hemisphere (NH) or Extended NH; CONUS or PACUS; and Southern Hemisphere. Exception is transmission of full disk every 3 hours. (Available Rapid Scan Operations yield increased transmissions to 7.5 minute intervals to capture rapidly changing, dynamic weather events).	<ol style="list-style-type: none"> <li>1. 1, 2, 4, and 8 km resolution visible standard sectors.</li> <li>2. 4 km equivalent resolution IR sectors.</li> <li>3. Equivalent and full resolution IR enhanced imagery.</li> <li>4. Full disk IR every 3 hours.</li> <li>5. 8 km water vapor sectors.(4 km on GOES-12)</li> <li>6. Quantitative precipitation estimates; high density cloud and water vapor motion wind vectors; and experimental visible and sounder winds.</li> <li>7. Operational moisture sounder data (precipitable water) in four levels for inclusion in NCEP numerical models. Other sounder products including gradient winds, vertical temperature and moisture profiles, mid-level winds, and derived product imagery (precipitable water, lifted index, and surface skin temperature).</li> <li>8. Tropical storm monitoring and derivation of intensity analysis.</li> <li>9. Volcanic ash monitoring and dissemination of Volcanic Ash Advisory Statements.</li> <li>10. Daily northern hemisphere snow cover analysis.</li> <li>11. Twice daily fire and smoke analysis over specific areas within CONUS.</li> </ol>
GOES-13 <i>(on-orbit storage at 105°W)</i>	5 Channels for Imager		
GOES-12 at 75°W	19 Channels for Sounder		

**Table 6-2. Satellite and Satellite Data Availability for the Current Hurricane Season  
(continued)**

SATELLITE	TYPE OF DATA	LOCAL TIME	PRODUCTS
METEOSAT-9 <i>(replaced METEOSAT-8 on April 11, 2007)</i>	Multi-spectral Spin-Scan Radiometer (SEVIRI) and High Resolution Visible (HRV)	SEVIRI: Full disk image every 15 minutes.  HRV: Sector scan to move with local noon.	1. 1 km resolution digital VIS imagery (HRV); 3 km resolution digital IR imagery (SEVIRI). 2. 3 km resolution VIS and IR WEFAX imagery. 3. 3 km water vapor imagery. 4. Tropical storm monitoring and derivation of intensity analysis. 5. Volcanic ash detection and analysis.
MTSAT-1R	Multi-band imager (Visible plus 4 IR channels)	Hourly Full disk and two Northern Hemisphere scans per hour, with special “quadrant” scans four per hour.	1. 1 km resolution digital VIS imagery 2. 5 km resolution digital IR imagery and water vapor 4. Tropical storm monitoring and derivation of intensity analysis. 5. Volcanic ash detection and analysis

**Table 6-2. Satellite and Satellite Data Availability for the Current Hurricane Season (continued)**

SATELLITE	TYPE OF DATA	LOCAL TIME	PRODUCTS
TRMM (NASA Tropical Rainfall Measuring Mission)	85 and 37 GHz Microwave	Fluctuates from 30°N to 30°S	<ol style="list-style-type: none"> <li>1. 15 km resolution microwave coverage of the tropics from 30°S to 30°N.</li> <li>2. Microwave analysis of 85 and 37 GHz radiance composited passes.</li> <li>3. Brightness temperature products of the 85 and 37 GHz horizontal and vertical polarization. Derived rain-rate products.</li> </ol>
MetOp-A  NOAA-18	AVHRR; GAC and LAC (recorded); HRPT (direct); AMSU-A; AMSU-B (N-17); MHS (N-18); HIRS VIIRS 1 km global,	0931D <sup>1</sup> /2131A <sup>2</sup>  0138D/1338A	<ol style="list-style-type: none"> <li>1. 1 km resolution HRPT and Local Area Coverage (LAC) data.</li> <li>2. 4 km resolution APT and Global Area Coverage (GAC) data.</li> <li>3. Mapped imagery.</li> <li>4. Unmapped imagery (all data types) at DMSP sites.</li> <li>5. Sea-surface temperature analysis.</li> <li>6. Soundings.</li> <li>7. Moisture profiles.</li> <li>8. Remapped GAC sectors.</li> <li>9. Sounding-derived products-- total precipitable water, rain rate, and surface winds under sounding</li> <li>10. Daily northern hemisphere snow cover analysis.</li> <li>11. Twice daily fire and smoke analysis over specific areas within CONUS.</li> </ol>

<sup>1</sup> D - descending

<sup>2</sup> A - ascending

**Table 6-2. Satellite and Satellite Data Availability for the Current Hurricane Season  
(continued)**

SATELLITE	TYPE OF DATA	LOCAL TIME	PRODUCTS
DMSP F-12	OLS Imagery (direct only), SSM/I (non-functional), SSM/T-1 (non-functional), SSM/T-2 (direct only)	0349D/1549A	<p>1. 0.3 nm (regional) and 1.5 nm (global) resolution (visual and infrared) imagery available via stored data recovery through AFWA.</p> <p>2. Regional coverage at 0.3 nm and 1.5 nm resolution (visual and infrared) imagery available from numerous DOD tactical terminals.</p> <p>3. SSM/T-1, SSM/T-2, SSM/I, and SSM/IS data transmitted to NESDIS and FNMOC from AFWA.</p>
DMSP F-13	OLS Imagery (recorded and direct), SSM/I, SSM/T-1	0633D/1833A	
DMSP F-14	OLS Imagery (recorded and direct), SSM/I, SSM/T-1 (inop), SSM/T-2	0543D/1743A	
DMSP F-15	OLS Imagery (recorded and direct), SSM/I, SSM/T-1, SSM/T-2	0756D/1956A	
DMSP F-16	OLS Imagery (recorded and direct), SSM/IS	0809D/2009A	
<i>DMSP F-17</i>	<i>OLS Imagery (recorded and direct), SSM/IS</i>	0534D/1734A	
		Note: Times are accurate to +/- 5 minutes	

**6.6. Current Intensity and Tropical Classification Number.** The current intensity (C.I.) number relates directly to the intensity of the storm. The empirical relationship between the C.I. number and a storm's wind speed is shown in Table 6-3. The C.I. number is same as the tropical classification number (T-number) during the development stages of a tropical cyclone but is held higher than the T-number while a cyclone is weakening. This is done because a lag is often observed between the time a storm pattern indicates weakening has begun and the time when the storm's intensity decreases. An added benefit of 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.

**Table 6-3. The Empirical Relationship\* between the C.I. Number and the Maximum Wind Speed and the Relationship between the T-Number and the Minimum Sea-Level Pressure**

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

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





## CHAPTER 7

### SURFACE RADAR REPORTING

**7.1. General.** Radar observations of tropical cyclones will be made at Department of Defense (DOD), National Weather Service (NWS), and Federal Aviation Administration (FAA) Weather Surveillance Radar-1988 Doppler (WSR-88D) facilities. Participating radar sites are listed in Table 7-1.

**7.2. The WSR-88D.** The WSR-88D is a computerized radar data collection and processing system. The design and implementation of the WSR-88D was a joint effort of the DOD, NWS, and FAA, and the utilization of the radar continues to be governed by tri-agency agreement. The WSR-88D is an S-band (10-cm), coherent radar, with a nominal beam width of 1 degree. The maximum data ranges are 248 nm (reflectivity) and 124 nm (velocity). Radar scanning strategies are selectable, using predetermined volume coverage patterns (VCP). The VCP in use depends upon which weather phenomena are under surveillance. Once the radar data has been collected, it is processed automatically at the radar site by a suite of algorithms which provide graphical products for forecaster use. TPC/NHC, as an external user, obtains these products through a network connection. CPHC controls and operates four WSR-88Ds in Hawaii and obtains products directly.

**7.3. Procedures.** As a tropical cyclone approaches, TPC/NHC uses the WSR-88D to perform radar center-fixing and to obtain other diagnostic information. Therefore, it is important to optimize WSR-88D performance for tropical cyclones and to allow other users, especially the TPC/NHC, access to radar products in the area of landfall. Most of the changes must be issued through the Master System Control Function (MSCF), Human Computer Interface (HCI). To facilitate this process, TPC/NHC in cooperation with the Radar Operations Center (ROC) has developed an operations plan for use during tropical cyclone events. The current tropical cyclone operations plan is available as a sub-link to the National Hurricane Operations Plan on the OFCM web site at <http://www.ofcm.gov/homepage/text/pubs.htm>. It is also available via fax from the ROC Hotline (1-800-643-3363).

**7.3.1. Radar Observation Requirements, WSR-88D.** Chief among the requirements is the appropriate display of hurricane-force winds. Changes must be made at the radar site, guided by the WSR-88D Tropical Cyclone Operations Plan, in order to deal effectively with hurricane conditions. The physical characteristics of the tropical cyclone are best represented by use of the precipitation mode, usually VCP 11, 21 or 121, depending upon range (*see tropical cyclone operations plan for further information*). Radar characteristics of hurricanes are given in Federal Meteorological Handbook Number 11 (FMH-11), Part B, Chapter 9. Further discussion of product usage appears in FMH-11, Part D, Unit Description and Operational Applications. A recommended product list appears in FMH-11 Part D, Application versus Product Table 4-1.

**Table 7-1. Participating Radar Stations <sup>1</sup>**

LOCATION	RADAR TYPE	LATITUDE	LONGITUDE
NATIONAL WEATHER SERVICE RADARS			
<u>U.S. Gulf and Atlantic coast</u>			
Albany, NY	WSR-88D	42°35' N	74°04' W
Atlanta, GA	WSR-88D	33°22' N	84°34' W
Binghamton, NY	WSR-88D	42°12' N	75°59' W
Birmingham, AL	WSR-88D	33°10' N	86°46' W
Boston, MA	WSR-88D	41°57' N	71°08' W
Brandon/Jackson, MS	WSR-88D	32°17' N	89°59' W
Brownsville, TX	WSR-88D	25°55' N	97°25' W
Caribou, ME	WSR-88D	46°02' N	67°48' W
Charleston, SC	WSR-88D	32°33' N	80°47' W
Columbia, SC	WSR-88D	32°39' N	81°03' W
Corpus Christi, TX	WSR-88D	27°47' N	97°31' W
Ft. Worth, TX	WSR-88D	32°34' N	97°18' W
Greer, SC	WSR-88D	34°53' N	82°13' W
Houston, TX	WSR-88D	29°28' N	95°05' W
Huntsville/Hytop, AL	WSR-88D	34°56' N	86°05' W
Jacksonville, FL	WSR-88D	30°29' N	81°42' W
Key West, FL	WSR-88D	24°36' N	81°42' W
Lake Charles, LA	WSR-88D	30°07' N	93°13' W
Melbourne, FL	WSR-88D	28°07' N	80°39' W
Miami, FL	WSR-88D	25°37' N	80°25' W
Mobile, AL	WSR-88D	30°41' N	88°15' W
Morehead City, NC	WSR-88D	34°46' N	76°53' W
New Orleans/Baton Rouge LA	WSR-88D	30°20' N	89°50' W
New York City, NY	WSR-88D	40°52' N	72°52' W
Philadelphia, PA	WSR-88D	39°57' N	74°25' W
Portland, ME	WSR-88D	43°53' N	70°15' W
Raleigh/Durham, NC	WSR-88D	35°40' N	78°29' W
Roanoke, VA	WSR-88D	37°01' N	80°16' W
San Antonio, TX	WSR-88D	30°43' N	97°23' W
Shreveport, LA	WSR-88D	32°27' N	93°50' W
State College, PA	WSR-88D	40°55' N	78°00' W
Sterling, VA	WSR-88D	38°58' N	77°29' W
Tallahassee, FL	WSR-88D	30°24' N	84°20' W
Tampa, FL	WSR-88D	27°42' N	82°24' W
Wakefield, VA	WSR-88D	36°59' N	77°00' W
Wilmington, NC	WSR-88D	33°59' N	78°26' W

<sup>1</sup>The criterion for selection is that the radar site is located within approximately 124 n mi (maximum velocity range) of the coastline.

NATIONAL WEATHER SERVICE RADARS  
U.S. Southwest

Phoenix, AZ	WSR-88D	33°17' N	111°40' W
San Diego, CA	WSR-88D	33°49' N	117°38' W
Tucson, AZ	WSR-88D	31°57' N	110°54' W
Yuma, AZ	WSR-88D	32°40' N	114°37' W

FAA RADARS

Molokai, HI	WSR-88D	21°08'N	157°11'W
Kohala, HI	WSR-88D	20°06'N	155°45'W
San Juan, PR	WSR-88D	18°07'N	66°05'W
South Hawaii, HI	WSR-88D	19°06'N	155°34'W
South Kauai, HI	WSR-88D	21°54'N	159°33'W

DEPARTMENT OF DEFENSE

Andersen AFB, Guam	WSR-88D	13°27'N	144°49'E
Columbus AFB, MS	WSR-88D	33°54'N	88°20'W
Dover AFB, DE	WSR-88D	38°50'N	75°26'W
Eglin AFB, FL	WSR-88D	30°34'N	85°55'W
Fort Hood, TX	WSR-88D	30°43'N	97°23'W
Fort Polk, LA	WSR-88D	31°09'N	92°58'W
Fort Rucker, AL	WSR-88D	31°28'N	85°28'W
Maxwell AFB, AL	WSR-88D	32°32'N	85°47'W
Moody AFB, GA	WSR-88D	30°33'N	83°00'W
Robins AFB, GA	WSR-88D	32°40'N	83°21'W

(NHC has *network* access to the above DOD sites.)

**7.3.2. Central Region Report.** The following fix definitions and criteria are used in reporting WSR-88D tropical cyclone radar observations:

- If the central region of a storm is defined by an identifiable circular, or nearly circular, wall cloud with an echo-free center, the fix (the geometric center) is reported as an "**EYE**".
- If the central region is recognizable, but not well-defined by a wall cloud (as in the case of a tropical storm), it is reported as a "**CENTER**."
- When the eye or center is only occasionally recognizable or some other central region uncertainty exists, the eye or center is reported as "**PSBL EYE**" or "**PSBL CENTER**."
- Remarks stating the degree of confidence will be included and will be classified as either "good," "fair," or "poor." If an eye is present, 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." Note that a partial eyewall may be the result of excessive range from the radar, or represent the true structure of the system. Doppler velocities will, in general, increase confidence in the center position and, if available, should always be examined prior to establishing a fix.

**7.3.3. Transmission of Radar Reports.** When the tropical cyclone is within 200 n mi of a WSR-88D, and the center fix is considered reliable, the appropriate tropical cyclone warning center (TPC/NHC or CPHC) may issue a tropical cyclone position estimate (AFOS category TCE) between 2-hourly intermediate advisories. Note that although the issuance of this product depends upon the quality of the radar fix, other data sources such as aircraft reconnaissance may be blended with the radar estimate to obtain a position. Thus, a radar position based on a particular radar may appear to disagree with the TCE position, but has in fact been taken into consideration.

In the case of communications failure, and the event that TPC/NHC cannot obtain the necessary radar data, the local NWS Weather Forecast Office may be called upon to estimate the radar position and render qualitative assessment of the circulation.

Other radar facilities not having weather transmission capability but wishing to provide information deemed important, should call the nearest NWS Weather Forecast Office or the TPC/NHC.

## CHAPTER 8

### NATIONAL DATA BUOY CAPABILITIES AND REQUIREMENTS

#### 8.1. General.

**8.1.1. Automated Reporting Stations.** The National Data Buoy Center (NDBC) maintains automated reporting stations in the coastal and deep ocean areas of the Gulf of Mexico, the Atlantic and Pacific Oceans, and in the Great Lakes. These data acquisition systems collect real-time meteorological and oceanographic measurements for operational and research purposes. Moored buoys are deployed in the Southern Gulf of Mexico, the Caribbean and the Atlantic Ocean east of the Lesser Antilles for the primary purpose of supporting National Hurricane Center operations. NDBC also quality controls and releases meteorological data from the National Ocean Service Water Level Observing Network and from moorings and coastal stations operated by cooperating Regional Ocean Observing Systems. The NDBC website at [www.ndbc.noaa.gov](http://www.ndbc.noaa.gov) provides locations, latest operating status, and site-specific information for NDBC stations and provides links to details on partner organization stations. Specific questions may be addressed to NDBC Data Management and Communications Branch, Stennis Space Center, Mississippi 39529-6000, phone 228-688-2835.

**8.1.2. Data Acquisition.** Moored buoy and C-MAN stations routinely acquire, store, and transmit data every hour; a few selected stations report more frequently. Data obtained operationally include sea level pressure, wind speed and direction, peak wind, and air temperature. Sea surface temperature and wave spectra data are measured by all moored buoys and a limited number of C-MAN stations. Relative humidity is measured at several stations. Ocean currents and salinity are measured at a few coastal stations.

NDBC acquires, encodes, and distributes data from partner organizations via NWS dissemination systems. Data from partner organizations pass through NDBC data quality control procedures prior to NWS dissemination. Frequency and timeliness of transmissions from these stations varies by organization.

#### 8.1.3. Drifting Buoys.

**8.1.3.1. NDBC.** NDBC is capable of acquiring, preparing, and deploying drifting buoys; however, an operational drifting buoy requirement has not been identified or funded.

**8.1.3.2. Navy.** Since 1998, the Naval Oceanographic Office (NAVOCEANO) has deployed meteorological drifting buoys to report surface meteorological and oceanographic measurements, for operational purposes, as tropical systems move through data sparse regions tracking toward the U.S. East Coast. Additionally, Navy drifting buoys have been deployed in the Intertropical Convergence Zone (ITCZ). The drifting buoy measurements, which are available to tropical forecasters, provide invaluable input for defining tropical storm movement and intensity, improve forecast model initialization, and give tropical forecasters a much better sense of storm characteristics and track as they approach the fleet concentration areas of

Jacksonville, FL, and Norfolk, VA. Drifting buoys typically have a life span of 1 to 2 years, and the data are available through the NAVOCEANO homepage and through standard World Meteorological Organization (WMO) data sources.

NAVOCEANO acquires, prepares, and deploys drifting meteorological buoys based on operational requirements identified by Commander-in-Chief, Atlantic Fleet (CINCLANTFLT). Currently, CINCLANTFLT has identified the Navy's drifting buoy support as a standing requirement to support fleet safety, assist in fleet sortie decisions, and enhance tropical weather preparedness.

**8.2. Requests for Drifting Buoy Deployment.** Drifting buoy deployments should be coordinated through the Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA). Deployments will be requested through the Office of the Federal Coordinator for Meteorology (OFCM) to HQ Air Force Reserve Command (AFRC). Deployments in advance of a U.S. land-threatening hurricane require a 36- to 48-hour notification.

**8.2.1. Tropical Prediction Center/National Hurricane Center (TPC/NHC).** TPC/NHC forecasters will issue through the Tropical Cyclone Plan of the Day (TCPOD) an alert or outlook for drifting buoy deployment 48 hours before the planned deployment. Hard tasking for the deployment will be issued via the TCPOD 16 hours, plus flying time to the deployment location, before the event.

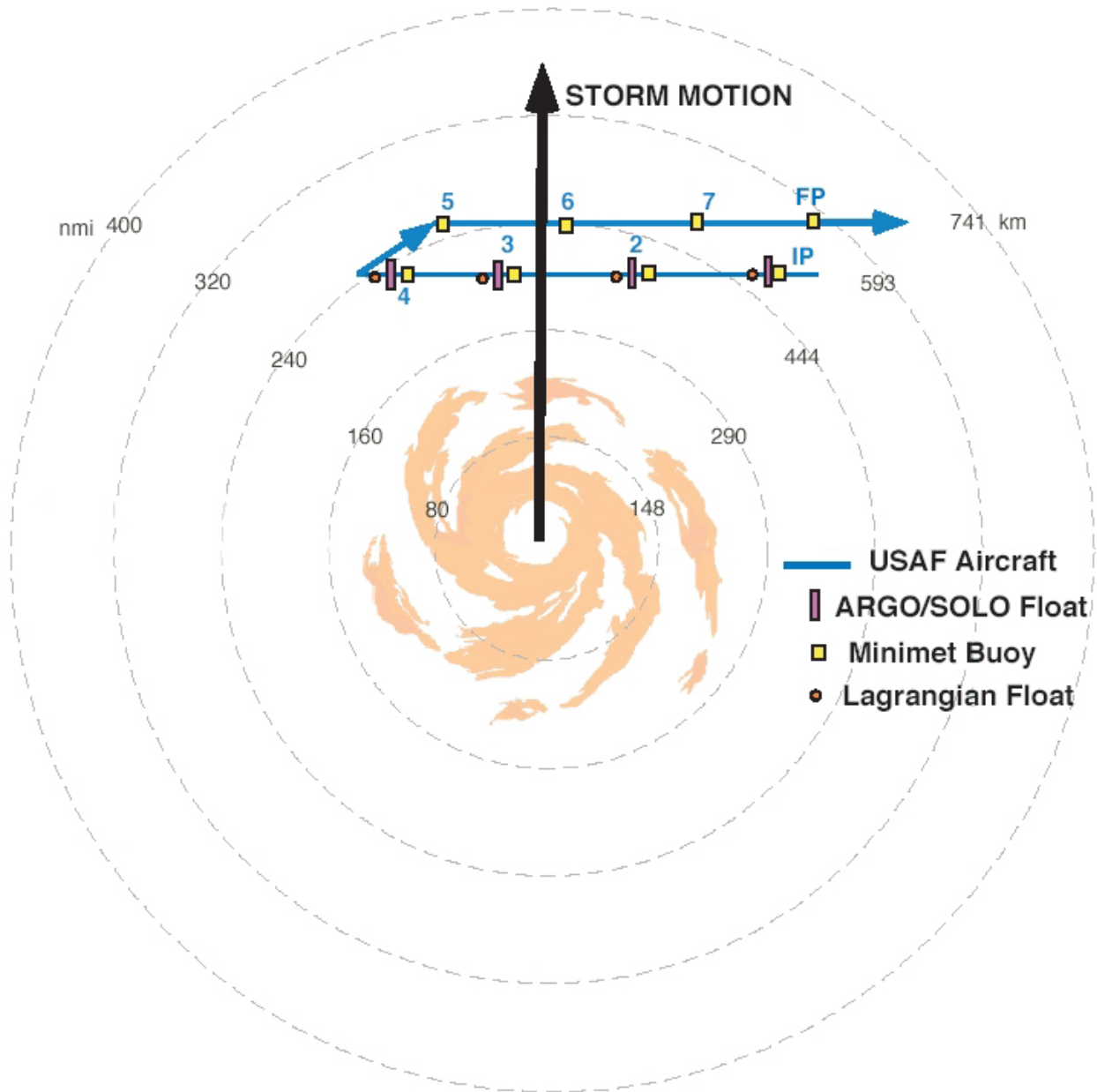
**8.2.2. Deployment of Buoys.** DOC may request the deployment of a drifting buoy and subsurface float array with up to 40 elements at a distance of 200 to 400 nm from the storm center, depending on the dynamics of the storm system. DOC will ensure the buoys and mission-related DOC personnel are delivered to AFRC. The specific DOC request for placement of the buoys will depend on several factors, including:

- Characteristics of the storm, including size, intensity, and velocity.
- Storm position relative to the coast and population centers.
- Availability of aircraft and dropsonde operators (DSO) certified for buoy deployment.

**8.2.3. Deployment Position.** The final deployment position will be provided before the flight crew briefing. An example of a possible buoy and float deployment pattern from the recent CLBAST Experiment is shown in Figure 8-1.

**8.3. Communications.** Moored buoy and C-MAN data are transmitted via NOAA Geostationary Operational Environmental Satellite (GOES) to the National Environmental Satellite, Data, and Information Service (NESDIS) or via the Iridium satellite communication system and then are relayed to the NWS Telecommunications Gateway (NWSTG) for processing and dissemination. Data from partner organizations acquired by NDBC are relayed to the NWSTG for processing and dissemination. Moored buoy observations are formatted into the World Meteorological Organization (WMO) FM13 SHIP code. C-MAN and other partner organization coastal station data are formatted into C-MAN code, which is very similar to the WMO FM12 SYNOP code. Drifting buoys transmit data via NOAA's Polar Orbiting Environmental Satellites (POES) to the U.S. Argos Global Processing Center, Largo, MD. Service Argos processes and formats the data into WMO FM18 BUOY code. The messages are

then routed to the NWSTG for distribution. The formats for WMO encoded messages may be found in the WMO Manual on Codes Volume One, WMO-No. 306.



**Figure 8-1. Example Buoy and Float Deployment Pattern**





## CHAPTER 9

### MARINE WEATHER BROADCASTS

**9.1. General.** The National Weather Service and the Department of Homeland Security's United States Coast Guard (USCG) broadcast forecast products that include information on tropical cyclones issued by the National Hurricane Center and the Central Pacific Hurricane Center. The broadcast of these products supports the U.S. participation in the Global Maritime Distress and Safety System, which provides the communications support to the International Maritime Organization's (IMO) global search and rescue plan.

**9.2. Global Maritime Distress and Safety System (GMDSS).** The goals of GMDSS are to provide more effective and efficient emergency and safety communications, and to disseminate maritime safety information to all ships on the world's oceans regardless of location or atmospheric conditions. These goals are defined in the International Convention for the Safety of Life at Sea (SOLAS) 1974, *as amended*. GMDSS is based upon a combination of satellite and terrestrial radio services and has changed international distress communications from being primarily ship-to-ship based to ship-to-shore (rescue coordination center) based. GMDSS provides for automatic distress alerting and locating, and requires ships to receive broadcasts of maritime safety information which could prevent a distress from happening in the first place. The NWS participates directly in the GMDSS by preparing weather forecasts and warnings for broadcast via two primary GMDSS systems--NAVTEX and Inmarsat-C SafetyNET.

**9.2.1. NAVTEX.** NAVTEX is an international, automated system for instantly distributing maritime navigational warnings, weather forecasts and warnings, search and rescue notices, and similar information to ships. It has been designated by the IMO as the primary means for transmitting coastal urgent marine safety information to ships worldwide. NAVTEX is broadcast from the 12 USCG stations. Coverage is reasonably continuous along the east, west, and Gulf coasts of the United States, as well as the area around Kodiak, Alaska, Guam, and Puerto Rico. Typical NAVTEX transmissions range from 200-400 nm.

**9.2.2. SafetyNET.** Satellite systems operated by Inmarsat Ltd. are an important element of the GMDSS. Inmarsat-C provides ship/shore, shore/ship, and ship/ship store-and-forward data and telex messaging; the capability for sending preformatted messages to a rescue coordination center; and the SafetyNET service. The Inmarsat-C SafetyNET service is a satellite-based worldwide maritime safety information broadcast service of high seas weather warnings, navigational warnings, radionavigation warnings, ice reports and warnings generated by USCG-conducted International Ice Patrol, and other information not provided by NAVTEX.

**9.3. Coastal Maritime Safety Broadcasts.** In addition to NAVTEX, the USCG and other government agencies broadcast maritime safety information, using a variety of different radio systems to ensure coverage of different ocean areas for which the United States has responsibility and to ensure all ships of every size and nationality can receive this vital safety information.

**9.3.1. VHF Marine Radio.** The USCG broadcasts nearshore and storm warnings of interest to the mariner on VHF channel 22A (157.1 MHz) following an initial call on the distress, safety, and calling channel 16 (156.8 MHz). Broadcasts are made from over 200 sites, covering the coastal areas of the U.S., including the Great Lakes, major inland waterways, Puerto Rico, Alaska, Hawaii, and Guam. All ships in U.S. waters over 20 meters in length are required to monitor VHF channel 16 and must have radios capable of tuning to the VHF simplex channel 22A. Typical coverage is 25 nm offshore.

**9.3.2. Medium Frequency Radiotelephone (Voice).** The USCG broadcasts offshore forecasts and storm warnings of interest to mariners on 2670 kHz, after first being announced on the distress, safety, and calling frequency 2182 kHz.

**9.3.3. NOAA Weather Radio.** The NOAA Weather Radio network continually broadcasts coastal and marine forecasts on frequencies near 162 MHz. Recorded voice broadcasts have largely been supplanted by a synthesized voice. The network provides near-continuous coverage of the coastal U.S., Great Lakes, Hawaii, Guam, *Commonwealth of the Northern Mariana Islands*, and the populated Alaska coastline. Typical coverage is 25 nm offshore.

**9.4. High Seas Broadcasts.** NWS high seas weather forecasts and warnings are also available on the following high frequency (HF) broadcasts.

**9.4.1. HF Radiotelephone (Voice).** *Weather forecasts and warnings for high seas and offshore areas are broadcast over scheduled HF single sideband (SSB) radiotelephone channels from USCG communications stations using a very distinctive and recognizable computer-synthesized voice.*

**9.4.2. HF Radiofacsimile.** The USCG broadcasts NWS high seas weather maps from five communications stations--Boston, MA (NMF); Point Reyes, CA (NMC); New Orleans, LA (NMG), Honolulu, HI (KVM-70) (a DOD station); and Kodiak, AK (NOJ). Limited satellite imagery, sea surface temperature maps, and text forecasts are also available.

**9.4.3. HF Radiotelex (HF SITOR).** High seas forecasts in text format, recognized by the GMDSS, are broadcast over scheduled GMDSS HF narrow-band direct printing channels from USCG communications stations. Limited offshore forecasts are also available.

**9.4.4. WWV, WWVH HF Voice (Time Tick).** Atlantic high seas warnings are broadcast at 7 and 8 minutes past the hour over WWV (Boulder, CO) on the following HF frequencies: 2.5, 5, 10, 15, and 20 MHz; Pacific high seas warnings are broadcast at 9 minutes

past the hour. Pacific high seas warnings are broadcast from 48-51 minutes past the hour over WWVH (Honolulu, HI) at 2.5, 5, 10, and 15 MHz. These are the National Institute of Standards and Technology (NIST) standard time/frequency broadcasts.

**9.5. Additional Information.** Further information concerning these and other marine broadcasts, including schedules, frequencies, and links to products can be found at:

- [www.nws.noaa.gov/om/marine/home.htm](http://www.nws.noaa.gov/om/marine/home.htm)
- [www.navcen.uscg.gov/marcomms/](http://www.navcen.uscg.gov/marcomms/)

In addition, the *National Geospatial-Intelligence Agency (NGA)*, Publication 117, Radionavigation Aids, (<http://www.nga.mil/portal/site/maritime/>) contains detailed information on maritime safety information broadcasts within the U.S. and worldwide. This publication is also available from the Superintendent of Documents; it can be ordered by calling 1-202-512-1800 or by visiting their Internet site at <http://bookstore.gpo.gov>.



## CHAPTER 10

### PUBLICITY

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

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

- NOAA Office of Public Affairs  
Herbert C. Hoover Building  
14th and Constitution Avenue, N.W.  
Washington, DC 20230
- Commander, Naval Meteorology and Oceanography Command  
1100 Balch Boulevard  
Stennis Space Center, MS 39522-3001
- Hq Air Force Reserve Command (AFRC/PA)  
Robins AFB, GA 31093
- Joint Staff Weather Officer  
The Joint Chiefs of Staff (J3/DDGO-ROD)  
Pentagon Room 2D-921G  
Washington, DC 20318-3000
- Federal Aviation Administration (APA-310)  
800 Independence Avenue, S.W.  
Washington, DC 20591
- Director, NOAA Aircraft Operations Center  
P.O. Box 6829  
MacDill AFB, FL 33608-0829
- Federal Coordinator for Meteorology  
Suite 1500, 8455 Colesville Road  
Silver Spring, MD 20910



## APPENDIX A

### LOCAL NATIONAL WEATHER SERVICE (NWS) OFFICE PRODUCTS

**A.1. Hurricane/Typhoon Local Statements (HLS).** WFOs with coastal county responsibilities and selected inland WFOs will issue these unnumbered products which are very specific and designed to inform media, local decision makers, and the public on present and anticipated storm effects in their county warning area (CWA) and adjacent coastal waters. *Keep HLSs as succinct as possible.*

**A.1.1. Mission Connection.** Alert the public, media, and local decision makers of potential or actual storm affects due to tropical cyclones. The product is intended to provide information to assist in the preparation and implementation of necessary precautions for the protection of life and property, as well as minimize the economic losses as a result of tropical cyclones.

#### **A.1.2. Issuance Guidelines.**

**A.1.2.1. Issuance Criteria.** The following WFOs will issue HLSs when their area of responsibility is affected by a tropical cyclone watch/warning or evacuation orders. HLSs may also be issued as needed to dispel rumors or to clarify tropical cyclone related information for their CWA. Coastal WFOs have the option to include inland counties in the HLS not affected by a watch or warning.

Coastal WFOs are defined as those having at least one county with significant tidal influences. Those are:

#### Eastern Region

Caribou, ME  
Portland, ME  
Boston, MA  
New York City, NY  
Philadelphia, PA  
Baltimore, MD/Washington, DC  
Wakefield, VA  
Newport/Morehead City, NC  
Wilmington, NC  
Charleston, SC

#### Southern Region

Brownsville, TX  
Corpus Christi, TX  
Houston/Galveston, TX  
Lake Charles, LA  
New Orleans, LA  
Mobile, AL  
Tallahassee, FL  
Tampa Bay, FL  
Miami, FL  
Key West, FL  
Melbourne, FL  
Jacksonville, FL  
San Juan, PR

#### Western Region

San Diego, CA  
Los Angeles/Oxnard, CA

#### Pacific Region

Honolulu, HI  
Guam  
WSO Pago Pago, American Samoa

Inland WFOs listed below will also issue HLSs when hurricane or tropical storm force winds are expected to impact their area of responsibility. Inland offices not issuing HLSs but expecting hurricane or tropical storm force winds may be required to issue an Inland Tropical

Storm/Hurricane Watches or Warnings.

Atlanta, GA	Jackson, MS
Birmingham, AL	Huntsville, AL
Austin/San Antonio, TX	Midland, TX
San Angelo, TX	Lubbock, TX
Fort Worth, TX	Shreveport, LA

**A.1.2.2. Issuance Times.** The initial HLS should be issued as soon as possible following the first issuance of a tropical storm/hurricane watch/warning for the WFO's area of responsibility. When a tropical storm or hurricane is close to the coast, issue HLSs every 2 to 3 hours or more frequently as circumstances warrant. Do not release HLSs immediately before an advisory unless information is coordinated with the appropriate tropical cyclone center. HLSs do not need to immediately follow the issuance of a new hurricane advisory. Issuing HLSs midway between advisories maintains a steady flow of information to the media and the public. However, when local storm impacts are changing rapidly, or a new advisory changes the potential impact on a local area, information needs to be distributed in a fresh HLS as soon as possible. Routine HLSs may cease when the tropical cyclone is no longer a threat to an office's CWA.

**A.1.2.3. Valid Time.** HLSs are valid at the time of issuance until a subsequent HLS is issued. HLSs are issued at least once every 6 hours.

**A.1.2.4. Product Expiration Time.** Generally 6 hours after the issuance time and should coincide with the next expected update or when the event is forecast to end.

**A.1.3. Technical Description.** HLSs will follow the format and content described in this section.

**A.1.3.1. Content.** HLSs will add localized details to tropical cyclone center's advisory releases and should not conflict with or repeat advisory information not directly applicable to the local office's CWA. Before the first HLS, use public information statements (PNS) to inform the public on routine hurricane preparedness information. The first HLS can also contain standard preparedness messages. Information may be added to the end of the HLS describing where additional storm information can be found in supporting Center's TCP and TCM as well as PNSs and NOWs (Short Term Forecast) issued by the local office.

HLSs should use tropical cyclone position estimates provided by their tropical cyclone center between advisories when appropriate. When tropical cyclones threaten the Samoas (American Samoa and Samoa), the two local offices will coordinate with RSMC Nadi, CPHC, and with each other to determine the best integrated and internally consistent forecast of conditions expected in the area.



The following table defines which products are issued via the normal suite of product headers during tropical cyclone watches/warnings and those products superseded by tropical cyclone watches/warnings and carried in a HLS.

**Table A-1. HLS Product Table**

Product	Tropical Cyclone Watch/Warning	
	HLS	Stand-alone
Flash Flood Watch/Warning/Statement		X
Flood Warning		X
Tornado Warning		X
Inland Tropical Storm or Inland Hurricane Watch/Warning		X
Severe Thunderstorm Warning		X <sup>1</sup>
Coastal Flood Watch/Warning/Statement (CFW)	X <sup>2</sup>	X <sup>2</sup>
Special Marine Warning		X <sup>3</sup>
Severe Weather Statement		X <sup>1</sup>
Marine Weather Statement		X <sup>1</sup>
Special Weather Statement	X	
Surf Zone Forecast/Surf Forecast	X	
High Surf Advisory/Warning (WFO Honolulu)	X	

<sup>1</sup> Can be issued as stand-alone products at the discretion of the WFO. However, their use should be confined to peripheral events, such as outer rainbands, prior to sustained tropical storm or hurricane strength winds

<sup>2</sup> If no CFW products were issued by the WFO prior to the issuance of a tropical cyclone watch or warning, then no CFW products will be issued tropical cyclone watches or warnings are in effect.

<sup>3</sup> WFOs have the option to issue stand-alone special marine warnings (SMW) on an as needed basis. This will primarily occur during watch situations prior to the onset of tropical storm winds impacting a marine zone. In cases of waterspouts, SMWs may be issued anytime during tropical cyclone watch/warning situations.

Complications occur when a CFW product is in effect and tropical cyclone watches and/or warnings are issued. The basic premise is if the threat level of a tropical cyclone product equals or exceeds the threat level of an existing CFW, then the CFW will be discontinued. The following details are further summarized in the matrix below:

- A CFW product is in effect for a Coastal Flood Warning and/or a High Surf Advisory/Warning and a tropical cyclone watch is issued - CFW will **continue** as a stand-alone product along with the HLS product.
- A CFW product is in effect for a Coastal Flood Warning and/or a High Surf Advisory/Warning and a tropical cyclone warning is issued - CFW will be **canceled** and users directed to the HLS for further information on coastal hazards.
- A CFW product is in effect for a Coastal Flood Watch and a tropical cyclone watch or warning is issued - CFW will be **canceled** and users directed to the HLS for further information on coastal hazards.

INITIAL WFO PRODUCT IN EFFECT	SUBSEQUENTLY ISSUED TROPICAL CYCLONE (TC) ADVISORY	CONTINUE CFW	CANCEL CFW	ISSUE HLS
Coastal Flood WATCH (CFW)	TC WATCH/WARNING		X	X
Coastal Flood WARNING (CFW)	TC WATCH	X		X
Coastal Flood WARNING (CFW)	TC WARNING		X	X
High Surf ADVISORY (CFW)	TC WATCH	X		X
High Surf ADVISORY (CFW)	TC WARNING		X	X
High Surf WARNING (CFW) (Pacific, Western Regions Only)	TC WATCH	X		X
High Surf WARNING (CFW) (Pacific, Western Regions Only)	TC WARNING		X	X

Finally, if tropical cyclone advisories are discontinued and coastal hazards are expected behind the departing tropical cyclone, the CFW products will be issued as appropriate.

**A.1.3.2. Format.** As appropriate, product header options are “Hurricane or Typhoon Local Statement,” “Tropical Storm Local Statement” or “Tropical Depression Local Statement.” All HLSs will contain at least one headline. Prepare each section of the HLS by a content/topic header set off by three dots before and after each header. Prioritize and adjust the order to focus on the greatest threat and the most important information impacting the area.

**A.1.4 Essential Contents of Hurricane/Typhoon Local Statements:** Some private sector vendors are parsing and scrolling HLS section information. Format consistency that is: ellipses, carriage returns and the exact section headline wording of the HLS information is required. After the headline(s), the first section will always be the NEW INFORMATION section. Subsequent section headlines should be arranged with the most important first. WFOs retain the option to use a non-specific section headline which is not already covered by the other sectional topics. *Any section may be omitted if it is not appropriate for a given situation.*

For the Headlines section, the vendor's software will key in on the singular blank line between the Time/Date line of the Mass News Dissemination Header and the ellipse (...) at the beginning and ending of each headline. For the following sections, the vendor's software will key on a blank line, the section headline as noted below in bold, and ellipse (before and after).

**...Headline(s)...**

More than one headline allowed with no blank lines in between, each section headline beginning and ending with ellipses

Section headers in bold must be written exactly as noted:

**...New Information...**

Specific new and vital information which you wish to bring to the attention users.

**...Areas Affected...**

Details of which counties, parishes, or cities are included in the HLS.

**...Watches/Warnings...**

Watches and warnings in effect and counties or parishes to which they apply.

**...Storm Information...**

Present location, movement, and winds. Use the tropical cyclone forecast/advisory as guidance.

**...Precautionary/Preparedness Actions...**

Short-term precautionary actions and times they should be completed. This includes any evacuation recommendations as provided or stated by state and/or local authorities. Listing these actions is particularly important once a tropical cyclone watch or warning is announced.

**...Storm Surge and Storm Tide...**

Storm surge and storm tide (storm surge plus astronomical tide) information, including times various heights are expected, present heights, and their locations. If data exists, a comparison of storm surge heights from previous tropical cyclones should be included. Storm surge information should be forecast as a range (i.e. 18-22 feet with locally higher values to 25 feet) and must agree with tropical cyclone center forecasts as included in the advisories. Include storm tide information because local officials might not have access to tide tables. Reference storm tide forecasts to appropriate datums understood by local authorities. For many portions of the coast, this would be mean sea level although some areas use mean lower low water.

**...Winds...**

Expected time of onset of tropical storm/hurricane/typhoon force winds. (Use the tropical cyclone forecast/advisory as guidance.) WFOs may provide information about the local

impacts of the expected winds. Give timing of impacts in ranges or general terms such as “afternoon,” “evening,” and so on.

**...Probability of Hurricane/Tropical Storm Conditions...**

Information on probability of hurricane/typhoon/tropical storm conditions.

**...Inland Flooding...**

**...Tornadoes...**

**...(Non-specific headline - Substitute appropriate header)...**

**...Next Update...**

Time of next or final statement.

**Example:**

HURRICANE LOCAL STATEMENT  
NATIONAL WEATHER SERVICE XXXXX  
1019 AM CDT TUE JUL 15 2003

...HURRICANE ZENIA MOVING ONTO THE MIDDLE TEXAS COAST  
NEAR PORT O'CONNOR...

...A HURRICANE WARNING IS IN EFFECT FROM BAFFIN BAY TO HIGH  
ISLAND...

...NEW INFORMATION...  
TEXT

...STORM SURGE AND STORM TIDE...  
TEXT

...WINDS...  
TEXT

```
Wtaaii cccc ddhmm  
HLSxxx  
stZXXX-XXX>XXX-DDHHMM-
```

```
(TROPICAL CYCLONE TYPE) LOCAL STATEMENT  
NATIONAL WEATHER SERVICE CITY, STATE  
time am/pm time_zone day mon DD YYYY
```

**...HEADLINE...**

**...Areas Affected...**

**...New Information...**

**...Watches/Warnings...**

**...Storm Information...**

**...Precautionary/Preparedness Actions...**

**...Storm Surge and Storm Tide...**

**...Winds...**

**...Probability of Hurricane/Tropical Storm Conditions...**

**...Tornadoes...**

**...(Substitute appropriate header)...**

**...Next Update...**

\$\$

**Figure A-1. Hurricane Local Statement Format**

**A.1.5. Relationship of HLSs to the NOW.** The NOW is a stand-alone product focused on conditions impacting the office's CWA for the next 0 to 6 hours. It will complement the HLS by providing critical storm information in the first eight lines.

**A.2. Extreme Wind Warning (EWW).** *Short duration warnings are issued by WFOs to protect lives and property. WFO forecasters issue short duration EWW products to provide the public with advance notice of the onset of extreme tropical cyclone winds, usually associated with the eyewall of a major (category 3 or higher) tropical cyclone. Extreme Wind Warnings inform the public of the need to take immediate shelter in an interior portion of a well-built structure due to the onset of extreme tropical cyclone winds.*

*An EWW for extreme tropical cyclone winds should be issued when both of the following criteria are met:*

- *Tropical cyclone is a category 3 or greater on the Saffir Simpson hurricane scale as designated by NHC.*
- *Sustained tropical cyclone surface winds of 100 knots (115 mph) or greater are occurring or are expected to occur in a WFO's county warning area within one hour.*

*The warning valid time should be two hours or less. Under rare situations, the valid time may be issued for a 3-hour period. An EWW will not be reissued or extended for the same county or parish during an extreme tropical cyclone event. Forecasters should use good judgment to ensure the valid time of the short duration warning takes into account the geographic size of the county or parish versus the forward speed of the tropical cyclone. Once the EWW for a county or parish has expired, WFOs should use the HLS or NOW products to provide additional information about the status of tropical cyclone winds over a county or parish.*

*Updated EWWs and amendments are not applicable. WFOs should issue Severe Weather Statements (SVS) to update the status of specific Extreme Wind Warnings. Updated information should include observed wind observations and/or reports of damage when available. Additionally, WFOs may issue SVSs to inform the public when all or portions of an EWW have been canceled or have expired.*

WFUS5i cccc ddhhmm  
EWWccc  
STC001-002-ddhhmm-  
/k.aaa.cccc.pp.s.####.yymmddThhnnZB-yymmddThhnnZE/

BULLETIN - EAS ACTIVATION REQUESTED  
EXTREME WIND WARNING  
NATIONAL WEATHER SERVICE city state  
time am/pm time\_zone day of the week month dd yyyy

THE NATIONAL WEATHER SERVICE IN city HAS ISSUED AN

\* EXTREME WIND WARNING FOR THE ONSET OF SUSTAINED WINDS OF 115 MPH OR GREATER FOR...

county one in section state (List warned counties)

county two in section state (# Counties will match # counties in UGC Line)

IN ASSOCIATION WITH (Phenomenon/The Event)

\* UNTIL hhmm am/pm time\_zone (Expiration time of warning)

\* AT hhmm am/pm time\_zone...(Warning basis statement and forecast impacts)

\* THESE EXTREME WINDS WILL AFFECT... (Pathcast Version)

location #1 AROUND hhmm am/pm time\_zone...

location #2 AROUND hhmm am/pm time\_zone...

**OR**

LOCATIONS IMPACTED INCLUDE... (Pathcast Version w/o time)

location #1...

location #2...

(Impact Locations are mandatory, either pathcast or no pathcast version listed above)

CALL TO ACTION

LAT...LON (Mandatory list of latitude/longitude points outlining the forecaster-drawn area of greatest impact)

\$\$

FORECASTER NAME/NUMBER (OPTIONAL)

**FIGURE A-2. Extreme Wind Warning**

**A.3. Inland Tropical Storm/Hurricane Watch or Warning (NPW).** Coastal and inland WFOs will issue an inland tropical storm watch or warning, or inland hurricane watch or warning, when a tropical cyclone is expected to spread tropical storm or hurricane force winds inland under the non-precipitation weather product NPW. The NPW will be exclusively used for this product's initial issuance, subsequent follow-up, and cancellation. The following WFOs are exempt from this policy and will issue NPWs for high wind watches and/or warnings if tropical storm winds move into their area of responsibility.

Albany, NY	Cleveland, OH
Binghamton, NY	Pittsburgh, PA
Buffalo, NY	State College, PA
Burlington, VT	Wilmington, OH
Charleston, WV	

**A.3.1. Mission Connection.** Long duration warnings are issued by WFOs to protect lives and property. Non-precipitation watches and warnings provide our users and partners advance notice of hazardous non-precipitation weather events which have the potential to threaten life and property.

#### **A.3.2. Issuance Guidelines.**

**A.3.2.1. Issuance Criteria.** An inland Tropical Cyclone Watch or Warning will be issued when the following criteria are met:

- Watch - WFOs will issue Inland Tropical Storm/Hurricane Watches when tropical storm/hurricane force winds are possible within the watch area within 36 hours.
- Warning - WFOs will issue Inland Tropical Storm/Hurricane Warnings when tropical storm/hurricane force winds are expected within the warning area within 24 hours.
- Coastal Counties/Zones - when the effects of the tropical cyclone can be clearly described to the public and not lead to confusion, inland sections of coastal counties or parishes may be placed under inland tropical storm/hurricane watches or warnings commensurate with NHC tropical cyclone watches or warnings. Coordination will occur with all impacted offices and NHC before the issuance.

**A.3.2.2. Issuance Times.** Event driven.



**A.3.2.3. Valid Time.** Watch is valid up to 48 hours after the issuance time. The valid time (event start and end times) is described in the watch headline. A warning is valid up to 36 hours after issuance time. The valid time (event start and end times) is described in the warning headline.

**A.3.2.4. Product Expiration Time.** Generally 6-8 hours after the issuance time and should coincide with the next expected update or when the event is forecast to end.

**A.3.3. Technical Description.** NPWs will follow the format and content described in this section.

**A.3.3.1. Content.**

- **Headline** - A headline will be “Inland Tropical Storm Watch (or Warning)” or “Inland Hurricane Watch (or Warning).”
- **Winds** - Expected time of onset of tropical storm/hurricane/typhoon force winds. (Use the tropical cyclone forecast/advisory as guidance).
- **Impacts** - WFOs may provide information about local impacts of the expected winds. Give timing of impacts in ranges or general terms such as “afternoon,” “evening,” and so on.

**A.3.3.2. Updates and Amendments.** For those offices issuing inland watches/warnings, NPW product will be updated as conditions warrant. At a minimum, this should be every six hours or after the issuance of a six hourly NHC TCP advisory.

**A.3.3.3. Cancellations and Expirations.** WFOs will issue NPWs to provide the public, media and emergency management notice that inland tropical storm/hurricane watches or warnings have expired or been cancelled.

**A.3.3.4. Relationship of NPW to ZFP/HLS Products.** The appropriate forecasts and statements will highlight watches and warnings.

```

WWaaii cccc ddhhmm
NPWxxx

URGENT - WEATHER MESSAGE
NATIONAL WEATHER SERVICE CITY, STATE
time am/pm time_zone day mon DD YYYY

...<Overview headline statement>...

...<General non-precipitation weather synopsis>...

st Zxxx-xxx>xxx-DDHHMM-
zone-zone-zone
INCLUDING THE CITIES OF...
time am/pm time_zone day mon dd yyyy

...HEADLINE...

TEXT

$$

```

**Figure A-3. Inland NPW Product Format**

**A.4. Inland Tropical Storm/Hurricane Watch or Warning for Subtropical Storms.** WFOs will issue an inland tropical storm wind watch or warning, or inland hurricane wind watch or warning when a subtropical storm is expected to spread tropical storm or hurricane force winds inland. *Use same procedures as noted in section A.3.*

**A.5. Post-Tropical Cyclone Reports (PSH).** All WFOs issuing HLSs will prepare post-storm reports. Inland offices issuing inland tropical storm/hurricane wind watches or warnings will also submit reports. Other offices whose CWA's experienced wind gusts greater than 33 knots, flooding, tornadoes, damage, or casualties will also submit reports. A standardized format has been introduced for easier post-processing of the data by end users.

**A.5.1. Mission Connection.** The PSH product is intended to provide the NHC, NWS Headquarters, the media, the public, and emergency management officials with a record of peak tropical cyclone conditions. This data is then used to formulate other post-event reports, news articles and historical records.

## **A.5.2. Issuance Guidelines.**

**A.5.2.1. Issuance Criteria.** If HLSs are issued, a PSH will be issued.

**A.5.2.2. Issuance Times.** Transmit the reports within 5 days following the transmission of the last HLS or inland tropical storm/hurricane wind watches or warnings. Amend reports as needed.

## **A.5.3. *Technical Description.***

**A.5.3.1. Content.** *Include the following items in the initial report and in any subsequent updated reports:*

*a. Wind data: If the observed peak gusts are greater than 33 knots, report highest sustained surface wind speed (knots) and duration (1-, 2- 8-, or 10-minute average which ever applies), peak gust (knots), and date/times of occurrence in UTC. Specify anemometer height (meters) if other than 10 meters. Report all land-based NOAA, Department of Defense, and Federal Aviation Administration official observing sites (ASOS/AWOS) in the OFFICIAL OBSERVATIONS portion of section A. Report other reliable land-based data collected by government sources or other institutions in the UNOFFICIAL OBSERVATIONS portion of section A. These include reports from stations maintained by the U. S. Coast Guard; state, county, and local governments; universities; private companies; and experimental networks. Report NOAA buoy/Coastal Marine Automated Network (C-MAN) stations, National Ocean Service stations, and trusted private or university observations in, or near, a WFO's marine warning area, in section b. Also list adjusted speeds corrected for instrument type and speed range if known. Data reports from the public are optional. However, NWS offices should encourage these data and include them in the PSH when considered reliable.*

*b. Pressure data: Report lowest sea level pressure (millibars), and date/time of occurrence (UTC). Report data from all sources given in the wind data section and other stations where significant pressure observations are available. Report pressures less than 1005 mb, with pressure greater than 1005 mb reported as needed or as requested.*

*c. Storm total rainfall: Report amount (inches) and duration (dates). Report data from all sources given in Section a, and other stations where significant rainfall observations are available. Report storm total rainfalls of 3 inches or more, with amounts less than 3 inches reported as needed or as requested.*

*d. Inland flooding: Report to include date/times (UTC) and counties/parishes/independent cities of occurrence, along with a brief worded summary, as appropriate.*

e. Maximum storm surge and storm tide: Reference storm tide to appropriate datums understood by local authorities. For many portions of the coast, this would be National Geodetic Vertical Datum although some areas use mean lower low water. Report storm tide in feet above the datum, and storm surge/wind waves in feet above the normal, predicted (astronomical) tide level. Identify location and date/time (UTC) of occurrence where possible. Report tides of 1 foot or greater above normal, with tides of less than 1 foot above normal reported as needed or as requested. Report extent of beach erosion as appropriate.

f. Tornadoes: Report times (UTC) and locations, along with a brief description of damage, as appropriate. The reports may be taken from Local Storm Reports (LSR) issued for the event.

g. Storm impacts: Including deaths, injuries, dollar damages, number of people evacuated, etc., per county/parish/independent city as reported by emergency management, trusted media sources, etc.

Please note: For land observations, marine observations, storm total rainfall, and tornadoes, latitude and longitude should be included. The AWIPS software will output the values, in the form xx.m (-)byy.n, where

- xx = degrees north latitude
- m = rounded decimal value for latitude, in tenths of a degree
- (-) = negative, or west, longitude, as necessary
- b = 100's place, if needed
- yy = degrees longitude, zero to 99
- n = rounded decimal value for longitude, in tenths of a degree

```

ACUS72 Kccc ddhhmm
PSHxxx

POST TROPICAL CYCLONE REPORT...(TROPICAL CYCLONE TYPE) (NAME)
NATIONAL WEATHER SERVICE CITY STATE
Time am/pm time_zone day of week mon dd yyyy
TEXT (see paragraph A.10 for specific details)
$$

```

**Figure A-4. Post-Tropical Cyclone Report Format**

**A.6. Information for Service Assessments.** WFOs will forward a copy of media reports, especially newspaper clippings (online and printed) representative of the event and its impacts. Send reports to the appropriate RH and TPC within 7 days following the issuance of the last product concerning the storm. Reports do not have to include all interviews or radio or television spots concerning the landfall event in each local office's CWA.

**A.7 Local Storm Reports (LSR).** WFOs will prepare these reports in accordance with LSR instructions (reference NWS Instruction 10-517, available at <http://nws.noaa.gov/directives>).

**A.8. Storm Reports.** WFOs will prepare these reports in accordance with Storm Data Preparation instruction (Reference NWS Instruction 10-1605).

**A.9. Correction Procedures.** Tropical cyclone centers and WFOs should correct products using the following format:

WTNT KNHC 161441 CCA  
TCDAT1

TROPICAL STORM ARTHUR DISCUSSION NUMBER 8...CORRECTED  
NWS TPC/NATIONAL HURRICANE CENTER MIAMI FL  
11 AM EDT TUE JULY 16 2002

CORRECTED FOR (GIVE REASON)

TEXT FOLLOWS....

CCA - If a second correction is necessary, the "A" becomes a "B" (CCB).  
"CORRECTED FOR" is optional but encouraged.

**A.9. Procedures for Populating WFO-Generated Wind Forecast Grids for Tropical Cyclone Events.** The following are short-term solutions to be followed by all impacted WFOs for populating WFO wind grids for tropical cyclones. Updates to this directive will take place as better methods for populating WFO-generated wind forecasts are integrated into the Interactive Forecast Preparation System.

**A.9.1. Wind Speed Values Within the 34 kt Wind Radii**

**0-24 hours**

Use wind forecast from the TCM as guidance for locating the 34-, 50- and 64-kt wind radii to maintain synoptic consistency. Apply local knowledge and mesoscale expertise to produce explicit/deterministic wind speed forecasts for all CWA/MAR grids using a full continuum of values up to the maximum sustained wind value provided by tropical cyclone centers.

**25-72 hours**

Use wind forecast from the TCM as guidance for locating the 34-, 50- and 64-kt wind radii to maintain synoptic consistency. Extrapolate the 64-kt radii from the 36-hour model guidance (TCMWind tool will do this). Coordinate consensus with NHC and adjacent WFOs. Apply local knowledge and mesoscale expertise to produce explicit/deterministic wind speed forecasts for all CWA/MAR grids using a full continuum of wind speeds up to 100 knots or up to the maximum sustained wind forecast by the NHC if it is less than 100 knots. For 101 kts and above use the capped value of 100 kts for grid points inside the 64 kt wind radii.

**73-120 hours**

Use forecast from the TCM as guidance for locating the center positions to maintain synoptic consistency. Extrapolate the 64-kt radii, the 50-kt radii and the 34-kt from model guidance (TCMWind tool will do this). Coordinate consensus with NHC and adjacent WFOs. Apply local knowledge and mesoscale expertise to produce explicit/deterministic wind speed forecasts for all CWA/MAR grids using a full continuum of wind speeds up to 64 knots or up to the maximum sustained wind forecast by the NHC if it is less than 64 knots. For 65 kts and above use the capped value of 64 kts for grid points inside the 64 kt wind radii.

**121-168 hours**

Use traditional guidance and WFO discretion to produce explicit/deterministic wind speed forecasts for all CWA/MAR grids using a full continuum of wind speeds up to 30 kts. The choice for 30 kts avoids potential confusion which can result from the automated rounding of 33 kts to 35 kts when generating graphical wind barbs, and with associated textual formatters which convert kts to miles per hour (then round to the nearest 5 mph).

**A.9.2. Wind Speed Values Outside the 34 kt Wind Radii****0-120 hours**

Use deterministic wind speed values.

**A.9.3. Wind Direction Values Inside or Outside the 34 kt Wind Radii****0-168 hours**

Use deterministic wind direction values.

**A.9.4. Wind Gust Values Inside or Outside the 34 kt Wind Radii.** At this time, there is no requirement to produce a gust grids. As an option, if a WFO desires to produce a gust grid it will have to be created with little or no guidance.

**A.9.5. Caveat.** It is highly recommended the following caveat be placed on all text and graphical products...“Winds in and near tropical cyclones should be used with caution due to uncertainty in forecast track, size, and intensity.”

**A.10. Product Examples.**

**EXAMPLE: HURRICANE LOCAL STATEMENT**

WTUS84 KCRP 151519  
HLSCR  
TXZ230>234-241>247-151815-

HURRICANE LOCAL STATEMENT  
NATIONAL WEATHER SERVICE CORPUS CHRISTI TX  
1019 AM CDT TUE JUL 15 2003

**...HURRICANE CLAUDETTE MOVING ONTO THE MIDDLE TEXAS COAST  
NEAR PORT O'CONNOR...**

**...A HURRICANE WARNING IS IN EFFECT FROM BAFFIN BAY TO HIGH  
ISLAND...**

**...NEW INFORMATION...**

AS OF 1130 PM MONDAY EVENING...EMERGENCY MANAGEMENT OFFICIALS  
RECOMMENDED EVACUATIONS OF RESIDENTS OF ARANSAS COUNTY.  
ALSO...EVACUATIONS HAVE BEEN RECOMMENDED FOR RESIDENTS AND  
NON-RESIDENTS OF PORT ARANSAS. NO OTHER EVACUATIONS HAVE BEEN  
REPORTED TO THE NATIONAL WEATHER SERVICE AT THIS TIME.

**...AREAS AFFECTED...**

THIS STATEMENT RECOMMENDS ACTIONS TO BE TAKEN BY RESIDENTS IN  
THE FOLLOWING COUNTIES OF ARANSAS...CALHOUN...KLEBERG...NUECES...  
REFUGIO...SAN PATRICIO...BEE...GOLIAD...LIVE OAK...MCMULLEN...JIM  
WELLS AND VICTORIA.

**...WATCHES/WARNINGS...**

A HURRICANE WARNING IS IN EFFECT FOR THE TEXAS COAST FROM BAFFIN  
BAY TO HIGH ISLAND. AN INLAND TROPICAL STORM WIND WARNING IS IN  
EFFECT FOR BEE...GOLIAD...LIVE OAK...JIM WELLS...MCMULLEN AND  
VICTORIA COUNTIES FOR TODAY. AN INLAND TROPICAL STORM WATCH IS IN  
EFFECT FOR DUVAL AND LASALLE COUNTIES FOR TONIGHT. A FLASH FLOOD  
WATCH IS IN EFFECT FOR TODAY FOR THE COUNTIES OF ARANSAS... BEE...  
CALHOUN...GOLIAD...LIVE OAK...MCMULLEN...REFUGIO...SAN PATRICIO AND  
VICTORIA.

**...STORM INFORMATION...**

AT 9 AM CDT...THE CENTER OF HURRICANE CLAUDETTE WAS LOCATED NEAR  
LATITUDE 28.5 NORTH AND LONGITUDE 96.1 WEST...OR APPROXIMATELY 20  
MILES EAST OF PORT O'CONNOR. MAXIMUM SUSTAINED WINDS ARE NEAR 80

MPH WITH HIGHER GUSTS. CLAUDETTE IS MOVING WEST-NORTHWEST NEAR 10 MPH. A CONTINUED MOVEMENT TOWARDS THE WEST-NORTHWEST IS EXPECTED TODAY. GIVEN THIS FORECAST TRACK...THE EYE OF CLAUDETTE IS EXPECTED TO MOVE ACROSS THE PORT OCONNOR TO PALACIOS AREA AROUND 11 AM. WEAKENING IS EXPECTED AFTER THE EYE OF CLAUDETTE MOVES INLAND.

**...PRECAUTIONARY/PREPAREDNESS ACTIONS...**

AS OF 1130 PM MONDAY EVENING...EMERGENCY MANAGEMENT OFFICIALS RECOMMENDED EVACUATIONS OF RESIDENTS OF ARANSAS COUNTY. ALSO...EVACUATIONS HAVE BEEN RECOMMENDED FOR RESIDENTS AND NON-RESIDENTS OF PORT ARANSAS. NO OTHER EVACUATIONS HAVE BEEN REPORTED TO THE NATIONAL WEATHER SERVICE AT THIS TIME. RESIDENTS OF SOUTH TEXAS...ESPECIALLY THOSE WHO LIVE IN THE COASTAL COUNTIES FROM KLEBERG TO CALHOUN...SHOULD COMPLETE ALL NECESSARY ACTIONS TO PROTECT LIFE AND PROPERTY.

**...STORM SURGE AND STORM TIDE...**

AT 9 AM CDT...TIDES WERE APPROXIMATELY 3.5 FEET ABOVE MEAN SEA LEVEL AT BOBHALL PIER...AND 2.5 FEET ABOVE MEAN SEA LEVEL AT PORT OCONNOR. AS CLAUDETTE MOVES ACROSS THE COASTLINE...TIDES WILL CONTINUE TO INCREASE...ESPECIALLY FROM ROCKPORT NORTHWARD.

TIDES ARE EXPECTED TO RISE TO BETWEEN 3 AND 4 FEET ABOVE MEAN SEA LEVEL SOUTH OF ROCKPORT...AND 5 TO 6 FEET ABOVE MEAN SEA LEVEL BETWEEN ROCKPORT AND PORT OCONNOR BY THIS AFTERNOON.

AT 5 FEET MSL...WATER WILL FLOOD MANY STREETS IN LAMAR... ROCKPORT...INGLESIDE...FULTON...ARANSAS PASS...PORT ARANSAS AND PORT OCONNOR. WATER WILL REACH 1/4 MILE INLAND TO THE SOUTHERN PART OF ROCKPORT. PORTIONS OF HIGHWAY 35 BETWEEN ARANSAS PASS AND ROCKPORT WILL BE UNDER 1 FOOT OF WATER. ROADS WEST OUT OF ROCKPORT WILL BE UNDER WATER. BEACH AND HARBOR FACILITIES WILL BE FLOODED AT PORT ARANSAS. AT 4 FEET MSL...THE JFK CAUSEWAY WILL HAVE AROUND 1 FOOT OF WATER OVER IT. THE T-HEADS WILL BE FLOODED. FLOODING IS LIKELY ALONG HIGHWAY 35 FROM ARANSAS PASS TO ROCKPORT. SOME FLOODING IS LIKELY ALONG WATERFRONT FACILITIES AND ROADS THAT ARE NEAR THE WATER ALONG MANY COASTAL COMMUNITIES.

AT 3 FEET MSL...BEACH ROADS WILL BE FLOODED ON PADRE AND MUSTANG SLANDS. THE JFK CAUSEWAY WILL HAVE SOME WATER OVER IT BUT NOT ENOUGH TO CLOSE IT DOWN. HIGH TIDES AT PORT ARANSAS OCCURRED AT



745 AM THIS MORNING AND WILL OCCUR AGAIN AT 817 AM ON WEDNESDAY. HIGH TIDES AT PORT OCONNOR WILL BE AT 259 PM THIS AFTERNOON AND 400 PM ON WEDNESDAY.

**...WINDS...**

AT 9 AM CDT...THE COAST GUARD REPORTED WINDS OF 30 TO 40 KNOTS FROM THE NORTHWEST AT PORT O'CONNOR. A MESONET SITE IN PORT OCONNOR REPORTED A WIND GUST AT 75 MPH AT 940 AM. WINDS ACROSS THE COASTAL WATERS FROM PORT O'CONNOR AND OUT TO 60 NAUTICAL MILES EAST OF PORT OCONNOR...HAVE INCREASED TO HURRICANE FORCE THIS MORNING.

WINDS OVER INLAND LOCATIONS FROM ROCKPORT TO VICTORIA ARE NORTH-NORTHWEST AROUND 25 TO 35 MPH. AS CLAUDETTE CONTINUES TO MOVE INLAND...WINDS WILL GRADUALLY INCREASE ACROSS THE ENTIRE AREA FROM EAST TO WEST.

TROPICAL STORM FORCE WINDS ARE EXPECTED TO SPREAD ACROSS THE REMAINDER OF THE COASTAL WATERS...PRIMARILY EAST OF PORT ARANSAS...THIS MORNING. WINDS GUSTING TO HURRICANE FORCE WILL MOVE INTO REFUGIO AND ARANSAS COUNTIES AROUND 11 AM CDT. THE TROPICAL STORM FORCE WINDS WILL ADVANCE SOUTHWEST DOWN THE COAST WITH TROPICAL STORM FORCE WINDS ENTERING THE COASTAL BEND NEAR CORPUS CHRISTI AROUND NOON. WIND GUSTS TO HURRICANE FORCE COULD OCCUR THIS AFTERNOON AND EVENING NEAR CORPUS CHRISTI AND REDFISH BAYS AND THE ADJACENT LAND AREAS.

**...SEAS AND RIP CURRENTS...**

AT 9 AM CDT...SEAS WERE AVERAGING AROUND 8 TO 10 FEET OUT TO AROUND 20 NAUTICAL MILES...14 TO 18 FEET BEYOND 20 NAUTICAL MILES. AS CLAUDETTE MAKES LANDFALL...SEAS WILL INCREASE TO 12 TO 17 FEET OUT TO 20 NAUTICAL MILES...15 TO 20 FEET BEYOND 20 NAUTICAL MILES OFFSHORE THIS MORNING. THESE LARGE SEAS WILL CONTINUE TO PRODUCE VERY ROUGH SURF AND DANGEROUS RIP CURRENTS ACROSS ALL OF THE SOUTH TEXAS BEACHES. ENTERING THE SURF IS STRONGLY DISCOURAGED THROUGH AT LEAST WEDNESDAY.

**...INLAND FLOODING...**

HEAVY RAINFALL WILL ACCOMPANY CLAUDETTE LATER THIS MORNING INTO THIS EVENING. THE GREATEST POTENTIAL FOR HEAVY RAIN SHOULD BE THIS AFTERNOON THROUGH WEDNESDAY. TOTAL RAINFALL AMOUNTS OF 5 TO 8 INCHES WILL BE POSSIBLE MAINLY TO THE NORTH OF A ROCKPORT TO ENCINAL LINE...WITH 2 TO 4 INCHES POSSIBLE TO THE SOUTH OF THIS LINE. THESE RAINFALL AMOUNTS MAY NEED TO BE REVISED IF THE FORECAST TRACK CHANGES. THIS AMOUNT OF RAINFALL WILL HAVE THE

POTENTIAL TO PRODUCE FLOODING OVER THE NORTHERN PORTIONS OF THE COASTAL BEND AND RIO GRANDE PLAINS AREA.

**...NEXT UPDATE...**

THE NEXT SCHEDULED STATEMENT WILL BE ISSUED AROUND 1 PM.

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**EXAMPLE: SHORT TERM FORECAST (NOWcast)**

FPUS71 KMOB 192130

NOWMOB

SHORT TERM FORECAST

NATIONAL WEATHER SERVICE MOBILE AL

0430 PM CDT SAT AUG 19 1995

ALZ051>064-MSZ067-075-076-078-079-192330-

BALDWIN-MOBILE-HANCOCK-HARRISON-JACKSON

.NOW...

...HURRICANE GARY WILL MOVE ACROSS BALDWIN AND MOBILE COUNTIES BY 530 PM...

SUSTAINED WINDS ABOVE 80 MPH WITH HIGHER GUSTS AND TORRENTIAL RAINFALL CAN BE EXPECTED AS THE RAIN BAND MOVES ACROSS. THE RAIN BAND SHOULD WEAKEN SLIGHTLY AS IT MOVES ACROSS CLARKE...WASHINGTON...AND GEORGE COUNTIES BY 6 PM. BUT PEOPLE IN THESE COUNTIES SHOULD EXPECT WIND GUSTS TO NEAR HURRICANE FORCE AND EXTREMELY HEAVY RAINFALL.

SCATTERED AREAS OF MODERATE TO HEAVY RAINFALL WILL CONTINUE ACROSS SOUTHERN ALABAMA AND MISSISSIPPI THROUGH 6 PM. BANDS OF STRONG STORMS WILL MOVE NORTHWESTWARD ACROSS THE AREA. EAST WINDS OF 30-40 MPH AND HEAVY RAIN WILL PERSIST WITH STRONGER WINDS AND HEAVIER RAINFALL NEAR THE RAIN BANDS. TEMPERATURES ACROSS THE REGION WILL REMAIN IN THE 70S.

\$\$

**EXAMPLE: EXTREME WIND WARNING (EWW)**

WFUS52 KTBW 131930  
EWWTBW  
FLC015-071-132100-  
/O.NEW.KTBW.EW.W.0013.040813T1938Z-040813T2100Z/

BULLETIN - EAS ACTIVATION REQUESTED  
EXTREME WIND WARNING  
NATIONAL WEATHER SERVICE TAMPA BAY - RUSKIN FL  
338 PM EDT FRI AUG 13 2004

THE NATIONAL WEATHER SERVICE IN RUSKIN HAS ISSUED AN

\* EXTREME WIND WARNING FOR THE ONSET OF SUSTAINED WINDS OF 115 MPH  
OR GREATER FOR...  
CHARLOTTE COUNTY IN SOUTHWEST FLORIDA  
LEE COUNTY IN SOUTHWEST FLORIDA

\* UNTIL 500 PM EDT

\* AT 335 PM EDT...SURFACE OBSERVATIONS AND NATIONAL WEATHER SERVICE  
DOPPLER RADAR INDICATED EXTREME WINDS...ASSOCIATED WITH THE  
EYEWALL OF HURRICANE CHARLEY...WERE MOVING ONSHORE NEAR NORTH  
CAPTIVA ISLAND. SUSTAINED WINDS IN EXCESS OF 140 MPH...CAPABLE OF  
PRODUCING WIDESPREAD DESTRUCTION...CAN BE EXPECTED AS THE EYEWALL  
PASSES OVERHEAD. MOVEMENT WAS NORTH NORTHEAST AT 20 MPH.

\* THESE EXTREME WINDS WILL AFFECT...  
ST. JAMES CITY BY 345 PM  
BOKEELIA BY 350 PM  
PUNTA GORDA BY 400 PM

THIS IS A DANGEROUS STORM! MOVE INTO AN INTERIOR ROOM AWAY FROM  
WINDOWS AND OUTER WALLS. COVER YOUR HEAD AND BODY WITH PILLOWS  
OR BLANKETS.

LAT...LON 2672 8226 2644 8213 2702 8174 2702 8207

\$\$

**EXAMPLE: INLAND HURRICANE WARNING**

WWUS45 KHGX 101030  
NPWHOU

URGENT - WEATHER MESSAGE  
NATIONAL WEATHER SERVICE HOUSTON-GALVESTON TX  
600 AM CDT FRI SEP 10 1995

...AN INLAND HURRICANE WARNING IN EFFECT FOR SOUTHEAST TEXAS...

HURRICANE FRED...LOCATED 60 MILES SOUTHEAST OF GALVESTON TX AT 6 AM CDT...IS MOVING TO THE NORTH NORTHWEST AT 10 MPH AND IS EXPECTED TO MAKE LANDFALL AROUND NOON CDT ON THE UPPER TEXAS COAST. FRED IS THEN FORECAST TO CONTINUE ON A NORTH NORTHWEST COURSE MOVING ACROSS HOUSTON AND REACHING THE SAN JACINTO NATIONAL FOREST BY LATE AFTERNOON. SUSTAINED WINDS OF 100 MPH WITH GUSTS TO 120 MPH SHOULD BEGIN SWEEPING ACROSS THE UPPER TEXAS COAST BY LATE MORNING.

TXZ177>179-197>199-210>212-102200-  
WALKER-SAN JACINTO-POLK-WASHINGTON-GRIMES-MONTGOMERY-  
COLORADO-AUSTIN-WALLER-

...INLAND HURRICANE WARNING...

WINDS ARE EXPECTED TO RAPIDLY INCREASE TO 50 TO 60 MPH BY 12 NOON AND 80 MPH WITH GUSTS TO 100 MPH BY MID AFTERNOON. 75 MPH WINDS WITH HIGHER GUSTS ARE LIKELY AS FAR INLAND AS HUNTSVILLE...NAVASOTA...AND LAKE LIVINGSTON BY LATE AFTERNOON.

BE PREPARED FOR NUMEROUS DOWNED TREES AND WIRES. DO NOT CROSS DOWNED WIRES...WHICH MAY STILL BE LIVE.  
\$\$

TXZ226-227-235-213-200-102200-  
WHARTON-FORT BEND-JACKSON-HARRIS-LIBERTY-

...INLAND HURRICANE WARNING...

WINDS FROM WHARTON TO HOUSTON AND LIBERTY ARE EXPECTED TO INCREASE TO 50 TO 60 MPH THIS MORNING AND 90 MPH WITH GUSTS TO NEAR 110 MPH BY MIDDAY...DECREASING TO 50 TO 60 MPH LATE THIS AFTERNOON.

FLYING DEBRIS WILL POSE A MAJOR THREAT TO ALL STRUCTURES IN THE WARNED AREA...ESPECIALLY GLASS FROM HIGH-RISE BUILDINGS IN DOWNTOWN HOUSTON. PEOPLE LIVING IN MOBILE HOMES AND THOSE CONCERNED ABOUT THE ABILITY OF THEIR HOMES TO WITHSTAND HURRICANE WINDS SHOULD MOVE TO A STRONG BUILDING OR SHELTER IMMEDIATELY. BE PREPARED FOR NUMEROUS DOWNED TREES AND WIRES. TAKE SHELTER IN SMALL INTERIOR ROOMS OR REINFORCED STRUCTURES.  
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**EXAMPLE: POST-TROPICAL CYCLONE REPORT**

ACUS72 KTBW  
 PSHTBW

POST TROPICAL CYCLONE REPORT...TROPICAL STORM ALBERTO  
 NATIONAL WEATHER SERVICE TAMPA BAY AREA - RUSKIN FL  
 900 PM EDT TUE JUN 13 2006

COUNTIES INCLUDED: LEVY...CITRUS...HERNANDO...PASCO...HILLSBOROUGH...  
 POLK...PINELLAS...MANATEE...SARASOTA...

A. LOWEST SEA LEVEL PRESSURE/MAXIMUM SUSTAINED WINDS AND PEAK GUSTS

-----  
 OFFICIAL OBSERVATIONS...

NOTE: ANEMOMETER HEIGHT IS 10 METERS AND WIND AVERAGING IS 2 MINUTES

LOCATION	ID	MIN	DATE/	MAX	DATE/	PEAK	DATE/
LAT	LO	PRES	TIME	SUST	TIME	GUST	TIME
DEG	DECIMAL	(MB)	(UTC)	(KT)	(UTC)	(KT)	(UTC)
-----							
KVVG-THE VILLAGES							
28.9	-81.9	1008.1	13/0745	210/024	13/1805	210/036	13/1805
KBKV-BROOKSVILLE							
28.5	-82.5	1006.8	13/0859	210/024	13/1928	210/037	13/1656
KPIE-SAINT PETERSBURG							
27.9	-82.7	1007.1	13/0836	200/035	13/0540	200/044	13/0547
KGIF-WINTER HAVEN							
28.0	-81.7	1009.1	13/0640	220/023	13/1706	220/030	13/1705
KTPA-TAMPA INTERNATIONAL							
28.0	-82.5	1007.8	13/0931	200/029	13/0509 I	220/039	13/0707 I

REMARKS: TAMPA ANEMOMETER STOPPED WORKING AT 13/0800.

UNOFFICIAL OBSERVATIONS...

NOTE: ANEMOMETER HEIGHT IN METERS AND WIND AVERAGING PERIOD IN MINUTES INDICATED UNDER MAXIMUM SUSTAINED WIND IF KNOWN

LOCATION LAT LON DEG DECIMAL	ID	MIN PRES (MB)	DATE/ TIME (UTC)	MAX SUST (KT)	DATE/ TIME (UTC)	PEAK GUST (KT)	DATE/ TIME (UTC)
-----							
CDRF1 CEDAR KEY							
29.1 -83.0		1004.1	13/1100	185/036 02/10	13/0830	180/048	13/0900
PTRF1 PORT RICHEY							
28.3 -82.7		1005.4	13/1205 I	210/029 01/05	13/1154	220/035	13/1200
VENF1 VENICE							
27.1 -82.6		1005.6	13/0705	209/036	13/0610	210/046	13/0637

REMARKS: PRESSURE SENSOR AT PORT RICHEY STOPPED WORKING AT 13/1245.

B. MARINE OBSERVATIONS...

NOTE: ANEMOMETER HEIGHT IN METERS AND WIND AVERAGING PERIOD IN MINUTES INDICATED UNDER MAXIMUM SUSTAINED WIND IF KNOWN

LOCATION LAT LON DEG DECIMAL	ID	MIN PRES (MB)	DATE/ TIME (UTC)	MAX SUST (KT)	DATE/ TIME (UTC)	PEAK GUST (KT)	DATE/ TIME (UTC)
-----							
42036 100 NM WEST OF BAYPORT							
28.5 -84.5		1008.5	13/0905	280/035 05/08	13/1040	080/045	12/1050
42013 30 NM WEST OF VENICE							
25.9 -85.9		1003.7	13/1040	170/029 03/10	12/2210	200/035	13/0310 I
42003 210 NM W OF CAPTIVA ISLAND							
25.9 -85.9		1005.6	13/1350	196/038	12/1350	160/049	12/0516

REMARKS: WIND SENSOR AT USF COMPS BUOY 42013 STOPPED WORKING AT 13/0311.

C. STORM TOTAL RAINFALL FROM 0000 UTC JUNE 12 UNTIL 2359 UTC JUNE 13 2006

CITY/TOWN LAT LON DEG DECIMAL	COUNTY	ID	RAINFALL (IN)
-----			
SUWANNEE 29.2 -83.1	LEVY	SUWF1	4.23
CHIEFLAND 29.5 -82.9	LEVY	CHIF1	3.67
WILLISTON 29.4 -82.5	LEVY	WLSF1	4.53
THE VILLAGES 28.9 -81.9	SUMTER	KVVG	0.87



COUNTY ROAD CREW OBSERVED THE TORNADO NEAR HIGHWAY 62.

2 E BARTOW POLK 12/0809 EF0  
27.9 -81.8

TORNADO OBSERVED 1 MILE EAST OF BARTOW AIRPORT.

1 S ARCADIA DESOTO 12/0658 EF0  
27.2 -81.9

TORNADO OBSERVED 1 MILE SOUTH OF ARCADIA.

REMARKS: NONE.

G. STORM IMPACTS BY COUNTY...

COUNTY DESCRIPTION	DEATHS	INJURIES	EVACUATIONS
LEVY 20 HOMES IN YANKEETOWN RECEIVED FLOOD DAMAGE AS TWO FEET OF WATER COVERED THE ROAD DOWNTOWN. WATER ALSO CLOSED NEAR SHORE AREAS OF HIGHWAY 40 AND 24.	0	0	100
CITRUS SURGE FLOODING NEAR HOMOSSASSA PUT 3 FEET OF WATER INTO ONE RESTAURANT AND DAMAGED 20 HOMES. TWO PEOPLE WHO DID NOT EVACUATE HAD TO BE RESCUED...ONE IN HOMOSASSA AND THE OTHER IN CRYSTAL RIVER. FORT ISLAND TRAIL WAS COVERED WITH 4 FEET OF WATER.	0	0	25
PASCO 4 FOOT SURGE UP AND DOWN THE COUNTY COAST LINE. WAS NOT HIGH ENOUGH TO FLOOD PROPERTY...EVEN AT HIGH TIDE.	0	0	0
HILLSBOROUGH A COUPLE OF TREES ON HOUSES. FRESH WATER FLOODING AND BAY OVERSPRAY CLOSED PARTS OF BAY SHORE BOULEVARD FOR A TIME.	0	0	0
MANATEE NO PROBLEMS.	0	0	0
SARASOTA NO PROBLEMS.	0	0	0

&&

Legend:

- I-Incomplete Data
- E-Estimated

\$\$

MCMICHAEL



## APPENDIX B

### DEFINING POINTS FOR TROPICAL CYCLONE WATCHES/WARNINGS

La Pesca, MX	23.76°N 97.78°W	Aucilla River, FL	30.05°N 83.92°W
Rio San Fernando, MX	25.00°N 97.60°W	Keaton Beach, FL	29.82°N 83.59°W
<b><u>Brownsville, TX</u></b>		Steinhatchee River, FL	29.70°N 83.40°W
Brownsville, TX	25.95°N 97.16°W	Suwanee River, FL	29.30°N 83.17°W
Port Mansfield, TX	26.59°N 97.29°W	<b><u>Tampa Bay, FL</u></b>	
Baffin Bay, TX	27.29°N 97.37°W	Suwanee River, FL	29.30°N 83.17°W
<b><u>Corpus Christi, TX</u></b>		Yankeetown, FL	29.03°N 82.74°W
Baffin Bay, TX	27.29°N 97.37°W	<i>Chassahowitzka, FL</i>	28.70°N 82.65°W
Corpus Christi, TX	27.67°N 97.19°W	<i>Aripeka, FL</i>	28.43°N 82.66°W
Port Aransas, TX	27.83°N 97.08°W	Anclote Key, FL	28.18°N 82.85°W
Port O'Connor, TX	28.40°N 96.39°W	Tarpon Springs, FL	28.15°N 82.77°W
<b><u>Houston, TX</u></b>		Anna Maria Island, FL	27.53°N 82.75°W
Port O'Connor, TX	28.40°N 96.39°W	<i>Middle of</i>	
Matagorda, TX	28.63°N 95.93°W	<i>Longboat Key, FL</i>	27.39°N 82.64°W
Sargent, TX	28.75°N 95.60°W	Englewood, FL	26.94°N 82.38°W
Freeport, TX	28.93°N 95.33°W	Boca Grande, FL	26.75°N 82.26°W
San Luis Pass, TX	29.08°N 95.13°W	Bonita Beach, FL	26.33°N 81.85°W
High Island, TX	29.57°N 94.39°W	<b><u>Miami, FL (Gulf)</u></b>	
<b><u>Lake Charles, LA</u></b>		Bonita Beach, FL	26.33°N 81.85°W
High Island, TX	29.57°N 94.39°W	Chokoloskee, FL	25.80°N 81.36°W
Sabine Pass, TX	29.71°N 93.85°W	East Cape Sable, FL	25.15°N 81.08°W
Cameron, LA	29.80°N 93.30°W	Flamingo, FL	25.14°N 80.93°W
Intracoastal City, LA	29.62°N 92.04°W	<b><u>Key West, FL (Gulf)</u></b>	
Morgan City, LA	29.49°N 91.29°W	Flamingo, FL	25.14°N 80.93°W
<b><u>New Orleans, LA</u></b>		Dry Tortugas, FL	24.66°N 82.86°W
Morgan City, LA	29.49°N 91.29°W	Key West, FL	24.55°N 81.81°W
Grand Isle, LA	29.25°N 89.96°W	Seven Mile Bridge, FL	24.70°N 81.15°W
Mouth of Mississippi		Craig Key, FL	24.83°N 80.77°W
River, LA	29.12°N 89.11°W	Key Largo, FL	25.09°N 80.44°W
Mouth of Pearl		Card Sound Bridge, FL	25.29°N 80.37°W
River, LA	30.15°N 89.60°W	Ocean Reef, FL	25.32°N 80.26°W
Pascagoula, MS	30.37°N 88.55°W	<b><u>Miami, FL (Atlantic)</u></b>	
MS/AL Border	30.40°N 88.40°W	Ocean Reef, FL	25.32°N 80.26°W
<b><u>Mobile, AL</u></b>		Florida City, FL	25.45°N 80.33°W
MS/AL Border	30.40°N 88.40°W	Golden Beach, FL	25.97°N 80.12°W
AL/FL Border	30.28°N 87.50°W	Hallandale Beach, FL	25.99°N 80.13°W
Destin, FL	30.39°N 86.50°W	Deerfield Beach, FL	26.32°N 80.10°W
<b><u>Tallahassee, FL</u></b>		Boca Raton, FL	26.36°N 80.07°W
Destin, FL	30.39°N 86.50°W	Jupiter Inlet, FL	26.95°N 80.07°W
Panama City, FL	30.12°N 85.70°W	<b><u>Melbourne, FL</u></b>	
Indian Pass, FL	29.68°N 85.27°W	Jupiter Inlet, FL	26.95°N 80.07°W
Apalachicola, FL	29.73°N 84.99°W	Stuart, FL	27.21°N 80.18°W
Ochlockonee River, FL	29.95°N 84.40°W	Fort Pierce, FL	27.46°N 80.30°W
St. Marks, FL	30.11°N 84.21°W	Vero Beach, FL	27.66°N 80.37°W
		Sebastian Inlet, FL	27.84°N 80.43°W

Cocoa Beach, FL	28.32°N	80.61°W	Tidal Potomac,		
Titusville, FL	28.64°N	80.63°W	Cobb Island, MD	38.26°N	76.84°W
New Smyrna Beach, FL	29.03°N	80.89°W	Tidal Potomac,		
Flagler Beach, FL	29.47°N	81.13°W	Indian Head, MD	38.61°N	77.15°W
<b><u>Jacksonville, FL</u></b>			Tidal Potomac,		
Flagler Beach, FL	29.47°N	81.13°W	Key Bridge, MD	38.89°N	77.07°W
St. Augustine, FL	29.89°N	81.31°W	Chesapeake Bay,		
Fernandina Beach, FL	30.66°N	81.45°W	Drum Point, MD	39.33°N	76.42°W
Altamaha Sound, GA	31.30°N	81.29°W	Chesapeake Bay,		
<b><u>Charleston, SC</u></b>			North Beach, MD	38.70°N	76.53°W
Altamaha Sound, GA	31.30°N	81.29°W	Chesapeake Bay,		
Savannah River, GA	32.04°N	80.86°W	Sandy Point, MD	39.02°N	76.40°W
Edisto Beach, SC	32.40°N	80.33°W	Chesapeake Bay,		
South Santee River, SC	33.12°N	79.27°W	Pooles Island, MD	39.29°N	76.27°W
<b><u>Wilmington, NC</u></b>			<b><u>Mt. Holly, NJ</u></b>		
South Santee River, SC	33.12°N	79.27°W	Cape Henlopen, DE	38.80°N	75.09°W
Murrells Inlet, SC	33.56°N	79.00°W	Cape May, NJ	38.93°N	74.90°W
Little River Inlet, SC	33.85°N	78.55°W	Great Egg Inlet, NJ	39.29°N	74.54°W
Cape Fear, NC	33.87°N	77.94°W	Little Egg Inlet, NJ	39.49°N	74.31°W
Surf City, NC	34.44°N	77.50°W	Manasquan Inlet, NJ	40.10°N	74.03°W
<b><u>Morehead City, NC</u></b>			Delaware Bay north/south of		
Surf City, NC	34.44°N	77.50°W	Slaughter Beach, DE to	38.91°N	75.30°W
New River Inlet, NC	34.32°N	77.34°W	East Point, NJ	39.19°N	75.02°W
Bogue Inlet, NC	34.39°N	77.11°W	Sandy Hook, NJ	40.46°N	74.00°W
Cape Lookout, NC	34.58°N	76.55°W	<b><u>New York City, NY</u></b>		
Ocracoke Inlet, NC	35.06°N	76.00°W	Sandy Hook, NJ	40.46°N	74.00°W
Cape Hatteras, NC	35.22°N	75.52°W	Fire Island Inlet, LI, NY	40.63°N	73.30°W
Oregon Inlet, NC	35.76°N	75.50°W	Moriches Inlet, LI, NY	40.77°N	72.75°W
(The inclusion of Pamlico and Albemarle			Montauk Point, LI, NY	41.07°N	71.86°W
Sounds should be on a case-by-case basis).			Port Jefferson Harbor,		
Currituck Beach			LI, NY	40.95°N	73.08°W
Light, NC	36.38°N	75.83°W	New Haven, CT	41.30°N	72.91°W
<b><u>Wakefield, VA</u></b>			Watch Hill, RI	41.31°N	71.86°W
Currituck Beach			<b><u>Boston, MA</u></b>		
Light, NC	36.38°N	75.83°W	Watch Hill, RI	41.31°N	71.86°W
(The inclusion of Currituck Sound, NC,			Point Judith, RI	41.35°N	71.49°W
should be on a case-by-case basis).			Westport, MA	41.45°N	71.20°W
NC/VA State Line	36.55°N	75.87°W	Woods Hole, MA	41.52°N	70.69°W
Cape Charles Light, VA	37.11°N	75.90°W	Chatham, MA	41.66°N	69.95°W
Parramore Island, VA	37.53°N	75.63°W	Plymouth, MA	41.98°N	70.65°W
Chincoteague, VA	37.93°N	75.32°W	Gloucester, MA	42.57°N	70.66°W
Chesapeake Bay, New Point			Merrimack River, MA	42.84°N	70.82°W
Comfort, VA	37.30°N	76.28°W	<b><u>Portland, ME</u></b>		
Chesapeake Bay,			Merrimack River, MA	42.84°N	70.82°W
Windmill Point, VA	37.61°N	76.28°W	Portsmouth, NH	43.06°N	70.70°W
Chesapeake Bay,			Portland, ME	43.64°N	70.20°W
Smith Point, VA	37.89°N	76.24°W	Rockland, ME	44.10°N	69.10°W
<b><u>Sterling, VA</u></b>			Stonington, ME	44.16°N	68.67°W
Chesapeake Bay,			<b><u>Caribou, ME</u></b>		
Smith Point, VA	37.89°N	76.24°W	Stonington, ME	44.16°N	68.67°W

Bar Harbor, ME 44.39°N 68.20°W  
 Eastport, ME 44.92°N 67.00°W

**CENTRAL PACIFIC HURRICANE CENTER  
 BREAKPOINTS**

**CALIFORNIA BREAKPOINTS**

**San Diego, CA**

Mouth of the Tijuana River, CA 32.53°N 117.12°W  
 San Mateo Point, CA 33.38°N 117.60°W  
 Mouth of San Gabriel River, CA 33.75°N 118.11°W

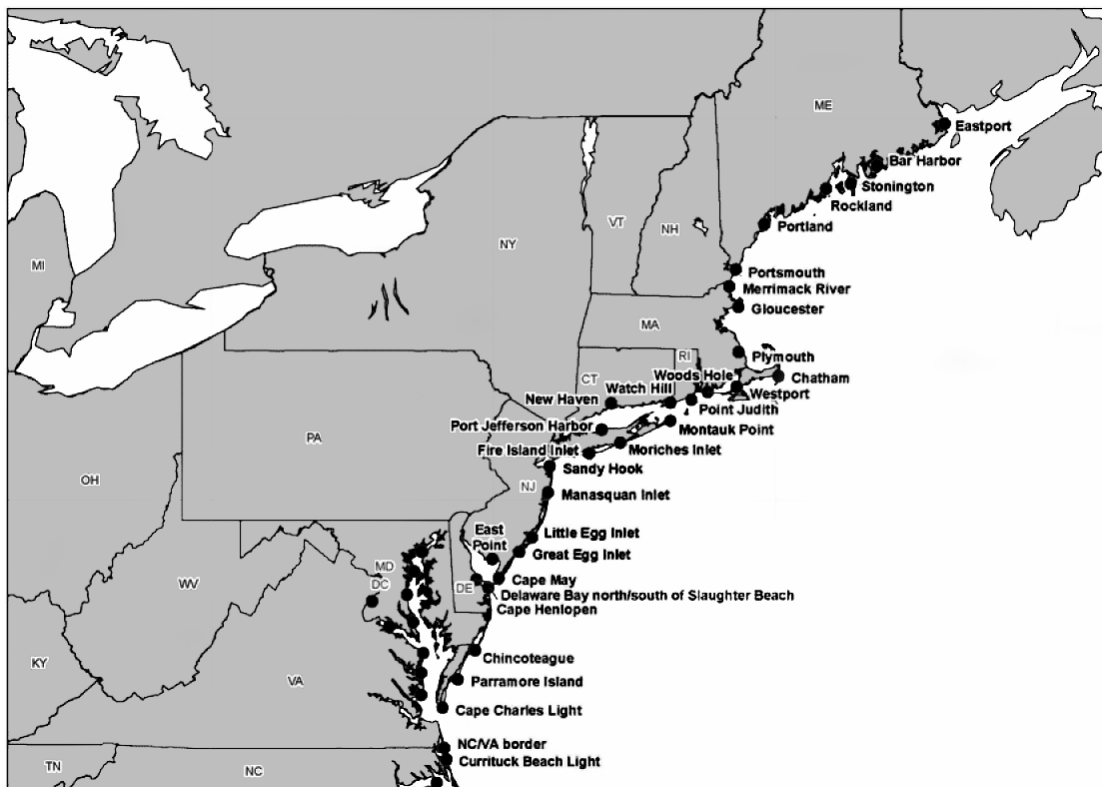
**Los Angeles/Oxnard, CA**

Mouth of San Gabriel River, CA 33.75°N 118.11°W  
 Point Mugu, CA 34.12°N 119.12°W  
 Point Conception, CA 34.45°N 120.45°W

**Honolulu, HI**

*Northwest Hawaiian Islands*

Nihoa 23.05°N 161.92°W  
 French Frigate Shoals 23.86°N 166.27°W  
 Maro Reef 25.33°N 170.50°W  
 Lisianski 26.08°N 174.00°W  
 Pearl and Hermes Atoll 27.83°N 175.83°W  
 Midway 28.02°N 177.37°W  
 Kure Atoll 28.42°N 178.33°W



**Figure B-1. Tropical Cyclone Break Points for the Northeast**

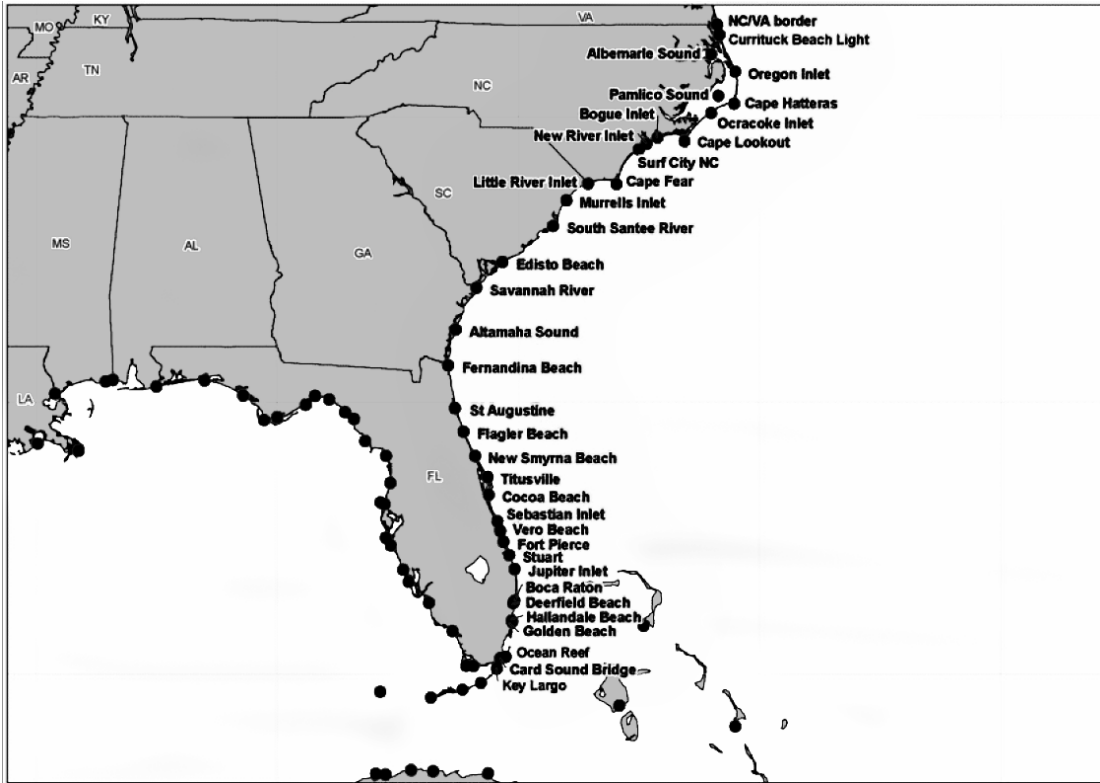


Figure B-2. Tropical Cyclone Break Points for the Southeast

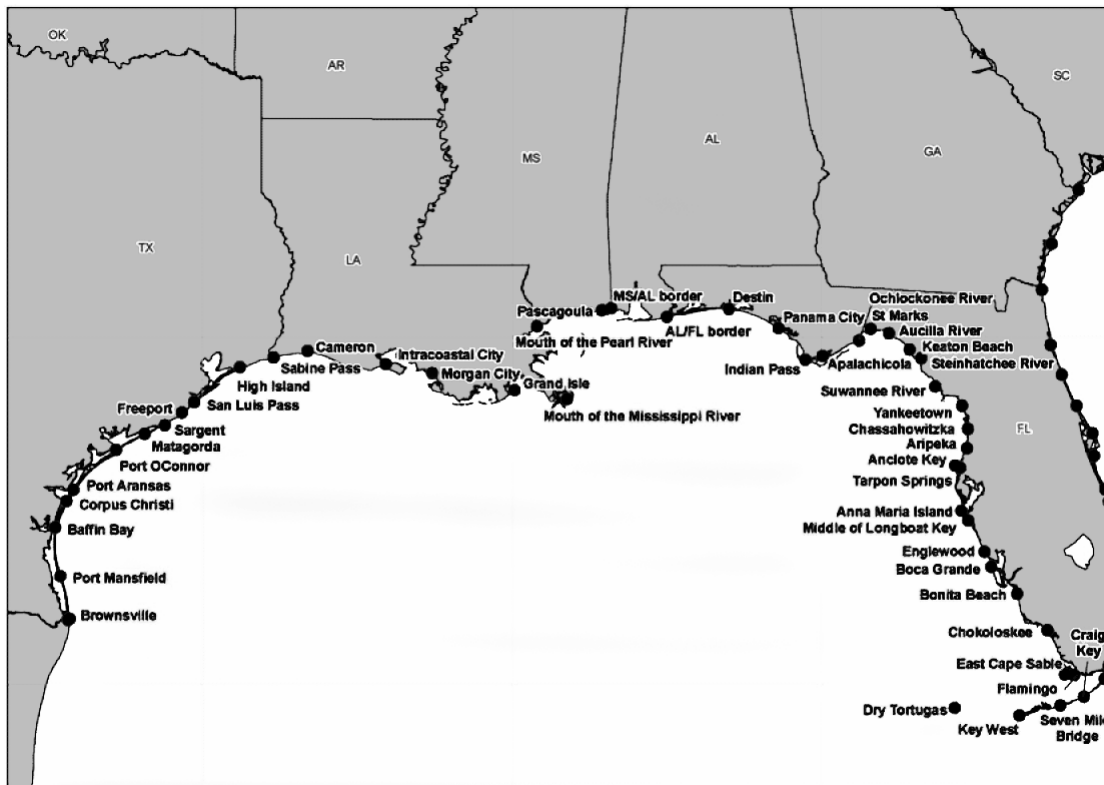


Figure B-3. Tropical Cyclone Break Points for the Gulf of Mexico

## APPENDIX C

### JOINT TYPHOON WARNING CENTER (JTWC) BULLETINS

Below are the abbreviated communications headers and titles for the products for which JTWC is responsible. A brief description of each product, to include scheduled transmission times, is available in USCINCPACINST 3140.1 (series)–JTWC’s governing instruction.

ABIO 10 PGTW	Significant Weather Advisory, Indian Ocean
ABPW 10 PGTW	Significant Weather Advisory, Western Pacific Ocean
WTPN 21-26 PGTW	Tropical Cyclone Formation Alert, Northwest Pacific Ocean
WTPN 31-36 PGTW	Tropical Cyclone Warning, Northwest Pacific Ocean
WDPN 31-36 PGTW	Prognostic Reasoning Bulletin, Northwest Pacific Ocean
WTIO 21-25 PGTW	Tropical Cyclone Formation Alert, North Indian Ocean
WTIO 31-35 PGTW	Tropical Cyclone Warning, North Indian Ocean
WTPS 21-25 PGTW	Tropical Cyclone Formation Alert, Southwest Pacific Ocean
WTPS 31-35 PGTW	Tropical Cyclone Warning, Southwest Pacific Ocean
WTXS 21-26 PGTW	Tropical Cyclone Formation Alert, South Indian Ocean
WTXS 31-36 PGTW	Tropical Cyclone Warning, South Indian Ocean
WTPN 21-25 PHNC	Tropical Cyclone Formation Alert, Northeast Pacific Ocean
WTPN 31-35 PHNC	Tropical Cyclone Warning, Northeast Pacific Ocean
FKPN 31-35 PHNC	Prognostic Reasoning Bulletin, Northeast Pacific Ocean
WTPS 21-25 PHNC	Tropical Cyclone Formation Alert, Southeast Pacific Ocean
WTPS 31-35 PHNC	Tropical Cyclone Warning, Southeast Pacific Ocean



## APPENDIX D

### FORMAT FOR NHOP/NWSOP FLIGHT INFORMATION FOR INTERNATIONAL AND DOMESTIC NOTAM ISSUANCE

Flight information shall be sent to the NOTAM office *via facsimile* for dissemination as an International and Domestic NOTAM in the following format (Note: The request is made for a domestic NOTAM which will then automatically makes its way into the international NOTAM system):

#### Header

#### **Request a Domestic NOTAM be Issued**

- A. Affected Center(s). This field will include all affected ARTCCs in 3-letter identifier format; e.g., ZNY, ZOA, ZAN. Synoptic track flights will probably utilize more than one ARTCC, and any adjacent ARTCC should be included when the flight track is within 100 miles of the adjacent center's airspace. Flights that are flying in the storm environment will utilize the ARTCC whose airspace is mostly affected.
- B. Start Time (YYMMDDZZZZ). For example, 0006011600. This time would correspond to the entry time on a reconnaissance track or time at the storm fix latitude/longitude.
- C. Ending Time (YYMMDDZZZZ). This would be the completion time of reconnaissance track or the time exiting the storm environment.
- E.\* Text. This field is free form and should include the following information: route of flight for the mission portion (latitude/longitude, fixes, airways), type of activity (laser, dropsonde, etc.), frequency/location of deployment, broadcast frequencies, any other pertinent information that may concern other flights. *Include a unit/agency phone number and point of contact for possible questions.*
- F. Lower Altitude (during mission). Use "Surface" since the dropsonde is the "reason" for the NOTAM as much or more so than the aircraft altitude.
- G. Upper Altitude (during mission). For example, FL450.

If only one altitude is to be used, then F and G may be combined. If altitude is going to vary throughout the mission, utilize "see text" and the information can be inserted there and the altitudes may be explained in field E.

\* Note that there is no paragraph "D". It is reserved for FAA use.

#### NOTES:

1. Only ICAO approved contractions may be used.
2. Using this format will help ensure timely and accurate information dissemination.





## APPENDIX E

### SAFFIR-SIMPSON HURRICANE SCALE

Saffir/Simpson Hurricane Scale (SSHS). A scale ranging from one to five based on the hurricane's present intensity. This can be used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane. This scale may be used in public hurricane releases although the SSHS may not be applicable for all geographical areas; e.g., Hawaii and Guam. In practice, sustained surface wind speed (1-minute average) is the parameter that determines the category since storm surge is strongly dependent on the slope of the continental shelf.

- ONE. Winds 74-95 mph (64-82 kts). No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage.
- TWO. Winds 96-110 mph (83-95 kts). Some roofing material, door, and window damage of buildings. Considerable damage to vegetation and mobile homes. Flooding damages piers, and small craft in unprotected anchorages break moorings.
- THREE. Winds 111-130 mph (96-113 kts). Some structural damage to small residences and utility buildings with a minor amount of curtainwall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain may be flooded well inland.
- FOUR. Winds 131-155 mph (114-135 kts). More extensive curtainwall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland.
- FIVE. Winds greater than 155 mph (>135 kts). Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required.

Note 1: A "major" hurricane is one that is classified as a Category 3 or higher.



## **APPENDIX F**

### **OFFICIAL INTERAGENCY AGREEMENTS**

The following enclosure is the Memorandum of Agreement (MOA) between the Air Force Reserve Command (AFRC) and the National Oceanic and Atmospheric Administration (NOAA), October 12, 2000. The purpose of this agreement is to establish policies, principles, and procedures under which the AFRC and NOAA provide aircraft weather reconnaissance and surveillance in support of NOAA's tropical cyclone forecast, warning, and research missions.

# MEMORANDUM OF AGREEMENT

## BETWEEN

### THE UNITED STATES AIR FORCE RESERVE COMMAND

## AND

### THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

**PURPOSE:** The National Oceanic and Atmospheric Administration (NOAA), an agency of the Department of Commerce, does not have the capability to fully support all operational requirements in support of tropical cyclone and winter storm aerial reconnaissance. This memorandum of agreement establishes policies, principles, and procedures under which the Air Force Reserve Command (AFRC) will provide aircraft weather reconnaissance support to NOAA. NOAA and AFRC enters into this agreement pursuant to its authority under 15 U.S.C. 313.

#### 1. REFERENCES:

- a. *National Hurricane Operations Plan (NHOP)*
- b. *National Winter Storms Operations Plan (NWSOP)*
- c. Department of Defense Appropriations Act, 2000

#### 2. BACKGROUND: The Air Force Reserve Command (AFRC) maintains 10 WC-130s to meet the Department of Commerce (DOC) aircraft reconnaissance requirements. AFRC will conduct up to five (5) sorties per day in support of NHOP requirements and up to two (2) sorties per day in support of NWSOP requirements. The Department of Defense (DOD), through AFRC, will bear all costs directly attributed to providing aircraft weather reconnaissance support. Support will be limited to the number of AFRC congressionally funded aircraft flying hours per year.

- a. Total flying hours used to support the weather reconnaissance mission are set annually in the DOD Appropriations Act. The 53rd Weather Reconnaissance Squadron (53 WRS) manages the flying hour program.
- b. The operational area for AFRC weather reconnaissance includes the Atlantic Ocean, Gulf of Mexico, the Caribbean Sea, and the North Pacific Ocean east of the international date line, as outlined in the NHOP and the NWSOP.
- c. The 53 WRS will be capable of operating from two (2) deployed locations, as well as from home station, simultaneously, supporting a maximum of five tropical cyclone

sorties per day or two winter storm sorties per day.

3. IMPLEMENTATION: Implementation details are contained in “GENERAL PROVISIONS.”
4. GENERAL PROVISIONS:
  - a. AFRC agrees:
    - 1) Within the limits of military capability, to meet NOAA’s requirements for aerial weather reconnaissance in accordance with the NHOP and NWSOP.
    - 2) To provide at the Tropical Prediction Center/National Hurricane Center (TPC/NHC) the staff and equipment required to support the mission of the Chief, Aerial Reconnaissance Coordination, All Hurricanes (CARCAH). CARCAH provides 24-hour telecon/aircraft SATCOM operational interface between NOAA/TPC/NHC and AFRC/53WRS for NHOP and NWSOP taskings. CARCAH is a subunit of and reports directly to the 53WRS.
  - b. NOAA agrees to promptly notify AFRC/53WRS of the requirements for tropical cyclone or winter storm mission taskings in accordance with the NHOP and the NWSOP. Tropical cyclone missions will be tasked by the Director, TPC/NHC. Winter storm missions will be tasked by the Director, National Centers for Environmental Prediction.
  - c. AFRC recognizes the obligation to support winter storm operations and associated research projects as delineated by the DOD Appropriations Act and the NWSOP. Support to research projects will be contingent upon aircraft availability.
5. MOBILIZATION: In times of national emergency or war, some or all AFRC/53WRS reconnaissance resources may not be available to fulfill DOC/NOAA needs.
6. EFFECTIVE AND TERMINATION DATES: This memorandum will become effective on the date signed by the last approving official. The parties will review this memorandum of agreement at least once every three years to determine whether it should be revised, amended, or cancelled. Amendments or revisions to this agreement require the mutual consents of the parties.

7. COORDINATION:

The agency contacts for coordination of the activities under this MOU are:

AOC: CAPT Robert W. Maxson, NOAA, Aircraft Operations Center, DOC, MacDill AFB, Florida; phone: (813) 828-3310 ext. 3001; fax: (813) 828-3266 E-mail [Bob.W.Maxson@NOAA.gov](mailto:Bob.W.Maxson@NOAA.gov)

Ms. Julie Robertson, (813) 828-3310 ext. 3010; fax: (813) 828-8923 E-mail  
Julie.A.Robertson@NOAA.gov

AFRC:

HQ AFRC/DOOX  
DSN 497-1161; Commercial (228)327-1161

403 WG/XPL  
SSgt Clarence Hester Jr., Logistics Plans Manager  
Keesler AFB, MS  
DSN 597-3521; Commercial (228) 377-3521  
Fax DSN 597-4624; Commercial (228) 377-3521  
Email: Clarence.Hester@keesler.af.mil

53 WRS  
Lt Col Dennis L. Price, Director of Operation  
817 H Street, Keesler AFB, MS 39534  
DSN 597-8510; Commercial (228) 377-8510  
Fax DSN 597-1923; Commercial (228) 337-1923  
Email: Dennis.Price@keesler.af.mil

## 8. RESOLUTION OF DISAGREEMENTS

Nothing herein is intended to conflict with current DOC or the NOAA Aircraft Operations Center directives. If the terms of this agreement are inconsistent with existing directives of either of the agencies entering into this agreement, then those portions of this agreement which are determined to be inconsistent shall be invalid, but the remaining terms and conditions not affected by the inconsistency shall remain in full force and effect. At the first opportunity for review of the agreement, all necessary changes will be accomplished either by an amendment to this agreement or by entering into a new agreement, whichever is deemed expedient to the interest of both parties.

Should disagreement arise on the interpretation of the provisions of this agreement, or amendments and/or revisions thereto, that cannot be resolved at the operating level, the area(s) of disagreement shall be stated in writing by each party and presented to the other party for consideration. If agreement on interpretation is not reached within thirty (30) days, the parties shall forward the written presentation of the disagreement to respective higher officials for appropriate resolution.

FOR THE UNITED STATES  
AIR FORCE RESERVE COMMAND



Date: 2 Oct 2000

FOR THE NATIONAL OCEANIC AND  
ATMOSPHERIC ADMINISTRATION

 Capt NOAA

Date: 10/12/2000





**APPENDIX G**  
**RECCO, HDOB, AND TEMP DROP**  
**CODES, TABLES, AND REGULATIONS**

DATE		ORGANIZATION				MISSION IDENTIFIER										
OBSERVATION NUMBER	9	RECCO INDICATOR SPECIFYING TYPE OF OBSERVATION <i>Table 1</i>	Q	TIME OF OBSERVATION (Hours and Minutes)  (GMT)	Y	DAY OF WEEK SUN-1	L <sub>o</sub>	LONGITUDE	h <sub>a</sub>	PRESSURE ALTITUDE OF AIRCRAFT REPORTED TO THE NEAREST DECAMETER	d	WIND DIRECTION AT FLIGHT LEVEL (Tens of deg. true.)	T	TEMPERATURE WHOLE °C	/	INDICATOR
	X		Q		OCTANT <i>Table 3</i>	L <sub>o</sub>	DEGREES AND TENTHS ( <i>Note 4</i> )	h <sub>a</sub>	d		T	INDEX TO <i>Table 9</i>				
	X		L <sub>a</sub>		LATITUDE	L <sub>o</sub>	B	TURBULENCE <i>Table 4</i>	d <sub>t</sub>		f	T <sub>d</sub>	DEW POINT WHOLE °C	H	GEOPOTENTIAL HEIGHT/D-VALUE OR SLP PER INDEX  ( <i>Note 8</i> )	
	X		L <sub>a</sub>		DEGREES AND TENTHS	B	f <sub>c</sub>	FLIGHT COND <i>Table 3</i> ( <i>Note 5</i> )	d <sub>a</sub>		f	T <sub>d</sub>	H			
	9		i <sub>d</sub>		DEW POINT INDICATOR <i>Table 2</i>	L <sub>a</sub>	f <sub>c</sub>	d <sub>a</sub>	METHOD OF OBTAINING WIND <i>Table 7</i>		f	w	PRESNT WEATHER ( <i>Note 7</i> , <i>Table 8</i> )	H		
1		2		3		4		5		6		7		8		
REMARKS																

TYPE AIRCRAFT				CALL SIGN				METEOROLOGIST							
1	INDICATOR	C	CLOUD TYPE <i>Table 11</i>	C	CLOUD TYPE <i>Table 11</i>	C	CLOUD TYPE <i>Table 11</i>	1	INDICATOR	C	CLOUD TYPE <i>Table 11</i>	C	CLOUD TYPE <i>Table 11</i>	C	CLOUD TYPE <i>Table 11</i>
k <sub>n</sub>	NR OF CLOUD LAYERS ( <i>Note 9</i> )	h <sub>s</sub>	ALTITUDE OF BASE	h <sub>s</sub>	ALTITUDE OF BASE	h <sub>s</sub>	ALTITUDE OF BASE	K <sub>n</sub>	NR OF CLOUD LAYERS ( <i>Note 9</i> )	h <sub>s</sub>	ALTITUDE OF BASE	h <sub>s</sub>	ALTITUDE OF BASE	h <sub>s</sub>	ALTITUDE OF BASE
N <sub>s</sub>	AMOUNT OF CLOUDS  ( <i>Note 9</i> , <i>Table 10</i> )	h <sub>s</sub>	<i>Table 12</i>	h <sub>s</sub>	<i>Table 12</i>	h <sub>s</sub>	<i>Table 12</i>	N <sub>s</sub>	AMOUNT OF CLOUDS  ( <i>Note 9</i> , <i>Table 10</i> )	h <sub>s</sub>	<i>Table 12</i>	h <sub>s</sub>	<i>Table 12</i>	h <sub>s</sub>	<i>Table 12</i>
N <sub>s</sub>		H <sub>t</sub>	ALTITUDE OF TOP	H <sub>t</sub>	ALTITUDE OF TOP	H <sub>t</sub>	ALTITUDE OF TOP	N <sub>s</sub>		H <sub>t</sub>	ALTITUDE OF TOP	H <sub>t</sub>	ALTITUDE OF TOP	H <sub>t</sub>	ALTITUDE OF TOP
N <sub>s</sub>	t <sub>t</sub>	<i>Table 12</i>	H <sub>t</sub>	<i>Table 12</i>	H <sub>t</sub>	<i>Table 12</i>	N <sub>s</sub>	H <sub>t</sub>	<i>Table 12</i>	H <sub>t</sub>	<i>Table 12</i>	H <sub>t</sub>	<i>Table 12</i>	H <sub>t</sub>	<i>Table 12</i>
9		10		11		12		13		14		15		16	
REMARKS															

RECCO RECORDING WORKSHEET															
4	INDICATOR	6	INDICATOR ( <i>Note 11</i> )	6	INDICATOR ( <i>Note 11</i> )	7	INDICATOR	7	INDICATOR	8	INDICATOR	8	INDICATOR	9	INDICATOR
d	DIRECTION OF SFC WIND (Tens of deg. true.)	W <sub>s</sub>	SIGNIFICANT WEATHER CHANGES <i>Table 14</i>	W <sub>s</sub>	SIGNIFICANT WEATHER CHANGES <i>Table 14</i>	I <sub>r</sub>	RATE OF ICING <i>Table 17</i>	h <sub>i</sub>	ALT OF BASE OF ICING STRATUM ( <i>Note 12</i> , <i>Table 12</i> )	d <sub>r</sub>	BEARING OF ECHO CENTER (Tens of Deg. True)	E <sub>w</sub>	ECHO WIDTH OR DIAMETER <i>Table 19</i>	V <sub>i</sub>	INFLIGHT VISIBILITY <i>Table 23</i>
d		S <sub>s</sub>	DISTANCE OF OCCURENCE OF W <sub>s</sub> <i>Table 15</i>	S <sub>s</sub>	DISTANCE OF OCCURENCE OF W <sub>s</sub> <i>Table 15</i>	I <sub>t</sub>	TYPE OF ICING <i>Table 18</i>	h <sub>i</sub>		d <sub>r</sub>		E <sub>i</sub>	LENGTH OF MAJ AXIS <i>Table 19</i>	T <sub>w</sub>	SEA SURFACE TEMPERATURE DEGREES AND TENTHS
f	SURFACE WIND SPEED ( <i>Note 10</i> )	w <sub>d</sub>	DISTANT WEATHER <i>Table 16</i>	w <sub>d</sub>	DISTANT WEATHER <i>Table 16</i>	S <sub>b</sub>	DISTANCE TO BEGINNING OF ICING <i>Table 15</i>	H <sub>i</sub>	ALTITUDE OF TOP OF ICING STRATUM ( <i>Note 12</i> , <i>Table 12</i> )	S <sub>r</sub>	DISTANCE TO ECHO CENTER <i>Table 19</i>	C <sub>e</sub>	CHARACTER OF ECHO <i>Table 21</i>	T <sub>w</sub>	
f		d <sub>w</sub>	BEARING OF W <sub>d</sub> <i>Table 13</i>	d <sub>w</sub>	BEARING OF W <sub>d</sub> <i>Table 13</i>	S <sub>a</sub>	DISTANCE TO ENDING OF ICING <i>Table 15</i>	H <sub>i</sub>		O <sub>e</sub>	ORIENTATION OF ELLIPSE <i>Table 20</i>	I <sub>e</sub>	INTENSITY OF ECHO <i>Table 22</i>	T <sub>w</sub>	
17		18		19		20		21		22		23		24	
REMARKS															

Figure G-1. Reconnaissance Code Recording Form

## Table G-1. Reconnaissance Code Tables

**TABLE 1** XXX

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

**TABLE 2** i<sub>d</sub>

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

**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<sub>c</sub>

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

**TABLE 6** d<sub>t</sub>

0 Spot of Wind  
 1 Average wind  
 / No wind reported

**TABLE 7** d<sub>a</sub>

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

**TABLE 8** w

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

**TABLE 9** j

0 Sea level pressure in whole millibars (thousands fig if any omitted)  
 1 Altitude 200 mb surface in geopotential decameters (thousands fig if any omitted)  
 2 Altitude 850 mb surface in geopotential meters (thousands fig omitted)  
 3 Altitude 700 mb surface in geopotential meters (thousands fig omitted)  
 4 Altitude 500 mb surface in geopotential decameters  
 5 Altitude 400 mb surface in geopotential decameters  
 6 Altitude 300 mb surface in geopotential decameters  
 7 Altitude 250 mb surface in geopotential decameters (thousands fig if any omitted)  
 8 D - Value in geopotential decameters; if negative 500 is added to HHH  
 9 Altitude 925 mb surface in geopotential meters  
 / No absolute altitude available or geopotential data not within ± 30 meters/4 mb accuracy requirements

**TABLE 10** N<sub>s</sub>

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

**TABLE 11** C

0 Cirrus (Ci)  
 1 Cirrocumulus (Cc)  
 2 Cirrostratus (Cs)  
 3 Altopumulus (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<sub>s</sub>h<sub>s</sub>H<sub>t</sub>H<sub>t</sub>h<sub>i</sub>h<sub>i</sub>H<sub>i</sub>H<sub>i</sub>

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	29,000 ft
80	30,000 ft
81	35,000 ft
82	40,000 ft
	etc, etc
89	Greater than 70,000 ft
//	Unknown

**TABLE 13** d<sub>w</sub>

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

**TABLE 14** W<sub>s</sub>

0 No change  
 1 Marked wind shift  
 2 Beginning or ending or 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<sub>b</sub>S<sub>e</sub>S<sub>s</sub>

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

## Table G-1. Reconnaissance Code Tables (continued)

**TABLE 16**  $w_d$

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

**TABLE 17**  $I_r$

- 7 Light
- 8 Moderate
- 9 Severe
- / Unknown or contrails

**TABLE 18**  $I_t$

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

**TABLE 19**  $S_r, E_w, E_l$

- 0 ONM      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 GGggj<sub>d</sub> YQL<sub>a</sub>L<sub>a</sub>L<sub>a</sub> L<sub>o</sub>L<sub>o</sub>L<sub>o</sub>Bf<sub>c</sub> h<sub>a</sub>h<sub>a</sub>h<sub>a</sub>d<sub>t</sub>d<sub>a</sub>

ddff TTT<sub>d</sub>T<sub>d</sub>w /jHHH

SECTION TWO (ADDITIONAL)

1k<sub>n</sub>N<sub>s</sub>N<sub>s</sub>N<sub>s</sub> Ch<sub>s</sub>h<sub>s</sub>H<sub>t</sub>H<sub>t</sub> ..... 4ddff

6W<sub>s</sub>S<sub>s</sub>W<sub>d</sub>d<sub>w</sub> 7I<sub>r</sub>I<sub>t</sub>S<sub>b</sub>S<sub>e</sub> 7h<sub>i</sub>h<sub>i</sub>H<sub>i</sub>H<sub>i</sub> 8d<sub>r</sub>d<sub>r</sub>S<sub>r</sub>O<sub>e</sub>

8E<sub>w</sub>E<sub>l</sub>c<sub>e</sub>i<sub>e</sub> 9V<sub>i</sub>T<sub>w</sub>T<sub>w</sub>T<sub>w</sub>

SECTION THREE (INTERMEDIATE)

9XXX9 GGggj<sub>d</sub> YQL<sub>a</sub>L<sub>a</sub>L<sub>a</sub> L<sub>o</sub>L<sub>o</sub>L<sub>o</sub>Bf<sub>c</sub> h<sub>a</sub>h<sub>a</sub>h<sub>a</sub>d<sub>t</sub>d<sub>a</sub>

ddff TTT<sub>d</sub>T<sub>d</sub>w /jHHH

**Table G-2. Reconnaissance Code Regulations**

1. At the time of the observation the aircraft observing platform is considered to be located on the axis of a right vertical cylinder with a radius of 30 nautical miles bounded by the earth's surface and the top atmosphere. Present weather, cloud amount and type, turbulence, and other subjective elements are reported as occurring within the cylinder. Flight level winds, temperature, dew point, and geopotential values are sensed or computed and reported as occurring at the center of the observation circle. Radar echoes, significant weather changes, distant weather, and icing are phenomena that may also be observed/reported. Code groups identifying these phenomena may be reported as necessary to adequately describe met conditions observed.
2. The intermediate observation (Section Three) is reported following Section One (or Section Two if appended to Section One) in the order that it was taken.
3. Plain language remarks may be added as appropriate. These remarks follow the last encoded portion of the horizontal or vertical observation and will clearly convey the intended message. Vertical observations will not include meteorological remarks. These remarks must begin with a letter or word-e.g. "FL TEMP" vice "700 MB FL TEMP." The last report plain language remarks are mandatory, i.e., "LAST REPORT. OBS 01 thru 08 to KNHC, OBS 09 and 10 to KBIX."
4. The hundreds digit of longitude is omitted for longitudes from 100° to 180°.
5. Describe conditions along the route of flight actually experienced at flight level by aircraft.
6. TT, T<sub>d</sub>T<sub>d</sub>. When encoding negative temperatures, 50 is added to the absolute value of the temperature with the hundreds figure, if any, being omitted. A temperature of -52°C is encoded as 02, the distinction between -52°C and 2°C being made from i<sub>d</sub>. Missing or unknown temperatures are reported as //. When the dew point is colder than -49.4°C, Code T<sub>d</sub>T<sub>d</sub> as // and report the actual value as a plain language remark - e.g. "DEW POINT NEG 52°C".
7. When two or more types of w co-exist, the type with the higher code figure will be reported. Code Figure 1, 2 and 3 are reported based on the total cloud amount through a given altitude, above or below the aircraft, and when other figures are inappropriate. The summation principle applies only when two or more cloud types share a given altitude.
8. When j is reported as a /, HHH is encoded as ///.
9. If the number of cloud layers reported exceeds 3, k<sub>n</sub> in the first 1-group reports the total number of cloud layers. The second 1-group reports the additional number of layers being reported exclusive of those previously reported. In those cases where a cloud layer(s) is discernible, but a descriptive cloud picture of the observation circle is not possible, use appropriate remarks such as "Clouds Blo" or "As Blo" to indicate the presence of clouds. In such cases, coded entries are not made for group 9. The sequence in which cloud amounts are encoded depends upon type of cloud, cloud base, and vertical extent of the cloud. The cloud with the largest numerical value of cloud type code (C) is reported first, regardless of coverage, base, or vertical extent. Among clouds of the same cloud type code, sharing a common base, the cloud of greatest vertical extent is reported first. The summation principle is not used; each layer is treated as though no other clouds were present. The total amount of clouds through one altitude shared by several clouds will not exceed 8 oktas. Only use code figure 0 as a place holder when you can determine that no additional cloud layers exist. In case of undercast, overcast, etc., use code figure 9 as a placeholder.
10. Due to limitations in the ability to distinguish sea state features representative of wind speeds above 130 knots, surface wind speeds in excess of 130 knots will not be encoded. Wind speeds of 100 to 130 knots inclusive will be encoded by deleting the hundreds figure and adding 50 to dd. For wind speeds above 130 knots, dd is reported without adding 50 and ff is encoded as // with a plain language remark added, i.e., "SFC WIND ABOVE 130 KNOTS."
11. Significant weather changes which have occurred since the last observation along the track are reported for W<sub>s</sub>.
12. When aircraft encounters icing in level flight, the height at which the icing occurred will be reported for h<sub>i</sub>h<sub>i</sub>. The H<sub>i</sub>H<sub>i</sub> will be reported as //.

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## THE HDOB MESSAGE

The HDOB message is used to transmit High-Density/High-Accuracy (HD/HA) meteorological data from hurricane reconnaissance aircraft. These are created automatically by the system software. Each message consists of a communications header line (Table G-3), a mission/ob identifier line (Table G-4), and 20 lines of HD/HA data (Table G-5).

Within an HDOB message, the time interval (resolution) between individual HD/HA observations can be set by the operator to be 30, 60, or 120 seconds. However, regardless of the time resolution of the HD/HA data, *the meteorological parameters in the HDOB message always represent 30-second averages* along the flight track (except for certain peak values as noted in Table G-5).

The nominal time of each HD/HA record is the midpoint of the 30-second averaging interval. This means that an HD/HA record at time  $t$  will include data measured at time  $t+15$  seconds. For purposes of determining peak flight-level and SFMR winds, the encoding interval begins 15 seconds after the nominal time of the last HD/HA record and ends 15 seconds after the nominal time of the record being encoded.

A sample HDOB message is given below (message begins with URNT15...):

```
0           1           2           3           4           5           6           7
01234567890123456789012345678901234567890123456789012345678901234567890
-----
URNT15 KNHC 281426
AF302 1712A KATRINA           HDOB 41 20050928
142030 2608N 08756W 7093 03047 9333 +192 +134 133083 089 080 999 00
142100 2609N 08755W 7091 03054 9330 +166 +146 133106 115 103 999 00
142130 2610N 08754W 7058 03040 9295 +134 +134 135121 124 111 999 00
142200 2611N 08753W 7037 03060 9291 +124 +124 138129 136 122 999 00
.
.
.
142230 2612N 08752W 7010 03057 9282 +102 +102 141153 166 148 999 00
142300 2612N 08751W 7042 03010 9293 +088 +083 133159 164 147 999 00
142330 2613N 08750W 6999 03064 9279 +088 +088 138158 161 144 999 00
142400 2614N 08749W 7005 03046 9281 +080 +080 138155 158 142 999 00
142430 2614N 08748W 6998 03048 9278 +078 +078 138151 153 137 999 00
142500 2615N 08747W 7002 03048 9279 +084 +084 140146 148 133 999 00
$$
```

---

**Figure G-2. HDOB Description and Sample Message**



**Table G-5. HD/HA Data Line Format for HDOB Messages**

---

0	1	2	3	4	5	6	7						
01234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890						
-----													
<b>hhmmss</b>	<b>LLLLH</b>	<b>NNNNW</b>	<b>PPPP</b>	<b>GGGGG</b>	<b>XXXX</b>	<b>sTTT</b>	<b>sddd</b>	<b>www</b>	<b>SSS</b>	<b>MMM</b>	<b>KKK</b>	<b>ppp</b>	<b>FF</b>
142230	2612N	08752W	7010	03057	9282	+102	+102	141153	166	148	999	00	

- hhmmss:** Observation time, in hours, minutes and seconds (UTC). The observation time is the midpoint of the 30-s averaging interval used for the record's meteorological data.
- LLLLH:** The latitude of the aircraft at the observation time in degrees (LL) and minutes (LL). The hemisphere (H) is given as either N or S.
- NNNNH:** The longitude of the aircraft at the observation time, in degrees (NNN) and minutes (NN). The hemisphere (H) is given as either E or W.
- PPPP:** Aircraft static air pressure, in tenths of mb with decimal omitted, at the observation time. If pressure is equal to or greater than 1000 mb the leading 1 is dropped.
- GGGGG:** Aircraft geopotential height, in meters, at the observation time.
- XXXX:** Extrapolated surface pressure or D-value (30-s average). Encoded as extrapolated surface pressure if aircraft static pressure is 550.0 mb or greater (i.e., flight altitudes at or below 550 mb). Format for extrapolated surface pressure is the same as for static pressure. For flight altitudes higher than 550 mb, **XXXX** is encoded as the D-value, in meters. Negative D-values are encoded by adding 5000 to the D-value.
- s:** Sign of the temperature or dew point (+ or -).
- sTTT:** The air temperature in degrees and tenths Celsius, decimal omitted (30-s average).
- sddd:** The dew point temperature, in degrees and tenths Celsius, decimal omitted (30-s average).
- www:** Wind direction in degrees (30-s average). North winds are coded as 000. 999 indicates missing value.
- SSS:** Wind speed, in kt (30-s average). 999 indicates missing value.



**MMM:** Peak 10-second average wind speed occurring within the encoding interval, in kt. 999 indicates missing value.

**KKK:** Peak 10-second average surface wind speed occurring within the encoding interval from the Stepped Frequency Microwave Radiometer (SFMR), in kt. 999 indicates missing value.

**ppp:** SFMR-derived rain rate, in  $\text{mm hr}^{-1}$ , evaluated over the 10-s interval chosen for KKK. 999 indicates missing value.

**FF:** Quality control flags.

First column indicates status of positional variables as follows:

- 0 All parameters of nominal accuracy
- 1 Lat/lon questionable
- 2 Geopotential altitude or static pressure questionable
- 3 Both lat/lon and GA/PS questionable

Second column indicates status of meteorological variables as follows:

- 0 All parameters of nominal accuracy
  - 1 T or TD questionable
  - 2 Flight-level winds questionable
  - 3 SFMR parameter(s) questionable
  - 4 T/TD and FL winds questionable
  - 5 T/TD and SFMR questionable
  - 6 FL winds and SFMR questionable
  - 9 T/TD, FL winds, and SFMR questionable
-

## Table G-6. TEMP DROP CODE

EXTRACT FROM: WMO-No. 306 MANUAL ON CODES

FM 37-X Ext. TEMP DROP - Upper-level pressure, temperature, humidity and wind report from a sonde released by carrier balloons or aircraft. See Figure G-4 for an example TEMP DROP message for tropical cyclone operations.

### CODE FORM:

#### PART A

SECTION 1     $M_i M_i M_j M_j$      $YYGGI_d$      $99L_a L_a L_a$      $Q_c L_o L_o L_o L_o$      $MMMU_{L_a} U_{L_o}$

SECTION 2     $99P_o P_o P_o$      $T_o T_o T_{a_o} D_o D_o$      $d_o d_o f_o f_o f_o$

$P_1 P_1 h_1 h_1 h_1$      $T_1 T_1 T_{a1} D_1 D_1$      $d_1 d_1 f_1 f_1 f_1$

$P_n P_n h_n h_n h_n$      $T_n T_n T_{an} D_n D_n$      $d_n d_n f_n f_n f_n$

SECTION 3     $88P_t P_t P_t$      $T_t T_t T_{at} D_t D_t$      $d_t d_t f_t f_t f_t$   
or  
88999

SECTION 4     $77P_m P_m P_m$      $d_m d_m f_m f_m f_m$      $(4v_b v_b v_a v_a)$   
or  
 $66P_m P_m P_m$      $d_m d_m f_m f_m f_m$      $(4v_b v_b v_a v_a)$   
or  
77999

SECTION 10    31313

51515     $101A_{df} A_{df}$      $0P_n P_n P'_n P'_n$   
or

$101A_{df} A_{df}$      $P_n P_n h_n h_n h_n$   
61616

62626

#### PART B

SECTION 1     $M_i M_i M_j M_j$      $YYGG8$      $99L_a L_a L_a$      $Q_c L_o L_o L_o$      $MMMU_{L_a} U_{L_o}$

SECTION 5     $n_o n_o P_o P_o P_o$      $T_o T_o T_{a_o} D_o D_o$

$n_1 n_1 P_1 P_1 P_1$      $T_1 T_1 T_{a1} D_1 D_1$

$n_n n_n P_n P_n P_n$      $T_n T_n T_{an} D_n D_n$

SECTION 6 21212 n<sub>0</sub>n<sub>0</sub>P<sub>0</sub>P<sub>0</sub>P<sub>0</sub> d<sub>0</sub>d<sub>0</sub>f<sub>0</sub>f<sub>0</sub>f<sub>0</sub>

n<sub>1</sub>n<sub>1</sub>P<sub>1</sub>P<sub>1</sub>P<sub>1</sub> d<sub>1</sub>d<sub>1</sub>f<sub>1</sub>f<sub>1</sub>f<sub>1</sub>

n<sub>n</sub>n<sub>n</sub>P<sub>n</sub>P<sub>n</sub>P<sub>n</sub> d<sub>n</sub>d<sub>n</sub>f<sub>n</sub>f<sub>n</sub>f<sub>n</sub>

SECTION 7 31313 s<sub>r</sub>r<sub>a</sub>r<sub>a</sub>s<sub>a</sub>s<sub>a</sub> 8GGgg

SECTION 9 51515 101A<sub>df</sub> A<sub>df</sub> or

101A<sub>df</sub> A<sub>df</sub> 0P<sub>n</sub>P<sub>n</sub>P<sub>n</sub>P<sub>n</sub> or

101A<sub>df</sub> A<sub>df</sub> P<sub>n</sub>P<sub>n</sub>h<sub>n</sub>h<sub>n</sub>h<sub>n</sub>

SECTION 10 61616

62626

## PART ALPHA (A)

### IDENTIFICATION LETTERS: M<sub>J</sub>M<sub>J</sub>

Identifier: M<sub>J</sub>M<sub>J</sub> - Identifier for Part A of the report.

### DATE/TIME GROUP: YYGGI<sub>d</sub>

Identifier: YY - Date group

Identifier: GG - Time group

Identifier: I<sub>d</sub> - The highest mandatory level for which wind is available.

### LATTITUDE: 99L<sub>a</sub>L<sub>a</sub>L<sub>a</sub>

Identifier: 99 - Indicator for data on position follows.

Identifier: L<sub>a</sub>L<sub>a</sub>L<sub>a</sub> - Latitude in tenths of degrees

### LONGITUDE: Q<sub>c</sub>L<sub>0</sub>L<sub>0</sub>L<sub>0</sub>

Identifier: Q<sub>c</sub> - The octant of the globe.

Identifier: L<sub>0</sub>L<sub>0</sub>L<sub>0</sub> - Longitude in tenths of degrees

### MARSDEN SQUARE: MMMU<sub>la</sub>U<sub>lo</sub>

Identifier: MMM - Marsden square.

Identifier: U<sub>la</sub>U<sub>lo</sub> - Units digits in the reported latitude and longitude.

### SEA LEVEL PRESSURE: 99P<sub>0</sub>P<sub>0</sub>P<sub>0</sub> T<sub>0</sub>T<sub>0</sub>T<sub>0</sub>D<sub>0</sub>D<sub>0</sub> d<sub>0</sub>d<sub>0</sub>f<sub>0</sub>f<sub>0</sub>

Identifier: 99 - Indicator for data at the surface level follows

Identifier: P<sub>0</sub>P<sub>0</sub>P<sub>0</sub> - Indicator for pressure of specified levels in whole millibars (thousands digit omitted)

Identifier: T<sub>0</sub>T<sub>0</sub>T<sub>0</sub> - Tens and digits of air temperature (not rounded off) in degrees Celsius, at specified levels beginning with surface.

Identifier: D<sub>0</sub>D<sub>0</sub> - Dewpoint depression at standard isobaric surfaces beginning with surface level.

### NOTE

When the depression is 4.9C or less encode the units and tenths digits of the depression. Encode depressions of 5.0 through 5.4C as 50. Encode depressions of 5.5C through 5.9C as 56. Dew point depressions of 6.0 and above are encoded in tens and units with 50 added. Dew point depressions for relative humidities less than 20% are encoded as 80. When air temperature is below -40C report  $D_n D_n$  as //.

Identifier:  $d_o d_o$  – True direction from which wind is blowing rounded to nearest 5 degrees. Report hundreds and tens digits. The unit digit (0 or 5) is added to the hundreds digit of wind speed.

Identifier:  $f_o f_o f_o$  – Wind speed in knots. Hundreds digit is sum of speed and unit digit of direction, i.e. 295° at 125 knots encoded as 29625.

NOTE: 1. When flight level is just above a standard surface and in the operator's best meteorological judgment, the winds are representative of the winds at the standard surface, then the operator may encode the standard surface winds using the data from flight level. If the winds are not representative, then encode /////.

NOTE: 2. The wind group relating to the surface level ( $d_o d_o f_o f_o$ ) will be included in the report; when the corresponding wind data are not available, the group will be encoded as /////.

### STANDARD ISOBARIC SURFACES : $P_1 P_1 h_1 h_1 h_1 T_1 T_1 T_1 D_1 D_1 d_1 d_1 f_1 f_1$

Identifier:  $P_1 P_1$  – Pressure of standard isobaric surfaces in units of tens of millibars.

(1000 mbs = 00, 925mbs = 92, 850mbs = 85, 700mbs = 70, 500mbs = 50, 400mbs = 40, 300mbs = 30, 250mbs = 25).

Identifier:  $h_1 h_1 h_1$  – Heights of the standard pressure level in geopotential meters or decameters above the surface. Encoded in decameters at and above 500mbs omitting, if necessary, the thousands or tens of thousands digits. Add 500 to hhh for negative 1000mb or 925mb heights. Report 1000mb group as 00// ///// ///// when pressure is less than 950mbs.

Identifier:  $T_1 T_1 T_1 D_1 D_1$  – Same temperature/dew point encoding procedures apply to all levels.

Identifier :  $d_1 d_1 f_1 f_1$  – Same wind encoding procedures apply to all levels.

### DATA FOR TROPOPAUSE LEVELS: 88 $P_t P_t P_t T_t T_t T_t D_t D_t d_t d_t f_t f_t$

Identifier: 88 – Indicator for Tropopause level follows

Identifier:  $P_t P_t P_t$  – Pressure at the tropopause level reported in whole millibars. Report 88 $P_n P_n P_n$  as 88999 when tropopause is not observed.

Identifier:  $T_t T_t T_t D_t D_t$  – Same temperature/ dew point encoding procedures apply.

Identifier:  $d_t d_t f_t f_t$  - Same wind encoding procedures apply.

### MAXIMUM WIND DATA: 77 $P_n P_n P_n d_n d_n f_n f_n 4v_b v_b v_a v_a$

Identifier: 77 – Indicator that data for maximum wind level and for vertical wind shear follow when max wind does not coincide at flight. If the maximum wind level coincides with flight level encode as 66

Identifier:  $P_n P_n P_n$  – Pressure at maximum wind level in whole millibars.

Identifier:  $d_n d_n f_n f_n$  - Same wind encoding procedures apply.

### VERTICAL WIND SHEAR DATA: $4v_b v_b v_a v_a$

Identifier: 4 – Data for vertical wind shear follow.

Identifier:  $v_b v_b$  – Absolute value of vector difference between max wind and wind 3000 feet BELOW the level of max wind, reported to the nearest knot. Use “//” if missing and a 4 is reported. A vector difference of 99 knots or more is reported with the code figure “99”.

Identifier:  $v_a v_a$  – Absolute value of vector difference between max wind and wind 3000 feet above the level of max wind, reported to the nearest knot. Use “/” if missing and a 4 is reported. A vector difference of 99 knots or more is reported with the code figure “99”.

### **SOUNDING SYSTEM INDICATION, RADIOSONDE/ SYSTEM STATUS, LAUNCH TIME:**

**31313**  $s_r r_a r_a s_a s_a$  **8GGgg**

Identifier:  $s_r r_a r_a s_a s_a$  - Sounding system indicator, radiosonde/ system status:  $s_a r_a r_a s_a s_a$

Identifier:  $s_a$  - Solar and infrared radiation correction ( **0** – no correction)

Identifier:  $r_a r_a$  – Radiosonde/sounding system used ( **96** – Descending radiosonde)

Identifier:  $s_a s_a$  – Tracking technique/status of system used ( **08** – Automatic satellite navigation)

Identifier: **8GGgg** – Launch time

Identifier: **8** – Indicator group

Identifier: **GG** – Time in hours

Identifier: **gg** – Time in minutes

### **ADDITIONAL DATA GROUPS: 51515 101XX 0P<sub>n</sub>P<sub>n</sub>P<sub>n</sub>P<sub>n</sub>**

Identifier: **51515** – Additional data in regional code follow

Identifier: **10166** – Geopotential data are doubtful between the following levels 0P<sub>n</sub>P<sub>n</sub>P<sub>n</sub>P<sub>n</sub>. This code figure is used only when geopotential data are doubtful from one level to another.

Identifier: **10167** – Temperature data are doubtful between the following levels 0P<sub>n</sub>P<sub>n</sub>P<sub>n</sub>P<sub>n</sub>. This code figure shall be reported when only the temperature data are doubtful for a portion of the descent. If a 10167 group is reported a 10166 will also be reported. EXAMPLE: Temperature is doubtful from 540mbs to 510mbs. SLP is 1020mbs.

The additional data groups would be : 51515 10166 00251 10167 05451.

Identifier: **10190** – Extrapolated altitude data follows:

When the sounding begins within 25mbs below a standard surface, the height of the surface is reported in the format **10190 P<sub>n</sub>P<sub>n</sub>h<sub>n</sub>h<sub>n</sub>h<sub>n</sub>**. The temperature group is not reported.

EXAMPLE: Assume the release was made from 310mbs and the 300mb height was 966 decameters. The last reported standard level in Part A is the 400mb level. The data for the 300mb level is reported in Part A and B as 1019030966.

When the sounding does not reach surface, but terminates within 25mbs of a standard surface, the height of the standard surface is reported in Part A of the code in standard format and also at the end of Part A and Part B of the code in the format as **10190 P<sub>n</sub>P<sub>n</sub>h<sub>n</sub>h<sub>n</sub>h<sub>n</sub>**.

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

Identifier: **10191** – Extrapolated surface pressure precedes. Extrapolated surface pressure is only reported when the termination occurs between 850mbs and the surface. Surface pressure is reported in Part A as 99P<sub>0</sub>P<sub>0</sub>P<sub>0</sub> //// and in Part B as 00P<sub>0</sub>P<sub>0</sub>P<sub>0</sub> ////. When surface pressure is extrapolated the 10191 group is the last additional data group reported in Part B.

### **AIRCRAFT AND MISSION IDENTIFICATION: 61616 AFXXX XXXXX XXXXX OB X**

Identifier: **61616** – Aircraft and mission identification data follows.

Identifier: **AFXXX** – The identifier AF for U.S. Air Force and the last three digits of the aircraft’s tail number.

Identifier: **XXXXX XXXXX** – The identifier for the type of mission being flown.

If a training mission the mission identifier is **WXWXA TRAIN**. The fifth letter “A” is the only character that could possibly change. The “A” defining that the flight originated in the Atlantic basin. The letter “C” identifies the Central Pacific area and the letter “E” identifies the Eastern Pacific.

If an operational storm mission: the first two numbers Identifier the number of times an aircraft has flown this system and the second two numbers Identifier the system number. The last character again identifies the basin flown. The name of the storm would replace TRAIN.  
EXAMPLE: AF968 0204A MARIE – Aircraft number 50968, this was the second flight into this system and the system was the fourth of the season. The system reached tropical storm strength and was named MARIE.

Identifier: **OB 14** – The observation (both vertical and horizontal) number as transmitted from the aircraft.

#### **NATIONALLY DEVELOPED CODES: 62626**

Identifier: **62626** – This is the remarks section. Only the remarks EYE, EYEWALL XXX, MXWNBND XXX, or RAINBAND will be used. If the remarks EYEWALL is used it will be followed by the radian to the eye center.

Identifier: **SPL XXXXNXXXXXW hmmm** - Impact location of the sonde based on its last GPS position and the splash time. The splash location will be recorded automatically by computer.

Identifier: **LAST WND XXX** - Height of the last reported wind. If a surface wind is reported the Last Wind remark is omitted. XXX will never be less than 13 meters

Identifier: **MBL WND dddff** - The mean boundary level wind. The mean wind in the lowest 500 meters of the sounding

Identifier: **AEV XXXXX** - This is the software version being used for the sounding.

Identifier: **DLM WND dddff bbbttt** - The Deep Layer Mean wind. It is the average wind over the depth of the sounding. Where dddff is the wind averaged from the first to the last available wind (these would correspond to the first and last significant levels for wind); ttt is the pressure at the top of the layer, and bbb is the pressure at the bottom of the layer (in whole mbs, with thousands digit omitted).

Identifier: **WL150 dddff zzz** - Average wind over the lowest available 150 m of the wind sounding. Where dddff is the mean wind over the 150 m layer centered at zzz m.

#### **PART ALPHA (B)**

#### **DATA FOR SIGNIFICANT TEMPERATURE AND RELATIVE HUMIDITY LEVELS SIGNIFICANT ISOBARIC LEVELS:**

**n<sub>0</sub>n<sub>0</sub>P<sub>0</sub>P<sub>0</sub>P<sub>0</sub> T<sub>0</sub>T<sub>0</sub>T<sub>0</sub>D<sub>0</sub>D<sub>0</sub>**

#### **IDENTIFICATION LETTERS: M<sub>J</sub>M<sub>J</sub>**

Identifier: **M<sub>J</sub>M<sub>J</sub>** - Identifier for Part B of the report.

#### **DATE/TIME GROUP: YYGG8**

Identifier: **YY** - Date group

Identifier: **GG** - Time group

Identifier: **8** - Indicator for the use of satellite navigation for windfinding.

**LATTITUDE: 99L<sub>a</sub>L<sub>a</sub>L<sub>a</sub>** (Same as Part A)

**LONGITUDE: QcL<sub>0</sub>L<sub>0</sub>L<sub>0</sub>L<sub>0</sub>** (Same as Part A)

**MARSDEN SQUARE: MMMU<sub>1a</sub>U<sub>10</sub>** (Same as Part A)

**SEA LEVEL PRESSURE: n<sub>0</sub>n<sub>0</sub>P<sub>0</sub>P<sub>0</sub>P<sub>0</sub> T<sub>0</sub>T<sub>0</sub>T<sub>0</sub>D<sub>0</sub>D<sub>0</sub>**

Identifier: **nono** – Indicator for number of level starting with surface level. Only surface will be numbered as “00”.

Identifier: **P<sub>0</sub>P<sub>0</sub>P<sub>0</sub>** – Indicator for pressure of specified levels in whole millibars (thousands digit omitted)

Identifier: **T<sub>0</sub>T<sub>0</sub>T<sub>0</sub>** – Tens and digits of air temperature (not rounded off) in degrees Celsius, at specified levels beginning with surface.

Identifier: **D<sub>0</sub>D<sub>0</sub>** – Dewpoint depression at standard isobaric surfaces beginning with surface level. Encoded the same as Part A.

**FOR STORM DROPS ONLY.** If SLP is less than 950mb encode the 1000mb group as 00/// //// // //. When the SLP is between 950mb and 999mb encode 1000mb as 00PoPoPo //// // (500 meters are added to height below surface).

**DATA FOR SIGNIFICANT WIND LEVELS: n<sub>0</sub>n<sub>0</sub>P<sub>0</sub>P<sub>0</sub>P<sub>0</sub> d<sub>0</sub>d<sub>0</sub>f<sub>0</sub>f<sub>0</sub>**

Identifier: **n<sub>0</sub>n<sub>0</sub>** – Number of level starting with surface level. Only surface will be numbered as “00”.

Identifier: **P<sub>0</sub>P<sub>0</sub>P<sub>0</sub>** – Pressure at specified levels in whole millibars.

Identifier: **d<sub>0</sub>d<sub>0</sub>** – True direction from which wind is blowing rounded to nearest 5 degrees. Report hundreds and tens digits. The unit digit (0 or 5) is added to the hundreds digit of wind speed.

Identifier: **f<sub>0</sub>f<sub>0</sub>f<sub>0</sub>** – Wind speed in knots. Hundreds digit is sum of speed and unit digit of direction, i.e. 295° at 125 knots encoded as 29625.

Same notes in Part A apply.

31313, 51515, 61616, 62626 – Repeated from Part A.

**FIGURE G-3. EXAMPLE TEMP DROP MESSAGE FOR TROPICAL CYCLONES**

UZNT13 KNHC 061851  
XXAA 56187 99251 70786 08158 99990 26444 //// 00540 26247 13070 92827  
22856 12565 85560 17834 13075 70200 13045 13585 88999 77999  
31313 09608 81828  
51515 10166 00270  
61616 AF968 0204A MARIE OB 14  
62626 MXWNBND SPL 2525N07835W 1826 LST WND 012 MBL WND 13065  
AEV 20200 DLM WND 13075 990699 WL150 13070 843  
XXBB 56188 99251 70786 08158 00006 26444 11000 25841 22991 24657 33860  
18233 44719 15657 55699 13045  
21212 00990 //// 11983 13570 22959 13065 33865 12560 44787 13075 55719  
13575 66699 13585  
31313 09608 81828  
51515 10166 00270  
61616 AF968 0204A MARIE OB 14  
62626 MXWNBND SPL 2525N07835W 1826 LST WND 012 MBL WND 13065  
AEV 20200 DLM WND 13075 990699 WL150 13070 843





## APPENDIX H

### WSR-88D OPERATIONS PLAN FOR TROPICAL CYCLONE EVENTS

In order to perform radar center-fixing and obtain other diagnostic information, TPC/NHC must obtain radar products from WSR-88D sites in the area of landfall. As a tropical cyclone approaches, software commands must be issued at the site, using the Unit Control Position (UCP), in order for TPC/NHC to obtain the necessary products. To facilitate this process, TPC/NHC, in cooperation with the NWS Weather Forecast Office, Melbourne, and the NEXRAD Radar Operations Center (ROC), has developed an operations plan for use during tropical cyclone events.

The latest addition can be found on the OFCM web site at:

*<http://www.ofcm.gov/homepage/text/pubs.htm> .*



**APPENDIX I**  
**TELEPHONE AND TELETYPE LISTING**

DEPARTMENT OF COMMERCE

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AGENCY	LOCATION	TTY <sup>1</sup>	TELEPHONE
Alternate NHC (NCEP, HPC)	Camp Springs, MD	B	COM 301-763-8201
AOC	Tampa Bay, FL		COM 813-828-3310
CPHC - Forecaster and Warning Desk - Admin - Director - Operations	Honolulu, HI	B	COM 808-973-5284 COM 808-973-5270 COM 808-973-5272 FAX 808-973-5281
CPHC Satellite Coordinator	Honolulu, HI	B	COM 808-973-5285
WFO Guam	Tiyan, Guam	B	COM 671-472-0950/1/2
NDBC - Operations Branch	SSC, MS		COM 228-688-7720
NESDIS Satellite Analysis Branch	Camp Springs, MD	B	COM 301-763-8444
NHC	Miami, FL	AB	COM 305-229-4415
TAFB Lead Forecaster (TPC/NHC)	Miami, FL	AB	COM 305-229-4425
Hydrometeorological Prediction Center (HPC)	Camp Springs, MD	B	COM 301-763-8201
NCEP Senior Duty Met (Data QC)	Camp Springs, MD	B	COM 301-763-8298
NWS Hydrometeorological Services Core (Headquarters)	Silver Spring, MD		COM 301-713-1858 ext. 108 FAX 301-713-1520
INTERDEPARTMENTAL			
OFCM	Silver Spring, MD		COM 301-427-2002 DSN 851-1460

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<sup>1</sup> A AWDS  
B AWIPS

DEPARTMENT OF DEFENSE

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AGENCY	LOCATION	TTY	TELEPHONE	
AFWA	Offutt AFB, NE	AB	COM DSN	402-294-7264 271-7264
CARCAH OLA, 53 WRS	Miami, FL	A	COM DSN	305-229-4474 434-3420
FACSFAC VACAPES OAC	Oceana, VA		COM DSN	804-433-1233 433-1233
FACSFAC Roosevelt Roads	Roosevelt Roads, PR		COM DSN	787-865-7007 831-7007/5202/5203
17 OWS/WXJ (Satellite Analyst)	Pearl Harbor, HI	A	COM DSN	808-471-3533 471-3533
325 OSS/OSW (Southeast Air Defense Sector/WE)	Tyndall AFB, FL	A	COM DSN	904-283-2845 523-2845
Keesler AFB Command Post	Keesler AFB, MS		COM DSN	228-377-4330 597-4330
NAVLANTMETOCEN Norfolk, VA			COM DSN	757-444-7583/7750 564-7583/7750
JTWC (Typhoon Duty Officer)	Pearl Harbor, HI	A	COM	808-474-2320
Fleet Numerical Meteorology and Oceanography Center (FNMOC) (Alternate JTWC)	Monterey, CA		COM DSN	831-656-4325 878-4325
53 WRS/DO	Keesler AFB, MS	A	COM DSN	228-377-2409 597-2409
53 WRS (Office)	Keesler AFB, MS		COM DSN	228-377-3207 597-3207
53 WRS (Alternate CARCAH)	Keesler AFB, MS	A	COM DSN	228-377-1939 597-1939

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DEPARTMENT OF TRANSPORTATION/FEDERAL AVIATION ADMINISTRATION

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	ARTCC		ARTCC PHONE DIRECTORY	
	ID	TMU	ADMINISTRATION	WATCH DESK OPERATIONS MANAGER
ANCHORAGE	ZAN	907-269-1108	907-269-1137	907-269-1103
ALBUQUERQUE	ZAB	505-856-4547	505-856-4601	505-856-4500
CHICAGO	ZAU	630-906-8445	630-906-8221	630-906-8341
BOSTON	ZBW	603-879-6666	603-879-6633	603-879-6655
WASHINGTON	ZDC	703-771-3471	703-771-3440/1	703-771-3470
DENVER	ZDV	303-651-4540	303-651-4101	303-651-4248
FT. WORTH	ZFW	817-858-7520	817-858-7500	817-858-7503
HOUSTON	ZHU	281-230-5530	281-230-5600	281-230-5560
INDIANAPOLIS	ZID	317-247-2267	317-247-2231	317-247-2242
JACKSONVILLE	ZJX	904-549-1570	904-549-1501	904-549-1537
KANSAS CITY	ZKC	913-254-8502	913-254-8403	913-791-8500
LOS ANGELES	ZLA	661-265-8250	661-265-8215	661-265-8205
SALT LAKE CITY	ZLC	801-320-2580	801-320-2501	801-320-2560
MIAMI	ZMA	305-716-1736	305-716-1500	305-716-1588
MEMPHIS	ZME	901-368-8250	901-368-8103	901-368-8234
MINNEAPOLIS	ZMP	651-463-5517	651-463-5510	651-463-5580
NEW YORK	ZNY	631-468-1010	631-468-1001	631-468-5959
OAKLAND	ZOA	510-745-3812	510-745-3000	510-745-3331
CLEVELAND	ZOB	440-774-0319	440-774-0320	440-774-0426
SEATTLE	ZSE	253-351-3525	253-351-3500	253-351-3520
ATLANTA	ZTL	770-210-7697	770-210-7600/3	770-210-7622
HONOLULU	HNL	N/A	808-840-6100	808-840-6201
SAN JUAN	SJU		787-253-8707	787-253-8664/5
TORONTO	YYZ		905-676-4590/1/2	Note:
MONTREAL	YUL		514-633-3211	TMO - Traffic Management Officer
MONCTON	YOM		506-867-7176	Area Manager - Watch Supervisor
WINNIPEG	YWG		204-983-8337	ARTCC - Air Route Traffic Control Center
EDMONTON	YEG		780-890-8304/5	
GANDER	YQX		709-651-5225	Canadian ACC - Area Control Centre
VANCOUVER	YVR		604-775-9601/6	

AIR TRAFFIC TACTICAL OPERATIONS ATT-100  
AIR TRAFFIC MANAGEMENT SERVICE  
AIR TRAFFIC CONTROL  
SYSTEM COMMAND CENTER - ATT 2

COM 703-904-4403  
COM 703-904-4401  
800-333-4286

HERNDON, VA.  
CENTRAL ALTITUDE  
RESERVATION FUNCTION (CARF)

703-904-4427  
DSN 725-3331/725-3333

NATIONAL NOTAM OFFICE  
HERNDON, VA

703-904-4557

ATCSCC NATIONAL OPERATIONS  
MANAGER (NOM)

703-904-4525/703-904-4953  
800-333-4286 MILITARY USE ONLY

CANADIAN OFCF (ARU)

ADMIN HOURS 613-998-6583

TELECONFERENCE 613-954-7425  
613-957-6390  
ARU OPS (24 HRS) 613-957-6343  
(ATCSCC OF CANADA) 613-992-9740  
613-992-7940  
613-992-9751

ARU FAX 613-957-6412

CENTER WEATHER SERVICE UNITS (CWSU) in FAA Coastal Facilities

Boston ARTCC 603-879-7698  
New York ARTCC 631-468-1083  
Washington ARTCC 703-771-3480  
Jacksonville ARTCC 904-549-1839  
Miami ARTCC 305-716-1635  
Houston ARTCC 281-230-5676  
Los Angeles ARTCC 661-265-8258  
Oakland ARTCC 510-745-3457  
Seattle ARTCC 253-351-3741  
Anchorage ARTCC 907-269-1145

## APPENDIX J

### PHONETIC PRONUNCIATION LISTING CARIBBEAN BASIN

Abaco	AB-a-KO	Escondido	es-cond-dee-dow
Abreojos	aahbray-oh-hoes	Eugenia	ayuh-hen-yuh
Amalie	a-MAHL-ye	Exuma	ek-SOO-ma
Angel	aan-hel		
Anguilla	ang-GWIL-a	Flores	FLO-rish
Antigua	an-TEE-ga	Fort de France	for-de-FRAHCS
Arena	aah-ray-nah		
Arista	ah-ree-staa	Galera	gaa-lehra
Aruba	ah-ROO-ba	Grenada	gre-NAY-dah
Antilles	an-TILL-leez	Guadeloupe	GWAH-deh-loop
Azores	uh-ZOHRZ	Guasave	gwaa-saa-ve
		Guaymas	gwhy-maahs
Bahia	ba-e-yuh		
Ballenas	ba-yaynas	Huatulco	whaa-tool-coe
Barahona	ba-ra-HO-na		
Barbados	bar-BAY-dohz	Islas	eeslas
Barbuda	bar-BOO-dah		
Barra	baa-rra	Jalisco	ha-lee-sco
Barranquilla	Bahr-rahn-KEE-yah	Juanico	whaa-nee-coe
Basse-Terre	baha-TER		
Bimini	BIM-I-ni	Lazaro	laasa-roe
Bonaire	ba-NAIR	Loreto	lo-ae-toe
Burros	bhoorroes	Leeward	LEE-werd
Cap Haitien	kahp ah-ee-SYAN	Manzanillo	manza-nee-oh
Caracas k	ah-RAH-kahs	Maracaibo	mar-a-KYE-boh
Cardenas	car-denaass	Maracay	mah-rah-KYE
Caribbean	kar-a-BE-an	Marigot	ma-ree-GOH
Castries	KAS-tree	Mateo	muh-ta-yo
Cayman	kay-MAHN	Mayaguez	may-yah-GWAYS
Champerico	chaam-per-e-coe	Medano	may-daa-no
Charlotte		Melaque	may-laa-kay
Colima	coleema	Merida	MAY-re-thah
Corrientes	cor-re-ehn-tays	Mochis	mo-chees
Cozumel	koh-soo-MEL	Montego	mon-TEE-go
Curacao	koor-a-SOH	Montserrat	mont-se-RAT
Cuyutlan	coo-yootlaan	Mugu	muhgu
		Mulege	moo-lay-hay
Dominica	dom-I-NEE-ka		
		Nicaragua	nik-a-RAH-gwah
Eleuthera	el-OO-thera		

Ocho Rios OH-cho REE-os  
Oranjestad o-RAHN-yuh-stat

Paramaribo par-a-MAR-I-boh  
Parguera par-GWER-a  
Penasco pen-yaas-co  
Pointe-a-Pitre pwan-ta-PEE-tr  
Ponce PON-sa  
Port-au-Prince port-oh-PRINS  
Punta poonta

Revillagigedo ray-veeaheehaydo

Saba SAH-ba  
Sao Miguel soun ME-gel  
Sipacate see-paa-caa-tay  
St Croix ST croy  
St Lucia ST LOO-she-a  
Soufriere soo-free-AR  
Surinam SOOR-I-nam

Tobago to-BAY-go  
Todos todohs  
Tomas tow-maas  
Tonala ton-aahla  
Tosca toesca

Vallartavah-yar-ta

Yavaros yaa-vaa-roce  
Yucatan yoo-ka-TAN

Zihuatanejo zeeh-whaa-tanay-ho

Tampico tam-PEE-ko  
Tehuantepec te-whaan-te-pec  
Tela TAY-lah



## APPENDIX K

### ACRONYMS/ABBREVIATIONS

#### -A-

AB	Data type header for Tropical Weather Outlook
AFB	Air Force Base
AFOS	Automation of Field Operations and Services
AFRC	Air Force Reserve Command
AFSATCOM	Air Force Satellite Communications System
AFWA	Air Force Weather Agency
AIM	Airman's Information Manual
AMOS	Automated Meteorological Observing Station
AMSU	Advanced Microwave Sounding Unit
AOC	Aircraft Operations Center (NOAA)
APT	Automatic Picture Transmission
ARGOS	Argos, Inc., a French data collection system
ARSA	Airport Radar Service Area
ARTCC	Air Route Traffic Control Center
ARWO	Aerial Reconnaissance Weather Officer
APUP	Associated Principal User Processor (WSR-88D)
ASDL	Aircraft-to-Satellite Data Link
ATC	Air Traffic Control
ATCSCC	Air Traffic Control System Command Center
<i>ATCT</i>	<i>Air Traffic Control Tower (FAA)</i>
AVAPS	Advanced Vertical Atmospheric Profiling System
AVHRR	Advanced Very High Resolution Radiometer
AWDS	Automated Weather Distribution System
AWIPS	Advanced Weather Interactive Processing System

#### -C-

CARCAH	Chief, Aerial Reconnaissance Coordination, All Hurricanes
CARF	Central Altitude Reservation Function
<i>CERAP</i>	<i>Center En Route Approach (FAA)</i>
CFW	Coastal Flood Watch/Warning
C.I.	Current Intensity
C-MAN	Coastal-Marine Automated Network
<i>CMC</i>	<i>Crisis Management Center (FAA)</i>
CNMI	Commonwealth of the Northern Mariana Islands
COM	Commercial (telephone)
CONUS	Continental United States
CPHC	Central Pacific Hurricane Center
°C	degree/degrees Celsius

**-D-**

DA	Daylight Ascending
DCS	Data Collection System
deg	degree (latitude or longitude)
Det	detachment
DMSP	Defense Meteorological Satellite Program
DOC	Department of Commerce
DOD	Department of Defense
DOT	Department of Transportation
DPTD	departed
DROP	dropsonde/dropwindsonde
DSN	Defense Switched Network (formerly AUTOVON)
DTG	date/time group

**-E-**

EDT	Eastern Daylight Time
ESA	European Space Agency
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure

**-F-**

FAA	Federal Aviation Administration
FACSFAC	Fleet Aerial Control and Surveillance Facility
FCM	Federal Coordinator for Meteorological Services and Supporting Research
FCMSSR	Federal Committee for Meteorological Services and Supporting Research
FCST	forecast
FCSTR	forecaster
<i>FEA</i>	<i>Flow Evaluation Area (FAA)</i>
FL	flight level
FLT LVL	flight level
FMH	Federal Meteorological Handbook
FNMOC	Fleet Numerical Meteorology and Oceanography Center (USN)
FSM	Federated States of Micronesia
ft	foot/feet
FTS	Federal Telephone System

**-G-**

GAC	Global Area Coverage
GOES	Geostationary Operational Environmental Satellite
GMDSS	Global Maritime Distress and Safety System
GMS	Geostationary Meteorological Satellite
GTS	Global Telecommunications System

**-H-**

HA	High Accuracy
HD	High Density
HDOB	High Density Observation
HF	High Frequency
hPa	hectopascal/hectopascals
h	hour/hours
HLS	Hurricane Local Statement
HNL	Honolulu (CPHC)
HPC	Hydrometeorological Prediction Center (NCEP)
HRD	Hurricane Research Division (NOAA/OAR/ERL/AOML)
HRPT	High Resolution Picture Transmission

**-I-**

ICAO	International Civil Aviation Organization
ICMSSR	Interdepartmental Committee for Meteorological Services and Supporting Research
ID	identification
IFR	Instrument Flight Rules
INIT	initials
<i>IOM</i>	<i>International Operations Manager (FAA)</i>
IR	Infrared
IWRS	Improved Weather Reconnaissance System

**-J-**

JTWC	Joint Typhoon Warning Center
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**-K-**

km	kilometer/kilometers
KBIX	ICAO identifier for Keesler AFB, MS
KMIA	ICAO identifier for Miami, FL
KMKC	ICAO identifier for Kansas City, MO WSFO
KNEW	ICAO identifier for New Orleans, LA WSFO
KNHC	ICAO identifier for the Tropical Prediction Center/National Hurricane Center, Miami, FL
KSFO	ICAO identifier for San Francisco, CA
kt	knot/knots
KWAL	ICAO identifier for Wallops Island, VA

**-L-**

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

**-M-**

m	meter/meters
MANOP	communications header
MAX	maximum
METEOSAT	European Space Agency geostationary meteorological satellite
<i>MIA</i>	<i>Minimum IFR Altitude</i>
min/MIN	minute
MHS	Microwave Humidity Sounder
MOU	Memorandum of Understanding
mph	mile/miles per hour
MTSAT-1R	Japanese Geostationary Satellite
MVMT	movement

-N-

NAPUP	Non-associated Principal User Processor (WSR-88D)
NASA	National Aeronautics and Space Administration
NAVLANTMETOCEN	Naval Atlantic Meteorology and Oceanography Center
NAVLANTMETOCDET	Naval Atlantic Meteorology and Oceanography Detachment
NAVLANTMETOCFAC	Naval Atlantic Meteorology and Oceanography Facility
NAVMETOCCOM	Naval Meteorology and Oceanography Command
NAVOCEANO	Naval Oceanographic Office
NAVPACMETOCEN	Naval Pacific Meteorology and Oceanography Center
NAVTRAMETOCFAC	Naval Training Meteorology and Oceanography Facility
NCEP	National Centers for Environmental Prediction (NOAA/NWS)
NCO	NCEP Central Operations
NDBC	National Data Buoy Center
NESDIS	National Environmental Satellite, Data, and Information Service
NFDC	National Flight Data notice to airman Center
NHC	National Hurricane Center
NHOP	National Hurricane Operations Plan
NLT	Not Later Than
nm	nautical miles
NOAA	National Oceanic and Atmospheric Administration
NOM	National Operations Manager (FAA)
<i>NOTAM</i>	<i>Notice to Airmen</i>
<i>NRL</i>	<i>Naval Research Laboratory</i>
NSC	NOAA Science Center
NSTL	National Space Technology Laboratories (NASA)
NWS	National Weather Service

-O-

OAC	Oceanic Aircraft Coordinator (USN)
OB	observation
OFCM	Office of the Federal Coordinator for Meteorological Services and Supporting Research
OPC	Ocean Prediction Center (NCEP)

OSDPD	Office of Satellite Data Processing and Distribution (NESDIS)
OSF	Operational Support Facility (WSR-88D)
OSS	Operations Support Squadron (USAF)

**-P-**

PA	Public Affairs
PANC	ICAO identifier for Anchorage, AK
PCN	Position Confidence Number
PHFO	ICAO identifier for Honolulu, HI
POD	Plan of the Day
POES	Polar-Orbiting Environmental Satellite
PRF	pulse repetition frequency (WSR-88D)

**-R-**

RECCO	Reconnaissance Code
RECON	reconnaissance
REQT	requested
ROC	Radar Operations Center
RPS	routine product set (WSR-88D)
RSMC	Regional/Specialized Meteorological Center (WMO)

**-S-**

SAB	Satellite Analysis Branch
SFC	surface
SFDF	Satellite Field Distribution Facility
SLP	Sea Level Pressure
SPC	Storm Prediction Center (NCEP)
SSM/I	Special Sensor Microwave Imager (DMSP)
SSM/IS	Special Sensor Microwave Imager Sounder
SSM/T	Special Sensor Microwave Temperature Sounder
SST	Sea Surface Temperature
<i>STMC</i>	<i>Supervisory Traffic Management Coordinator (FAA)</i>
SVD	Supplementary Vortex Data

**-T-**

TAFB	Tropical Analysis Forecast Branch (TPC)
TCA	Aviation Tropical Cyclone Advisory
TCD	Tropical Cyclone Discussion
TCE	Tropical Cyclone Position Estimate
TCP	Tropical Cyclone Public Advisory
TCPOD	Tropical Cyclone Plan of the Day
TD	Tropical Depression
TEMP	temperature
TEMP	temporary
TEMP DROP	Dropwindsonde Code

TF	Thermal Fine
TKO	takeoff
TMO	Traffic Management Officer in air route centers and towers
T-number	Tropical classification number
TOVS	TIROS-N Operational Vertical Sounder
TRMM	Tropical Rainfall Measurement Mission
TPC	Tropical Prediction Center
TS	Thermal Smooth
TWO	Tropical Weather Outlook

-U-

<i>UAS</i>	<i>Unmanned Aerial Systems</i>
UAV	Unmanned Aerial Vehicle
UCP	unit control position (WSR-88D)
UHF	Ultra High Frequency
US/U.S.	United States
USAF	United States Air Force
USCG	United States Coast Guard
USN	United States Navy
UTC	Universal Coordinated Time

-V-

VAS	VISSR Atmospheric Sounder
VCP	volume coverage pattern (WSR-88D)
VDM	Vortex Data Message
VDUC	VAS Data Utilization Center
VIS	Visible
<i>VIIRS</i>	<i>Visible Infrared Imaging Radiometer</i>
VISSR	Visible and Infrared Spin Scan Radiometer
VMI	velocity measurement increment (WSR-88D)
VTPR	Vertical Temperature Profile Radiometer

-W-

WEFAX	Weather Facsimile
WESTPAC	Western Pacific
WFO	Weather Forecast Office
WMO	World Meteorological Organization
WND	wind
WO	Data type header for special tropical disturbance statements
WPMDS	Weather Product Management and Distribution System (Offutt AFB)
WRS	Weather Reconnaissance Squadron
WS	Weather Squadron
WSD	Wind Speed and Direction (data buoy)
WSR-88D	Weather Surveillance Radar-1988 Doppler
WT	Data type header for hurricane bulletins

WW Data type header for subtropical storm bulletins

**-X-**

XMTD transmitted

**-Z-**

Z Zulu (UTC)

## APPENDIX L

### GLOSSARY

#### -A-

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

**Airport Radar Service Area (ARSA).** Regulatory airspace surrounding designated airports wherein ATC provides radar vectoring and sequencing on a full-time basis for all IFR and VFR aircraft. The service provided in an ARSA is called ARSA Service which includes: IFR/IFR-standard IFR separation; IFR/VFR-traffic advisories and conflict resolution; and VFR/VFR-traffic advisories and, as appropriate, safety alert. The Airman's Information Manual (AIM) contains an explanation of ARSA. The ARSA's are depicted on VFR aeronautical charts.

**Air Traffic Control System Command Center (ATCSCC).** The facility responsible for the real-time command, control, and oversight of air traffic activity within the National Airspace System. The ATCSCC is a 24 hour a day, 7 day a week operation.

**Area Manager.** Supervisor in charge of air route traffic control center or airport tower, shift to shift.

#### -C-

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

**Controlled Airspace.** An airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification.

- a. Controlled airspace is a generic term that covers Class A, Class B, Class C, Class D, and Class E airspace.
- b. Controlled airspace is also that airspace within which all aircraft operators are subject to certain pilot qualifications, operating rules, and equipment requirements in FAR Part 91 (for specific operating requirements, please refer to FAR Part 91). For IFR operations in any class of controlled airspace, a pilot must file an IFR flight plan and receive an appropriate ATC clearance. Each Class B, Class C, and Class D airspace area designated for an airport contains at least one primary airport around which the airspace is designated (for specific designations and descriptions of the airspace classes, please refer to FAR Part 71).



- c. Controlled airspace in the United States is designated as follows:

**CLASS A:** Generally, that airspace from 18,000 feet MSL up to and including FL 600, including the airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska. Unless otherwise authorized, all persons must operate their aircraft under IFR.

**CLASS B:** Generally, that airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports in terms of airport operations or passenger enplanements. The configuration of each Class B airspace area is individually tailored and consists of a surface area and two or more layers (some Class B airspace areas resemble upside-down wedding cakes), and is designed to contain all published instrument procedures once an aircraft enters the airspace. An ATC clearance is required for all aircraft to operate in the area, and all aircraft that are so cleared receive separation services within the airspace. The cloud clearance requirement for VFR operations is "clear of clouds."

**CLASS C:** Generally, that airspace from the surface to 4,000 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower, are serviced by a radar approach control, and that have a certain number of IFR operations or passenger enplanements. Although the configuration of each Class C area is individually tailored, the airspace usually consists of a surface area with a 5 nautical mile (NM) radius, an outer circle with a 10 NM radius that extends from 1,200 feet to 4,000 feet above the airport elevation and an outer area. Each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while within the airspace. VFR aircraft are only separated from IFR aircraft within the airspace. (See OUTER AREA).

**CLASS D:** Generally, that airspace from the surface to 2,500 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower. The configuration of each Class D airspace area is individually tailored and when instrument procedures are published, the airspace will normally be designed to contain the procedures. Arrival extensions for instrument approach procedures may be Class D or Class E airspace. Unless otherwise authorized, each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while in the airspace. No separation services are provided to VFR aircraft.

**CLASS E:** Generally, if the airspace is not Class A, Class B, Class C, or Class D, and it is controlled airspace, it is Class E airspace. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be configured to contain all instrument procedures. Also in this class are Federal airways, airspace beginning at either 700 or 1,200 AGL used to transition to/from the terminal or en route environment, en route domestic, and offshore airspace areas designated below 18,000 feet MSL.

Unless designated at a lower altitude, Class E airspace begins at 14,500 MSL over the United States, including that airspace overlying the waters within 12 nautical miles of the 48 contiguous States and Alaska, up to, but not including 18,000 MSL, and the airspace above FL 600.

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

**-E-**

**Extratropical cyclone.** A synoptic scale low pressure system whose primary energy source is baroclinic.

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

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

**-H-**

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

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

**Hurricane/Typhoon/Tropical Cyclone Season.** The portion of the year having a relatively high incidence of hurricanes/typhoons/tropical cyclones. The seasons for the specific areas are as follows (Note: tropical cyclones can occur during any month of the year in the Western Pacific.):

- |  |                       |
|--|-----------------------|
| ○ Atlantic, Caribbean,<br>and the Gulf of Mexico | June 1 to November 30 |
| ○ Eastern Pacific                                | May 15 to November 30 |
| ○ Central Pacific                                | June 1 to November 30 |
| ○ Western Pacific                                | July 1 to December 31 |

**Hurricane Warning Offices.** The designated hurricane warning offices follow:

- Tropical Prediction Center/National Hurricane Center, Miami, Florida
- Central Pacific Hurricane Center, Honolulu, Hawaii

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

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

**-I-**

**ICAO-Controlled Airspace.** An airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification. *(Note: Controlled airspace is a generic term which covers Air Traffic Service airspace Classes A, B, C, D, and E).*

**-M-**

**Major Hurricane.** A "major" hurricane is one that is classified as a Category 3 or higher.

**Maximum 1-Min Sustained Surface Wind.** When applied to a particular weather system, refers to the highest 1-minute average wind (at an elevation on 10 meters with an unobstructed exposure) associated with that weather system at a particular point in time.

**Micronesia.** An area defined by the Commonwealth of the Northern Marianas Islands, the Republic of Palau, the Federated States of Micronesia, and the Republic of the Marshall Islands.

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

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

**-N-**

**National Operations Manager.** Supervisor in charge of the overall operation of the Air Traffic Control System Command Center.

**-P-**

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

**-R-**

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

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

**-S-**

**Storm Surge.** An abnormal rise in sea level accompanying a hurricane or other intense storm, and whose height is the difference between the observed level of the sea surface and the level that would have occurred in the absence of the cyclone. Storm surge is usually estimated by subtracting the normal or astronomic tide from the observed storm tide.

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

**Subtropical Cyclone.** A non-frontal low pressure system that has characteristics of both tropical and extratropical cyclones. This system is typically an upper-level 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 center. In comparison to tropical cyclones, such systems have a relatively broad zone of maximum winds that is located farther from the center, and typically have a less symmetric wind field and distribution of convection.

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

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

**Super Typhoon.** A "super" typhoon is one that is classified as having winds of 130 knots (150 mph) or greater.

**Sustained Surface Wind.** The 1-minute averaged wind at the 10-meter elevation with an unobstructed exposure.

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

-T-

**Traffic Management Specialist.** ATCSCC personnel responsible for the active management of traffic throughout the National Airspace System.

**Tropical Cyclone.** A warm-core, non-frontal synoptic-scale cyclone, originating over tropical or subtropical waters, with organized deep convection and a closed surface wind circulation about a well-defined center.

**Tropical Cyclone Plan of the Day.** A coordinated mission plan that tasks operational weather reconnaissance requirements during the next 1100 to 1100Z UTC day or as required, describes reconnaissance flights committed to satisfy both operational and research requirements, and identifies possible reconnaissance requirements for the succeeding 24-hour period.

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

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

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

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

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

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

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

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

**-U-**

**Uncontrolled Airspace (Class G Airspace).** That portion of the airspace that has not been designated as Class A, Class B, Class C, Class D, or Class E and within which Air Traffic Control has neither the authority nor the responsibility for exercising control over air traffic.

**-V-**

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

**-W-**

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



## APPENDIX M

### DISTRIBUTION

#### DEPARTMENT OF COMMERCE

#### NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Administration Office, Aircraft Operations Center (AOC)	20
Assistant Administrator for Satellite and Information Services (E)	2
Director, National Climatic Data Center (E/CC)	2
Chief, Library and Information Services Division (E/OC4)	4
Chief, Satellite Services Division (E/SP2)	1
Chief, Library Division MASC (MC5)	2
Assistant Administrator for Ocean Svcs and Coastal Zone Management (N)	1
Director, Office of Public Affairs, NOAA (PA)	2
Assistant Administrator for Oceanic and Atmospheric Research (R)	1
Director, Environmental Research Laboratories (R/E/FS)	4
Chief, International Programs (R/E/FS7)	2
Director, AOML Hurricane Research Division (R/E/AO)	5
Director, Program Development and Coordination Staff (R/PDC)	2
Assistant Administrator for Weather (W)	1
Director, National Data Buoy Center (W/DB)	6
Director, National Centers for Environmental Prediction (W/NP)	1
Director, Central Operations (W/NP1)	2
Director, Environmental Modeling Center (W/NP2)	1
Deputy Director, Environmental Modeling Center (W/NP2x1)	1
Director, Hydrometeorological Prediction Center (W/NP3)	2
Director, Marine Prediction Center (W/NP4)	2
Director, Tropical Prediction Center (W/NP8)	20
Director, Office of Hydrology (W/OH)	1
Director, Office of Meteorology (W/OM)	1
Chief, International Activities Division (W/IA)	1
Chief, Hydrometeorological Services Core (W/OM12)	20
Director, NWS Eastern Region (W/ER)	50
Director, NWS Central Region (W/CR)	16
Director, NWS Southern Region (W/SR)	56
Director, NWS Western Region (W/WR)	15
Director, NWS Pacific Region (W/PR)	15
NOAA Budget Officer, Office of Management and Budget	1



DEPARTMENT OF DEFENSE

OFFICE OF THE JOINT CHIEFS OF STAFF

Joint Staff/J3/DDGO-ROD 2

UNIFIED/SPECIFIED COMMANDS

USCENTCOM/CCJ3-OW	1
USCINCPAC/J316 (ENV.GP)	1
USCINCSO/SCJ3-SWO	1
USEUCOM/EPOC-CCPD	
USJFCOM	1
USSOCOM/SCSO-OC-M	1
USSOUTHCOM/SCJ322	1
USSTRATCOM/J3624	2
USTRANSCOM/TCJ3	1

DEPARTMENT OF THE AIR FORCE

HQ USAF/A3O-W	3
HQ ACC/DOW	34
HQ AFMC/DOW	2
HQ AFSPC/XOSW	5
HQ AFSOC/DOW	1
HQ AMC/A3W	10
HQ AOC/XPPD	1
HQ AETC/TTO	2
HQ AETC/DOYW	10
HQ AU/WE	1
HQ AFWA/XO	6
HQ PACAF/DOW	6
HQ USAFE/DOW	2
AFRL/VSB (AFMC)	1
AFCCC (AFWA)	1
AFCWC (AFWA)	1
ANG/XOOSW	1
MSD/AOW (AETC)	1
OO-ALC/LHW	2
3 WS/CC	1
17 OWS/CC	1
18 WS/CC	1
25 OWS/CC	2
26 OWS/CC	2

28 OWS/CC	2
36 OSS/OSW (PACAF)	1
45 WS/CC	3
45 SPW/XP and SE	4
46 WS/CC	2
88 WS/CC	1
78 OSS/OSW	1
325 OSS/OSW	1
335 TRS/UAO	2
607 WS/CC	1

#### AFRC

HQ USAF/REO	3
HQ AFRC/DOO	2
HQ AFRC/DOT/DOTA	2
HQ AFRC/DOVA	2
HQ 22AF/DOT/DOTA	2
403 WG/DO/XP	5
53 WRS	75
CARCAH (OL-A 53 WRS)	10

#### DEPARTMENT OF THE ARMY

HQ Department of the Army/DAMI- POB	2
Topographic Engineering Center	1
COE/CEWES-CD-P	1

#### DEPARTMENT OF THE NAVY

Commandant of the Marine Corps (DCS/Aviation)	12
Oceanographer of the Navy	2
NAVMETOCCOM	5
Commanding Officer, NAVOCEANO (N2513)	75
Commanding Officer, NAVLANTMETOCCEN	2
NAVPACMETOCCEN/JTWC, Pearl Harbor, HI	2
NAVLANTMETOCFAC Jacksonville	1
NAVTRAMETOCFAC Pensacola	1
CINCLANTFLT (N37)	2
CINCPACFLT (N3WX)	1
COMTHIRDFLT	1
COMFITMATAEWINGLANT, NAS Oceana, VA	1
Commander, Naval Air Warfare Center, Weapons Division	2
Office of Naval Research (Code 1122MM)	2
NRL, Stennis Space Center, MS	1
NRL, Atmospheric Division, Monterey, CA	2
OPTEVFOR (Code 314)	1

Coastal System Station (Code 05W)	1
AFWTF, Roosevelt Roads, PR	1

DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

Air Traffic System Requirements Service ARS-1	1
Air Traffic System Requirements Service/Weather ARW-1	1
Air Traffic Operations ATO-1	3
Air Traffic Operations ATO-110	1
Air Traffic Operations ATO-120	3
Air Traffic Resource Management Program ATX-100/ATX-400	2
Air Traffic Control System Command Center (ATCSCC) ATO-200	9
FAA Regional Air Traffic Division Managers	
AAL-500 Anchorage	1
ACE-500 Kansas City	1
AEA-500 New York	1
AGL-500 Chicago	1
ANE-500 Boston	1
ANM-500 Seattle	1
ASO-500 Atlanta	1
ASW-500 Dallas/Fort Worth	1
AWP-500 Los Angeles	1
Albuquerque ARTCC	2
Atlanta ARTCC	3
Boston ARTCC	3
Honolulu ARTCC	3
Houston ARTCC	3
Jacksonville ARTCC	3
Los Angeles ARTCC	2
Memphis ARTCC	1
Miami ARTCC	3
New York ARTCC	3
Oakland ARTCC	2
San Juan ARTCC	3
Seattle ARTCC	2
Washington ARTCC	2
AMA-500, Oklahoma City, OK	1
AIA-100/AIA-200	3
AOP-4	1
APA-300	3
ARW-100/ARW-200	2
Houston AIFSS	3
Miami (QAS) AIFSS	2
New York AIFSS	1
San Juan AIFSS	2

## U.S. COAST GUARD

Commandant, USCG Headquarters (G-OPN-1)	2
Commandant, USCG (G-OPF)	1
Commander, Atlantic Area, USCG	2
Commander, Pacific Area, USCG	2
Commander, Maintenance and Logistics Command Atlantic	2
Commander, Maintenance and Logistics Command Pacific	1
Commander, First Coast Guard District	1
Commander, Fifth Coast Guard District	2
Commander, Seventh Coast Guard District	3
Commander, Eighth Coast Guard District	3
Commander, Ninth Coast Guard District	1
Commander, Eleventh Coast Guard District	1
Commander, Thirteenth Coast Guard District	1
Commander, Fourteenth Coast Guard District	2
Commander, Seventeenth Coast Guard District	1
Commanding Officer, USCG Air Station, Aquadilla, PR	1
Commanding Officer, USCG Air Station, Atlantic City, NJ	1
Commanding Officer, USCG Air Station, Cape Cod, MA	1
Commanding Officer, USCG Air Station, Clearwater, FL	1
Commanding Officer, USCG Air Station, Corpus Christi, TX	1
Commanding Officer, USCG Air Station, Elizabeth City, NC	1
Commanding Officer, USCG Air Station, Houston, TX	1
Commanding Officer, USCG Air Station, Kapolei, HI	1
Commanding Officer, USCG Air Station, Kodiak, AK	1
Commanding Officer, USCG Air Station, Los Angeles, CA	1
Commanding Officer, USCG Air Station, McClellan AFB, CA	1
Commanding Officer, USCG Air Station, McKinleyville, CA	1
Commanding Officer, USCG Air Station, Mt. Clemens, MI	1
Commanding Officer, USCG Air Station, New Orleans, LA	1
Commanding Officer, USCG Air Station, North Bend, OR	1
Commanding Officer, USCG Air Station, Opa Locka, FL	1
Commanding Officer, USCG Air Station, Port Angeles, WA	1
Commanding Officer, USCG Air Station, San Diego, CA	1
Commanding Officer, USCG Air Station, San Francisco, CA	1
Commanding Officer, USCG Air Station, Savannah, GA	1
Commanding Officer, USCG Air Station, Sitka, AK	1
Commanding Officer, USCG Air Station, Traverse City, MI	1
Commanding Officer, USCG Air Station, Warrenton, OR	1
Commanding Officer, USCG Reserve Training Center	1

## DEPARTMENT OF AGRICULTURE

World Agriculture Outlook Board	1
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DEPARTMENT OF ENERGY

Office of Emergency Management 1  
Office of Biological and Environmental Research 1

DEPARTMENT OF INTERIOR

Bureau of Reclamation, Office of Liaison Engineering and Research 1

DEPARTMENT OF STATE

Office of Advanced Technology 1

NATIONAL SCIENCE FOUNDATION

Director, Meteorology Program 1  
Director, Atmospheric Sciences Division 1

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Goddard Space Flight Center, Code 912 1  
Director, Atmospheric Sciences Division 1

DEPARTMENT OF HOMELAND SECURITY/  
FEDERAL EMERGENCY MANAGEMENT AGENCY

FEMA, Mitigation Directorate 2  
FEMA Region I 1  
FEMA Region IV 2  
FEMA Region IX 20

OTHER U.S.

Congressional Research Service, Library of Congress 1  
University of Chicago Library, The Joseph Regenstein Library 1  
South Florida Water Management District 1  
Natural Hazards Research and Applications Information Center 1  
Department of Atmospheric Sciences, Colorado State University 1  
Cumberland County Maine Emergency Management Agency 1  
Meteorological Services, Inc., Tampa, FL 3  
GTE Government Systems 1  
Larkin Associates 1  
Nash C. Roberts, Jr. Consultants, New Orleans, LA 1  
Hurricane and Weather Specialists, Inc., Valrico, FL 1

GOVERNMENT OF CANADA

Meteorological Operations Division, Canadian Meteorological Centre (AES), Dorval, QU	1
Officer in Charge, METOC Centre, Maritime Command Headquarters, Halifax, NS	1
Base Meteorological Officer, CFB Greenwood, NS	1
Atmospheric Environment Service, Downsview, ON	1
Transport Canada, Altitude Reservation Unit	2
Transport Canada, Monkton ACC	2

UNITED KINGDOM

Assistant Director, Head of Defense Services, Meteorological Office	1
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MICRONESIA

Department of Homeland Security/Office of Civil Defense, Guam	2
Emergency Management Offices:	
- Commonwealth of the Northern Mariana Islands (CNMI), Saipan	1
- Republic of Palau, Koror	1
- Republic of the Marshall Islands, Majuro	1
- Federated States of Micronesia (FSM), Pohnpei State, Kolonia	1
- Federated States of Micronesia (FSM), Yap State, Colonia	1
- Federated States of Micronesia (FSM), Chuuk State, Weno Island	1
- Federated States of Micronesia (FSM), Kosrae State, Tofol	1

