NATIONAL POST-STORM DATA ACQUISITION PLAN

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Office of the Federal Coordinator for Meteorological Services
and Supporting Research

Front Cover Photo Credit
Jackson County Alabama tornado outbreak, 6 February 2008, EF-4 intensity with estimated peak wind of 180mph. (Courtesy of NOAA, http://www.srh.noaa.gov/hun/stormsurveys/2008-02-06/jackson.php)

Federal Committee for Meteorological Services
and Supporting Research (FCMSSR)

Interdepartmental Committee for Meteorological Services
and Supporting Research (ICMSSR)

Committee for Environmental Services, Operations and Research Needs (CESORN)

Working Group for Natural Disaster Reduction and Post-Storm Data Acquisition
(WG/NDR/PSDA)

NATIONAL POST-STORM DATA ACQUISITION PLAN

Office of the Federal Coordinator for
Meteorological Services and Supporting Research

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FOREWORD

This publication is the 2nd edition of the National Post-Storm Data Acquisition Plan (NPSDAP). It is a compilation of procedures and agreements reached through efforts of the Working Group for Natural Disaster Reduction and Post-Storm Data Acquisition (WG/NDR/PSDA). The WG/NDR/PSDA brings together the cognizant federal agencies on items of mutual interest and concern related to the acquisition and preservation of perishable environmental data following a significant storm, flood, tornado, or tsunami event.

The NPSDAP describes the mechanisms and procedures for coordinating the environmental data acquisition activities of participating federal agencies following a significant event. The intent of the NPSDAP is to provide a description of the types of data required or desired by the participating agencies and the means used to coordinate the various data acquisition activities. It is not the goal of the NPSDAP to prescribe the data acquisition activities of participating agencies, but instead to coordinate those agency activities already required by existing mission directives. The procedures outlined herein will no doubt be revised and refined as experience is gained in their application.

The effectiveness of the NPSDAP begins with the participation and dedication of the agency representatives assigned as members of the WG/NDR/PSDA. It is their willingness to accept personal responsibility to be available at what are typically stressful and inconvenient times and function as the primary liaison for their agency that permits that agency to perform its task most efficiently.

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

EXECUTIVE SUMMARY

The impetus for development of a national plan to coordinate the acquisition of post-storm data stemmed from a recognition by elements of several federal agencies that they were performing complementary and, in some cases, duplicate tasks while acquiring environmental data following significant storm events. These agencies desired to improve and leverage use of their individual resources by a collective response to the data acquisition task.

A series of informal meetings were held where the data acquisition capabilities and requirements of the interested agencies were identified, and a number of recommendations resulted. The National Post-Storm Data Acquisition Plan (NPSDAP) addresses one set of principal recommendations by documenting: the types of data required, the acquisition processes, and the coordinating procedures to be used leading up to and following a significant storm event. The Plan serves as a framework for both coordination of data acquisition activities of the participating agencies during a significant event, and the documentation and deposition of data and products following that event. Funding for the activities of the participating agencies is provided primarily by the individual agency's parent organization or through the Department of Homeland Security in support of one or more of the Emergency Support Functions (ESFs) found in the National Response Framework (NRF).

Environmental events addressed in the NPSDAP include landfalling tropical cyclones (hurricanes/typhoons and tropical storms), coastal extratropical storms (Nor'easters), severe convective outbreaks (tornadoes and windstorms), riverine and flash flooding, and tsunamis (tidal waves). The plan includes data requirements and acquisition capabilities of participating agencies, event response initiation criteria, coordination procedures, agency points of contact, and data archival procedures. Agency response to a particular event is the responsibility of the individual agency according to its mission requirements, data needs, and available resources.

The NPSDAP is a dynamic document. The contributors to its development anticipate and expect that the NPSDAP will evolve over time to reflect changes in the missions and resources of the interested agencies, the addition of types of hazards included in the plan, and the effects of evolving technologies.

As the body of data acquired by the participating agencies and associated event documentation grows, preparation of event and actuarial statistics becomes feasible. The responsibility and methodology for preparation of these statistics could become elements of future versions of the NPSDAP. Such statistics should prove useful to private sector institutions, such as the insurance industry, as well as other federal agencies.

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1 INTRODUCTION AND BACKGROUND

1.1 General

Failure can be informative. When powerful storms and major floods damage or destroy American communities and infrastructure we can learn from the experience. That learning can lead to more accurate forecasts; better designed building, transportation, and communication systems; more robust response and recovery mechanisms; and more effective land use planning. But a key piece of such learning involves close technical observation and measurement of the factors that characterize the event and its impacts on the communities, infrastructure, and environment. Making those observations and measurements requires a timely and well-coordinated deployment of engineers, scientists, technicians, and equipment into impacted areas. The National Post-Storm Data Acquisition Plan (NPSDAP) establishes a planning template that addresses this need.

The impetus for the development of a national plan to coordinate the activities of federal agencies involved in post-event data acquisition grew from a charge by the president of the Coastal Engineering Research Board, United States (U.S.) Army Corps of Engineers (USACE), following the ad hoc coordination by several federal agencies in the aftermath of Hurricane Hugo of September 1989. The charge directed that means be explored and, if feasible, a plan be prepared and implemented that would establish procedures for coordinating the activities of federal agencies involved in post-storm data acquisition. In March 1992, the Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM)'s Interdepartmental Committee for Meteorological Services and Supporting Research approved the formation of the Working Group for Post-Storm Data Acquisition, more recently renamed the Working Group for Natural Disaster Reduction and Post-Storm Data Acquisition (WG/NDR/PSDA). The first meeting of the working group was held in September 1992.

The motivation for development of a national plan was threefold. The first was to minimize or eliminate the duplication of effort by agencies performing post-event data acquisition. The minimization or elimination of duplicate efforts is directed toward best using the limited resources available to perform these surveys. The second was to assure these highly perishable data are indeed collected, and collected with the degree of accuracy required by all data users. It is generally acknowledged that the acquisition of these data is urgent; that the physical effects which depict the event are transient and can begin to change or be obliterated immediately after the event. The third was to define the coordination procedures of the agencies participating in the acquisition of post-storm environmental data, to collaborate data sharing and ensure a means for data archival and future retrieval are established.

1.2 Scope

The procedures outlined herein apply to the conterminous 48 states, Alaska, Hawaii, the Commonwealth of Puerto Rico, and the Virgin Islands, Guam, American Somoa, and the Confederation of Northern Marianna Islands. This plan defines the roles and coordinating procedures of the agencies participating in the acquisition of post-storm environmental data. When only a single agency is involved in a post-storm response, that agency should follow procedures specified in its internal documents, but those practices should be consistent with those contained herein as possible. It is recognized that many federal missions are undertaken in the overall response and recovery process that follows a significant storm event. The intent of this plan is to address an important, though limited, aspect of this response process.

Environmental events addressed in the NPSDAP include landfalling tropical cyclones (hurricanes/typhoons and tropical storms), coastal extratropical storms (Nor'easters), severe convective outbreaks (tornadoes and windstorms), riverine and flash flooding, and tsunamis (tidal waves). The plan includes data requirements and acquisition capabilities of the participating agencies, event response initiation criteria, coordination procedures, agency points of contact, and data deposition procedures.

While the original NPSDAP addressed only post-storm activities, new technologies have ushered in opportunities to pre-deploy, densify and harden observation systems providing the capability to collect and disseminate real-time data of relevance to those who forecast the events and manage Federal, State, and local response and recovery. As with previous versions of the NPSDAP, these data support those agencies that characterize the actual event to improve scientific understanding and modeling capabilities. As a result of adding real-time data, this plan supports almost all of the Emergency Support Functions (ESFs) outlined in the National Response Framework in either a real-time or long-term application. For each ESF there is an ESF Coordinator at the FEMA National Response Coordination Center (NRCC) during exercises and real world events. The NRCC critical phone list located in Appendix J provides contact numbers for each ESF coordinator should one of the NPSDAP agencies need some assistance. A description of the support provided by the NPSDAP to ESFs is outlined in Table 1.

Table 1-1 NPSDAP Support to ESFs

ESF	Real-time Support to ESFs	Long-term Support to ESFs
ESF #1 – Transportation	NPSDAP pre-storm deployments could yield on-site wind and flooding data needed to refine road and bridge conditions and aide routing of evacuations and relief supplies before, during, and after, the events.	NPSDAP will yield wind speed, direction, and damage data and high-water elevation and flooding data needed to characterize event strength and frequency and infrastructure performance. Such information could lead to more robust transportation systems and better models of system performance during severe weather.
ESF #2 – Communications		NPSDAP information can be used to prevent placement of communications equipment in flood areas and can be used to understand the environmental impacts on communications equipment.

Table 1-1 (Continued) NPSDAP Support to ESFs

ESF	Real-time Support to ESFs	Long-term Support to ESFs
ESF #3 – Public Works and Engineering	NPSDAP real-time instrumentation could provide data that would improve estimates of infrastructure damage, due to winds, waves and highwater/surge.	NPSDAP could improve characterization of wind speed, durations and damage and flood extent, depth, and volume and led to improve infrastructure and damage estimation models. The data also provides the means for development of more accurate and risk consistent building codes and standards than currently exist
ESF #4 – Firefighting	NOT SUPPORTED BY NPSDAP	NOT SUPPORTED BY NPSDAP
ESF #5 – Emergency Management	NPSDAP pre-storm deployments could yield on-site wind, waves and flooding/surge/water-level data needed to estimate the spatial extent and severity of storm impacts throughout the event.	NSSDAP data could yield better models for predicting damages from storms.
ESF #6 – Mass Care, Emergency Assistance, Housing, and Human Services	NPSDAP real-time data could be used for planning the location of and timing for set up of ESF #6 facilities.	NSSDAP data could provide Preparedness and Mitigation Planning to reduce or prevent future damage by similar events
ESF #7 – Logistics Management and Resource Support	The real-time information collected and disseminated by the NPSDAP directly supports comprehensive, national incident logistics planning, management, and sustainment capability	
ESF #8 – Public Health and Medical Services	NOT SUPPORTED BY NPSDAP	NOT SUPPORTED BY NPSDAP
ESF #9 – Search and Rescue	The real-time information collected and disseminated by the NPSDAP directly supports life-saving assistance, search and rescue operations	
ESF #10 – Oil and Hazardous Materials Response	Water-level and wind speed and direction data collected and disseminated by the NPSDAP directly supports oil and hazardous materials (chemical, biological, radiological, etc.) response and environmental short- and long-term cleanup.	

Table 1-1 (Continued) NPSDAP Support to ESFs

ESF	Real-time Support to ESFs	Long-term Support to ESFs
ESF #11 – Agriculture and Natural Resources		The information collected and disseminated by the NPSDAP directly supports natural and cultural resources and historic properties protection and restoration.
ESF #12 – Energy		NPSDAP will yield wind speed, direction, and damage data and high-water elevation and flooding data needed to characterize event strength and frequency and infrastructure performance. Such information could lead to more robust energy systems and better models of system performance during severe weather.
ESF #13 – Public Safety and Security	The information collected and disseminated by the NPSDAP directly supports public safety and security support as well as support to access, evacuation, traffic, and crowd control.	Development of hazard resilient infrastructure via direct measurement of severe hazard loads directly supports public safety and security during and after events
ESF #14 – Long-Term Community Recovery		The information collected and disseminated by the NPSDAP directly supports social and economic community impact assessments, long-term community recovery assistance to States, local governments, and the private sector as well as analysis and review of mitigation program implementation.
ESF #15 – External Affairs	The information collected and disseminated by the NPSDAP directly supports emergency public information and protective action guidance, media and community relations, Congressional and international affairs as well as tribal and insular affairs.	The information collected and disseminated by the NPSDAP directly supports emergency public information and protective action guidance, media and community relations, Congressional and international affairs as well as tribal and insular affairs.

1.3 Examples of Past Data Acquisition Responses

1.3.1 Hurricane Hugo

Hurricane Hugo made landfall on the United States mainland near Charleston, South Carolina, late on 21 September 1989. The U. S. Geological Survey (USGS) District Chief approached the USACE to cooperate in an aerial photoreconnaissance effort of the affected reach of shoreline. The National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) performed an extensive review of its operations during the event. An informal agreement was reached whereby the USGS would assume responsibility for leveling water marks identified by both USACE and USGS field teams, and the USACE would assume responsibility for acquiring aerial photo reconnaissance in a format acceptable to both agencies.

Over 350 high-water marks were identified and leveled, and over 250 controlled aerial photos covering approximately 150 miles of coastline (from Little River Inlet to Edisto Island, South

Carolina) were surveyed as a result of the ad hoc agreement between USACE and USGS. Subsequent to acquisition of these data, the Federal Emergency Management Agency (FEMA) partially reimbursed the USGS for its efforts. Both USGS and USACE published reports based upon the inundation data and aerial imagery. In an independent effort, the NWS performed an extensive review of its operations during the event and conducted a visual damage survey via aircraft.

1.3.2 Hurricane Andrew

Hurricane Andrew made first landfall on the continental United States near Homestead, Florida, early on the morning of 24 August 1992 and second landfall near Morgan City, Louisiana, on 26 August 1992. Three agencies were active in the Florida post-event survey; USACE, USGS, and the Florida Department of Natural Resources, a state agency.

As in Hugo, FEMA mission-assigned the USGS for the post-storm Andrew efforts. The USACE, primarily through the efforts of the Jacksonville District with assistance from the Waterways Experiment Station, performed extensive surveys of federal projects along the east and southwest coasts of Florida. The Florida Department of Natural Resources acquired low-level videotape imagery of the Florida east coast from Palm Beach to Key Biscayne and also performed some high-water surveys. All agencies published reports on their respective findings.

1.3.3 Hurricane Katrina

Hurricane Katrina destroyed or damaged extensive areas of coastal Louisiana, Mississippi, and parts of Alabama. Dozens of USGS, NOAA, and USACE river, tide gages, offshore buoys and meteorological observing systems were destroyed, many of which ceased reporting well before the storm crest. The loss of these systems hampered the assessment of flood, wind, and wave damage; complicated the forecasting of near-term flood and surge conditions; hindered the management of operations to dewater New Orleans; and frustrated the post-storm evaluation of levee performance and evaluation of coastal impacts due to waves and surge. As a result, the preservation of high-water mark data took on a heightened importance in the delineation of flood impact areas for insurance settlement, and the determination of advisory base flood elevations needed for reconstruction. In the aftermath of the storm, FEMA, USGS, and USACE collaborated on an extensive program to preserve high-water marks and map flood-impact areas but the efforts were not closely coordinated. While more than 1,000 highwater marks were eventually flagged and leveled, the work was undertaken in a patchwork process that evolved through personal contact and individual effort. As a result some data collection efforts were poorly integrated, delayed or incomplete and the quality of some of the data suffered because of miscommunications and inconsistent collection methods.

The lack of bathymetric survey data offshore of the MS mainland coast, MS Sound, and offshore of the MS barrier islands hindered post-storm studies to evaluate impacts and the evaluation of impacts due to potential future storms.

Research teams from the University of Florida and Texas Tech University deployed portable hardened wind observing stations prior to landfall, providing the only source of reliable high resolution overland ground level wind speed / direction data throughout the storm. Portions of this dataset were transmitted in real-time to the NWS and NOAA's Hurricane Research Division (HRD) to aid in intensity forecasts. Research teams coordinated with NOAA for placement of the portable systems. The teams on the ground retrieved immediately perishable structural performance data in the process of retrieving the equipment. Overland ground level wind measurement assets have been deployed in this manner since 1999 through university wind research programs, including deployment in over 20 hurricanes and tropical storms.

1.4 Goals

The goals of the National Post-Storm Data Acquisition Plan (NPSDAP) expand upon the objectives contained in the Terms of Reference document for the WG/NDR/PSDA and include:

a. Identifying the requirements, resources, and capabilities of the participating agencies;

b. Developing procedures for coordinating agency activities during and following storm events;

c. Developing mechanisms for aggregating and sharing resources among the participating agencies; and

d. Preparing summaries of event documentation and data acquired under the NPSDAP.

As experience is gained in responding to events and procedures become more refined and efficient, resources available outside the participating agencies should be identified and arrangements made to access these resources. Examples of such resources include aircraft for transport of personnel and for aerial photo-reconnaissance, expertise residing in academic institutions for field assessment and interpretation of storm effects and damage, and data acquired during scientific field experiments involving the same or similar storm events.

2 AUTHORITY AND CAPABILITIES OF PARTICIPATING FEDERAL AGENCIES

2.1 General

The Department of Commerce through the OFCM assumes overall responsibility for the preparation and maintenance of the NPSDAP. The OFCM also assumes overall responsibility for post-event federal agency coordination. The role each agency assumes during the post-event period is determined by the individual agency's authority and mission requirements; see sections 2.2 and 2.3 for additional information on agency authorities and mission requirements. Specific agency authority and mission statements are contained in Appendix A.

2.2 Participating Agencies

The following federal departments are participants in the coordination plan, to include the specified individual agencies within the departments:

- Department of Defense (DOD) - U.S. Army Corps of Engineers (USACE), U.S. Air Force (USAF), Civil Air Patrol (CAP)-USAF Auxiliary.
- Department of Commerce (DOC) - National Oceanic and Atmospheric Administration (NOAA), National Institute of Standards and Technology (NIST).
- Department of Interior (DOI) - U.S. Geological Survey (USGS).
- Department of Agriculture (USDA) - Natural Resources Conservation Service (NRCS).
- Department of Homeland Security (DHS) - Federal Emergency Management Agency (FEMA).

The American Association for Wind Engineering (AAWE), a non-profit agency, is an indispensible, contributing member of the NPSDAP team. The AAWE is a consortium of wind and surge experts affiliated with research universities, industry, and private consulting. These groups collaborate to collect field data before, during, and after U.S. land falling hurricanes, promote and investigate effective mitigation, and contribute to the development of national codes and standards for wind resistant design.

The Federal Highway Administration (FHWA) of the Department of Transportation (DOT), though not a current participant in the WG/NDR/PSDA, is expected to become more involved in the future. While they have no requirements to acquire environmental data following significant storm events, they work with state and local DOTs who are building the capabilities to do so. These sites, which monitor the highway system, could eventually be used in the post-storm data acquisition process.

Appendix B contains Uniform Resource Locator (URL) information for the home page and pertinent content addresses of the participating federal agencies. Most of those home pages contain organization charts. Contact information for agency representation on the WG/NDR/PSDA is provided in Appendix C.

2.3 Agency Capabilities and Data Requirements

2.3.1 Department of Defense (DOD)

The DOD is represented on the working group by elements of the U.S. Army and U.S. Air Force, primarily by the USACE and the Civil Air Patrol (CAP), a civilian auxiliary of the U.S. Air Force. The CAP and the Air Force Reserve Command's 53rd Weather Reconnaissance Squadron (53 WRS) serve principally in a supporting role to the other participating agencies. The USACE has primary responsibility for construction and maintenance of marine navigation in public waterways and coastal storm protection projects on public lands. The USACE post-event activities are coordinated through the Office of Chief of Engineers, and the Engineer Research and Development Center (ERDC).

a. **Capabilities**. The ERDC, in cooperation with participating USACE district offices, can provide data on nearshore wave conditions, winds, and water levels, beach profiles, LIDAR topographic and bathymetric surveys, aerial photography/imagery, damage assessment to marinas, coastal projects and navigation channels and structures, morphological changes to beaches, and identification of high-water marks.

The Joint Airborne Lidar Bathymetry Technical Center of Expertise executes the USACE National Coastal Mapping Program (NCMP), which provides lidar elevation and imagery data to support regional and scale management activities. The data are collected with a unique in-house survey capability that collects lidar topographic elevations and lidar water depths, both with concurrent digital aerial photography and hyperspectral imagery for land use and habitat characterization. This capability was used in the aftermath of the 2004 and 2005 hurricane seasons, providing elevation and imagery data over 2000 miles of shoreline, in addition to the 3500 miles collected as part of the NCMP since 2004. The data support the quantification of economic, environmental, and engineering impacts of storms to the coastal zone. The data are delivered to the USACE Coastal District in which they were collected and to the USGS Center for Coastal and Watershed Studies in St. Petersburg, FL. The data are archived at NOAA NGDC and USGS EROS Data Center. All of the data are available online through the NOAA Coastal Services Center Lidar Data Retrieval Tool. The data are also delivered on demand to any local, state, or federal agency that requests them. In addition to this unique in-house system and capability, the Joint Center maintains surveying contracts to obtain lidar and imagery from industry based systems. In all cases, the Joint Center coordinates operational plans with Federal and State stakeholders, such as USGS, NOAA, FEMA, National Aeronautics and Space Admnistration (NASA), and others, to prevent duplication and to ensure the widest dissemination of data and resulting products.

The CAP, through a Memorandum of Understanding between the DOD and OFCM, provides light aircraft, aircrews, and communications in support of post-storm overflights. The National Weather Service frequently uses CAP flights to survey ice damming, weak levees, remote reservoirs, and tornado tracks. The services that CAP provides are much more cost effective than other available aerial capabilities. In addition, the CAP National Operations Center often is able to provide a flight within 24 hours of the request. Any federal or state agency may request a CAP mission, through OFCM, by filling out the request form at http://www.ofcm.gov/wg-ndr-psda/index.htm and submit it to nws.ofcm.cap@noaa.gov followed by a phone call to (301) 427-2002. The CAP forms are also at Appendix H. Funding for CAP must be provided by all agencies that use CAP on an annual basis. Funding cannot be applied after the mission is flown.

The 53 WRS conducts aerial reconnaissance of tropical and extratropical cyclones to provide meteorological data on the geographic position of the storms; central sea-level pressure; vertical profiles of pressure, temperature, dew-point temperature, and wind speed and direction from the surface to flight level; geopotential heights of designated pressure surfaces; and other relevant data.

b. **Requirements**. Because they serve only in a supporting role, the CAP and 53 WRS have no individual requirements for data. The USACE requires environmental data to support the following missions:

- Coastal - shore protection, beach preservation and restoration, coastal navigation, environmental and water quality monitoring

- Estuarine - navigation, environmental and water quality monitoring

- Riverine - inland navigation, flooding and streambank erosion control, environmental and water quality monitoring

- Reservoir control - reservoir level monitoring, catchment rate determination

In the broadest sense, any data which contribute to the performance of these missions are of value. Types of data include: tropical and extratropical storm-surge water levels and waves, storm-generated coastal current, morphological changes, imagery, and topographic/bathymetric surveys, estuarine tidal inundation, precipitation-generated estuarine inflow, riverine flooding events, and reservoir overtopping.

c. **Data Disposition.** Imagery and other data captured during CAP missions will be stored by the agency requesting CAP support. Some of the data captured during 53 WRS missions is made available at: http://www.nhc.noaa.gov/reconlist.shtml. The USACE NCMP lidar data are available online through the NOAA Coastal Services Center Lidar Data Retrieval Tool at http://maps.csc.noaa.gov/TCM/. For all other USACE data please contact the USACE personnel listed in the WG/NDR/PSDA membership list at Appendix C.

2.3.2 Department of Commerce (DOC)

Within the DOC, NOAA is the principal meteorological agency of the federal government. By law, NOAA is responsible for reporting the weather of the U.S., providing weather and flood warnings and forecasts to the general public, developing and furnishing applied weather services, and recording the climate of the U.S. This mission is carried out within NOAA by the NWS; the National Environmental Satellite, Data, and Information Service (NESDIS); the Office of Oceanic and Atmospheric Research; the National Ocean Service (NOS); and the NOAA Marine and Aviation Operations (NMAO).

National Weather Service (NWS)

The NWS consists of a national headquarters in Silver Spring, MD; 6 regional headquarters across the continental U.S., Alaska and the Pacific; 122 weather forecast offices; and 13 river forecast centers which provide basin-specific forecast guidance on riverine and flash flooding. The NWS has two Tsunami Warning Centers that provide reliable tsunami detection, forecasts and warnings in the U.S. In addition, the agency's National Centers for Environmental Prediction (NCEP) include the following service centers: the Environmental Modeling Center, the Storm Prediction Center (SPC), NCEP Central Operations, the Hydrometeorological Prediction Center, the Ocean Prediction Center, the Tropical Prediction Center, the Climate Prediction Center, the Aviation Weather Center, and the Space Environment Center. These service centers provide focused expertise and guidance, modeling, and numerical weather prediction for severe local storms, marine weather, tropical weather, climatic trends, aviation weather, and the space environment. This support provides basic information for NWS Weather Forecast Offices and the external community, including other federal agencies and emergency management officials.

Respondents in the event of tornadoes and other severe convective storms, flooding, and other weather-related natural disasters, represent all strata of the NWS, depending on the type of event. Warning Coordination Meteorologists (WCM) at each of the 122 weather forecast offices are the initial responders to all major weather events, documenting apparent damage, causal effects, as well as commentary from witnesses.

For tornadoes suspected of producing greater than EF3 damage, a special Quick Response Team (QRT) may be dispatched by the NWS. NWS policy for PSDA, including QRTs, is located at: http://www.nws.noaa.gov/directives/sym/pd01016004curr.pdf. The NWS QRT enlists experienced wind damage expert(s) to determine the final EF-Scale rating for these events.

These experts include, but are not limited to: member(s) of the American Association for Wind Engineering (AAWE); other NWS personnel; members of the academic community; and, other private sector wind damage experts. These experts possess expertise in the areas of wind and associated wind-driven water loads on buildings and structures, societal impacts of winds, hurricanes and tornadoes, risk assessment, cost-benefit analysis, codes and standards, dispersion of urban and industrial pollution, wind energy, urban aerodynamics, etc.

a. **Capabilities**. The NWS provides a continuous weather watch throughout the Americas and the Pacific, with lesser amounts of data collected globally. Data are gathered via remote sensing (satellite, radar, vertical sounders, and automatic surface observing systems) as well as manually (surface observations). Observational and computational information are processed through numerical weather prediction and river forecast computer models which are available to a wide variety of users globally.

b. **Requirements**. The NWS data requirements include obtaining all available records that define the impact, extent, timing, and intensity of significant natural hazard episodes such as floods, tropical cyclones, extratropical cyclones, tornadoes and other severe convective events, katabatic winds, and tsunamis.

c. **Data Disposition.** The NWS stores PSDA data at: http://www.weather.gov/om/data/stormdata.shtml. Additional information on severe storm events can be accessed in NWS' Storm Data program at: http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms.

National Ocean Service (NOS)

The National Ocean Service mission is to measure and predict coastal and ocean phenomena, protect large areas of the oceans, work to ensure safe navigation, and provide tools and information to protect and restore coastal and marine resources.

NOS has eight program offices and two staff offices that manage and preserve our nation's ocean and coasts. Specifically, NOS:

- Provides products, services, and data, such as nautical charts, a framework for consistent geographic reference, and tidal and water-level monitoring.
- Manages 13 national marine sanctuaries and one national monument and provides funding to coastal states to manage 27 national estuarine research reserves.
- Participates in immediate response to hazardous spill events, damage assessment, and restoration activities.
- Supports states in protecting resources and guiding economic development in coastal areas. NOS also supports training for state coastal managers participating in the program.

- Assesses, monitors, and predicts the consequences of natural and human-induced environmental hazards such as hurricanes, erosion, and sea-level rise.

NOS Center for Operational Oceanographic Products and Services (CO-OPS)

a. **Background.** CO-OPS collects and distributes observations and predictions of water levels and currents to ensure safe, efficient and environmentally sound maritime commerce. The Center provides the set of water level and coastal current products required to support NOS' Strategic Plan mission requirements, and to assist in providing operational oceanographic data/products required by NOAA's other Strategic Plan themes. For example, CO-OPS provides data and products required by the National Weather Service to meet its flood and tsunami warning responsibilities. The Center manages the National Water Level Observation Network (NWLON), and a national network of Physical Oceanographic Real-Time Systems (PORTS) in major U.S. harbors. The Center establishes standards for the collection and processing of water level and current data, collects and documents user requirements which serve as the foundation for all resulting program activities, designs new and/or improved oceanographic observing systems, designs software to improve CO-OPS' data processing capabilities, maintains and operates oceanographic observing systems, performs operational data analysis/quality control, and produces/disseminates oceanographic products.

b. **Capabilities.** CO-OPS provides real-time water levels, currents, winds and other oceanographic and meteorological measurements for major US port areas. This infrastructure acquires and disseminates observations and predictions of data and information necessary to ensure secure, safe, efficient environmentally sound maritime commerce. The real-time tides and current critical infrastructure supports national security, safe navigation, sustainable coastal communities, and disaster response. Real-time water levels and current information are essential to post-incident environmental impacts and waterway evacuation.

c. **Requirements.** CO-OPS requires all available NOAA-collected oceanographic and meteorological data (historical and real-time), predictions, nowcasts and forecasts.

NOS - Coastal Services Center (CSC)

The CSC mission is to support the environmental, social, and economic well being of the coast by linking people, information, and technology.

a. **Background.** The National Oceanic and Atmospheric Administration Coastal Services Center helps communities prepare for and respond to coastal hazards. The Center's coastal hazards toolkit of services for state and local organizations allows users to quickly find the hazard-related information they need, effectively apply it, and visually showcase the results to their constituents and other end users. http://www.csc.noaa.gov/hazards

The coastal hazards toolkit of services provides

- Data and information
- Data analysis
- Visualization tools

Coastal communities have the potential to face any number of hazards, from hurricanes and coastal storms to sea level rise and inland flooding. Each community will benefit from up-to-date information and state-of-the-art decision-support tools. These products and services help coastal regions prepare for and react to both chronic episodic events and longer-term climate change issues such as sea-level rise.

b. **Capabilities.** The CSC has the following capabilities:

- Provides Training modules on how to access, process, and use NOAA forecast and observation data in geospatial formats before, during, and after a storm. The primary audience for the training modules is DHS/FEMA personnel, NOAA ICC staff, and NOAA HSOC staff for creation of situational awareness maps for decision briefings.
- Provides natural hazard vulnerability analysis; assistance on coastal zone management and building community resilience; supplies geospatial technology (e.g., Geographic Information System, or GIS) assistance and coastal inundation information; performs ecosystem and damage assessments; and provides technical assistance in recovering fisheries, restoring habitat, and rebuilding coastal communities.
- Provide technical assistance for disaster response, recovery and rebuilding efforts to include coastal resource management, support to application of Geographic Information System and remote sensing data, planning process support (includes community participation process design and facilitation), and assist with recovery project development.

c. **Requirements.** CSC requires forecast data from the NOAA NWS and to develop before, during, and after forecast maps for NOAA ICC, DHS/FEMA. This has been done on an as needed basis and in the past has been driven by mission assignment from FEMA before a land falling storm.

d. **Data Disposition.** CSC archives maps and products in the Charleston, SC office and sends them via FTP to DHS/FEMA and NOAA ICC during events. A tutorial is available for download. It is a self taught manual on how to get NWS forecast data, bring it into a GIS, and make decision briefing maps.

NOS Office of Response and Restoration (OR&R)

The Office of Response and Restoration protects coastal and marine resources, mitigates threats, reduces harm, and restores ecological function. The office provides comprehensive solutions to environmental hazards caused by oil, chemicals, and marine debris.

a. **Background.** To fulfill its mission of protecting and restoring NOAA trust resources, the Office of Response and Restoration:

- Provides scientific and technical support to prepare for and respond to oil and chemical releases
- Determines damage to natural resources from these releases
- Protects and restores marine and coastal ecosystems, including coral reefs
- Works with communities to address critical local and regional coastal challenges

The NOAA Emergency Response Program is housed in the NOAA OR&R office coordinates the response agency effort and compiles and manages NOAA's capabilities. Many of the post-storm activities are managed via this program.

b. **Capabilities.** OR&R responds to and mitigates the consequences of spills and other hazards that threaten coastal environments. They provide accurate, timely and relevant scientific advice to organizations charged with responding to and mitigating the consequences of spills and other hazards that threaten coastal environments and communities. The HAZMAT scientific team provides key technical advice during spills of oil or hazardous materials in the coastal zone. To do this, the HAZMAT team is on-call 24-hours a day, every day of the year. HAZMAT also responds to other technological and natural coastal hazards such as hurricanes and airplane crashes. HAZMAT carries out these functions under the National Response Plan and the National Oil and Hazardous Substances Pollution Contingency Plan. This group operates CAMEO, a well known NOAA software program which is in use at over 10,000 locations. CAMEO (Computer Aided Management to Emergency Operations) provides first responders and emergency planners information to quickly respond to chemical accidents. Provides on-scene Scientific Support Coordinators and supporting field teams and reachback support to provide technical support and scientific guidance to assist in response and restoration efforts.

NOAA National Geodetic Survey (NGS)

a. **Background**. The National Geodetic Survey has a rich history of service to the Nation, tracing its roots back to 1807 when President Thomas Jefferson chartered the Survey of the Coast. For over two hundred years, the NGS and its predecessor agencies have been world leaders in geodesy and cartography, with a primary focus of enabling safe and efficient transportation. Before WWII, aerial surveys were initiated to exploit the accuracy and relatively synoptic capability of photogrammetric techniques. For decades the NGS has collected aerial remotely sensed data to support two primary programs: the Coastal Mapping Program (CMP) and Aeronautical Survey Program (ASP). The CMP delivers accurate and up-to-date National Shoreline. In addition to promoting safe marine navigation, the National Shoreline provides the basis for a multitude of legal boundaries. The ASP delivers airport obstruction charts and other products used to design and validate the instrument approaches required for aircraft to land at U.S. airports during inclement weather. Through the capability to execute these programs, NGS provides emergency response imagery in the wake of national disasters.

During the past ten years the U.S. has experienced some very active hurricane seasons. The NOAA NGS learned from these disasters, and has made great strides in the application of directly geo-referenced digital image acquisition and data serving to support recovery efforts. In accordance with the National Response Plan (now National Response Framework), NGS collected post storm imagery when directed. These images assisted with efforts along coastlines affected by Hurricanes Isabel (2003), Ivan (2004), Jeanne (2004), Dennis (2005), Katrina (2005), Ophelia (2005), Rita (2005), Wilma (2005), Tropical Storm Ernesto (2006), and Hurricane Humberto (2007). These images were made available to emergency personnel and the public on the NOAA/NGS web site (http://www.ngs.noaa.gov/). After Hurricane Katrina, the 12,000 images posted on the web were downloaded at an unprecedented rate of approximately 4.5 million per day for the month after the storm. Several commercial vendors have incorporated the aerial imagery into web-based map servers, allowing for searches based on street addresses, city names, and points of interest.

b. **Capabilities**. Through the Coastal Mapping and Aeronautical Survey Programs, NGS utilizes both contracted and in-house assets to conduct end-to-end aerial surveys. NGS collects near-infrared and color (Red, Green, Blue) imagery at a nominal one-foot Ground Sample Distance (GSD). In conjunction with the NOAA Marine and Aviation Operations (NMAO) Aircraft Operations Center (AOC), NOAA dedicates one specially modified turbo-jet aircraft to the NGS Coastal Mapping and Aeronautical Survey Programs, and has several other aircraft that are used on an as-needed basis. NGS' current emergency response workflow enables imagery to be processed, and available via the internet within 12 hours of collection. The speed in which NOAA can respond to an event depends upon several factors, the least controllable of which is weather. The imagery provided are individual ortho-rectified RGB images in JPEG format. The resulting GSD after ortho-recitification is 0.5 m. Delivery of the full resolution TIFF images is not feasible via the web due to band-width limitations; the individual images in the TIFF format are over 150MB each. Special requests for these products are addressed on a case by case basis.

c. **Requirements**. To facilitate accurate data collection following an emergency, NGS requires the geographic extent of the requested imagery, and those data necessary to conduct aerial survey operations, current aviation weather reports, and aviation weather forecasts.

d. **Data Disposition.** NGS data are initially stored at NOAA headquarters located in Silver Spring, MD, with a mirrored RAID site in Norfolk, VA. As previously indicated, the imagery data are freely available to the public in JPEG format via the internet.

2.3.3 Department of the Interior (DOI)

Within DOI, the United States Geological Survey (USGS) is the principal Earth science agency responsible for collection, assessment, and dissemination of information, regarding the geology, topography, mineral resources, hydrology, and biology of the U.S. The USGS is a nationally recognized provider of water data and information for use by others to design, operate, manage, and regulate water resources, establish floodplain boundaries, issue flood warnings and river forecasts, and manage emergency operations. USGS real-time and long-term flow records and stage-discharge relationships (ratings) are key inputs for NWS forecast models and peak-flow data are fundamental to flood-frequency analyses on which depend the design of dams and the delineation of flood-insurance rate maps.

a. **Capabilities**.

Streamflow monitoring – Streamflow data (the volume of water passing a point of measurement on a stream) are collected primarily by the USGS National Streamflow Information Program (NSIP) through the operation of some 7,500 streamgages and some 27,000 peak-flow-only sites. The streamgaging network is operated by 48 USGS water science centers (usually corresponding to state boundaries) through 160 field offices dispersed throughout the Nation and strategically located near important rivers and streams. Real-time water-level and flow data for about 6,800 streamgages are available at http://waterdata.usgs.gov/nwis/rt. Interactive maps of the current National and state level flow conditions (relative to flooding or drought) are available at http://water.usgs.gov/waterwatch/. Maps and tables summarizing recent flooding conditions are available at http://water.usgs.gov/cgi-bin/wwdp.

Flood measurements – Physical measurements of stream depth, width, and water velocities are used to compute flows. Although most flow measurements are made with conventional current meters, a large percentage of high-flow measurements are made by use of Acoustic Doppler Current Meters (ADCPs) that provide rapid and detailed depth, velocity, and flow data. These instruments are routinely deployed to streamgages, but can be used to collect unique data for a variety of situations such as dam, and in some cases, levee breaks or leakages. USGS personnel are often called upon to make emergency measurements of flow by NWS forecasters, US Army Corps of Engineers dam operators, and emergency management personnel to aid in the management and assessment of the floods. Summaries of recent flood measurements (width, depth, velocities, etc.) are distributed at http://waterdata.usgs.gov/nwis/measurements for each state and streamgage.

Flood forensics – When direct flow measurements are not possible due to short notice or the inaccessibility of the site, the USGS collects detailed high-water mark and steam cross-sectional data and applies hydraulic models to estimate the peak flows. Multiple high-water marks are collected upstream and downstream of constrictions such as bridges or culverts to establish detailed flood profiles for hydraulic models. Accurate determinations of the elevations of the high-water marks are crucial to accurate determination of the flood flows: an elevation difference of highwater marks 0.10 feet could result in estimates that are much greater or lower than the actual flows. Hence highwater marks are surveyed to within +/- 0.01 feet. Indirect flow measurements are computed and summarized in non-published reports that may be viewed at the relevant USGS state office. Contract information for these state offices is available at http://water.usgs.gov/district_chief.html.

Storm-tide monitoring - The USGS developed a mobile storm-tide network to provide detailed time-series data for selected hurricane landfalls. The network was first deployed to monitor the landfall of Hurricane Rita in Southwest Louisiana in September 2005. The network generally consists of about 40 temporary water-level and barometric monitoring instruments. The instruments collect water levels at 30-second intervals before, during, and after surge floods. The instruments can be deployed to observe the interactions of floodwaters with engineered structures and with natural topographic features. Most of the storm-tide sensors log data for later analysis and use, but real-time units have been developed and deployed and could provide real-time on-site reconnaissance for selected facilities. Generally, the instruments can function unattended for 6-8 days. Real-time storm-surge data (for periods during and immediately after the storm) can be viewed by accessing storm-surge sites listed in state streamflow summary tables (http://waterdata.usgs.gov/XX/nwis/rt) where "XX" refers to the 2-letter abbreviation for the state of interest. As data are corrected and finalized, they are published in online "data series" reports with ASCII tab-delimited or fix-column format at http://water.usgs.gov/osw/programs/storm_surge.html.

Rapid-Deployable Gages – Often data are needed at ungaged sites. To provide data at short notice, the USGS developed small, rapidly deployable streamgages that provide real-time water-level data. These devices are equipped with satellite transmitters that permit real-time transmissions and solar panels and batteries that will sustain the deployment indefinitely. These data are available at http://waterdata.usgs.gov/XX/nwis/rt where "XX" refers to the 2-letter abbreviation for the state of interest.

Flood documentation – USGS Water Science Center (WSC) personnel are trained to flag and document high-water marks. USGS techniques differ from those more commonly used to develop flood-inundation maps. More effort is expended to flag multiple high-water marks needed to profile flood levels upstream and downstream of stream constructions and the elevations are surveyed to within 0.01 feet in order to permit calibration of flood models. However, the USGS has assisted some flood documentation efforts in which USGS efforts were limited to flagging so that others could level in elevations using more rapid, but less accurate GPS techniques. When the data are used by the USGS to construct flood maps, the data are available through USGS publications at http://pubs.er.usgs.gov/usgspubs/recentpubs.jsp.

Shoreline Change - Through the Coastal and Marine Geology Program, the USGS Geologic Division (GD) investigates the geologic impacts of extreme storms and hurricanes on the physical coastal environment. A major objective of these investigations is to improve the capability to predict coastal erosion and other coastal changes caused by extreme storms. To conduct these investigations, GD personnel employ aerial photography and oceanographic techniques, emerging technologies like airborne scanning laser (e.g., LIDAR), recently available declassified instruments and data, and a USGS network of tide and environmental sensors. State-of-the art research vessels, Global Positioning System (GPS) satellites, and side-scan survey and velocity measurement equipment are used to collect post-storm data. Images and data are available at http://coastal.er.usgs.gov/shoreline-change/.

b. **Requirements.** The operational needs of the USGS during pre- and post-storm activities include access to forecasts, flood reports, and warning statements issued by NWS; road condition and access reports issued by transportation officials, emergency management operation centers and law enforcement agencies; and identification/authorization credentials needed to quickly access flooded area. Potential data needs from other agencies include aerial photography, field support with small aircraft (fixed wing and helicopter), and analytical model results of storm surge and waves. Photographs of stream-gauging stations and bridge sites would be useful during and immediately after floods at which a survey and computation of discharge could be made after the flood.

c. **Data Disposition.** Various USGS data are stored in different locations depending of the type of data, frequency of recordings, and length of the data record as described above.

2.3.4 Department of Agriculture (USDA)

The National Resources Conservation Service (NRCS) provides technical and financial assistance through local conservation districts to land users, communities, watershed groups, federal and state agencies, American Indian tribes, and others at their request. At the local level, the NRCS staff works alongside state and local conservation staff and volunteers in a partnership to care for natural resources on private lands. The NRCS develops comprehensive technical guidance for conservation planning and assistance.

a. **Capabilities.** The Rural Development Act of 1972, Public Law 92-419, Sec. 302, Title III (7 USC 1010a), August 30, 1972, authorized a land inventory and monitoring program, including studies and surveys of erosion, sediment damage, flood plain identification, and land-use changes and trends. The NRCS informs the USDA of the extent of short-duration natural phenomena that affect health, safety, and agricultural production. Reports document impacts on resources of NRCS activities and describe the event in quantitative terms, including amount of precipitation and surface-wind speeds.

The Watershed Protection and Flood Prevention Act (Public Law 83-566, Statute 606) authorizes the Secretary of Agriculture to cooperate with state and local governments in planning and conducting improvements for soil conservation and other purposes. The NRCS can prepare reports on the impact of serious storms on the installed project measures.

The Snow Survey and Water Supply Forecasting Program, administered by NRCS, is found in the Code of Federal Regulations 7 CFS 612. NRCS is charged with the responsibility of collection snow data to develop monthly water supply forecasts from January through June in partnership with the National Weather Service, and to maintain and make publically available the database. In partnership with other federal, state, tribal and local government agencies and utility companies, data is collected through a network of over 1,200 manual snow courses (measured monthly) and 752 automated SNOw TELemtry (SNOTEL) stations located throughout Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. SNOTEL stations located at high elevations throughout the mountainous west collect air temperature, precipitation, barometric pressure, wind speed and direction, relative humidity, snow depth and snow water equivalent data year round. This network is the only high elevation climate data collection network in existence in the United States.

NRCS also operates the 150 station Soil Climate Analysis Network (SCAN). These automated stations are scattered across the United States and located primarily on agricultural lands. At these sites, soil moisture and temperature data in addition to air temperature, precipitation, barometric pressure, wind speed and direction, relative humidity, solar radiation, and if appropriate, snow depth and snow water equivalent, are collected.

b. **Requirements.** NRCS is typically required to make post-storm analyses to determine extent of damage to installed conservation measures in order that they may be restored to pre-storm conditions.

c. **Data Disposition.** All climate data collected by the NRCS can be accessed via the NRCS National Water and Climate Center (NWCC) website, http://www.wcc.nrcs.usda.gov.

2.3.5 Department of Homeland Security (DHS)

DHS and its ancillary Federal Emergency Management Agency (FEMA) are the federal coordinating agencies that respond to major disasters or threats in the United States and its territories. FEMA provides response and recovery and hazard mitigation assistance, emergency management preparedness training, flood insurance, and funding for related studies and services. Headquartered in Washington, DC, FEMA has 10 regional offices, with field offices and special facilities located nationwide.

a. **Capabilities**. When a Presidentially declared disaster occurs, one or more Joint Field Offices (JFOs) are established to coordinate federal disaster assistance for response and assistance. FEMA also employs a large contingent of temporary Disaster Assistance Employees (DAEs) when necessary in addition to its authorized permanent staff. FEMA is organized into eight primary directorates; Logistics Management, Disaster Assistance, Disaster Operations, Grant Programs, National Preparedness, U.S. Fire Administration, National Continuity Programs, and Mitigation. Within FEMA's Mitigation Directorate, which contains the Federal Insurance Administration (FIA), Flood Insurance Studies for the NFIP and Hurricane Evacuation Studies for the National Hurricane Program are coordinated. The National Response Coordination Center (NRCC) located in Washington DC assists in coordinating efforts among all federal office and the Emergency Support Function (ESF) Coordinator positions within the NRCC are activated for exercises, and emergencies. The ESF Coordinators may be of assistance to NPSDAP efforts and an ESF Coordinator contact sheet is at Appendix J. FEMA's website address is www.fema.gov, where the latest organization chart and articles on FEMA and Presidentially declared disasters may be viewed.

In addition, FEMA's Mitigation Directorate, Risk Reduction Division, Building Science Branch, in coordination with the JFO Mitigation Branch Director may elect to deploy a Mitigation Assessment Team (MAT) following a disaster. The objectives of the MAT are to inspect buildings and infrastructure, conduct forensic engineering analyses to determine causes of structural failure and success, and recommend actions that state and local governments, the construction industry, and building code organizations can take to reduce future damages and protect lives and property in hazard areas. FEMA MAT will notify OFCM via phone if they plan to deploy following a disaster. OFCM will then notify via phone all appropriate agencies of the NPSDAP about the FEMA MAT deployment. This notification should be followed up with coordination among all the agencies involved with PSDA activities.

b. **Requirements**. Perishable storm data are needed to support FEMA's mission. Data include high-water marks in riverine and coastal-flooded areas in addition to perishable wind-waterline and/or inland wind impact data. The data are typically obtained by field survey teams within a few days or a week after the storm event has occurred because perishable data indicators are quickly destroyed by response and recovery efforts and weather. Along with FEMA, personnel from the NWS, USACE, USGS, NIST, and NRCS, as well as private contractors, comprise perishable data collection teams in the field and assist in their analysis. Collected data are used to determine the extent and magnitude of the disaster, assess disaster damages, determine the range of mitigation alternatives, document successful construction practices, prepare benefit-cost analyses for federal recovery assistance and mitigation measures, and verify prediction models for natural hazards. For disaster response and recovery efforts, reconnaissance data are required during or within 12-24 hours after the event and are obtained by radar, reconnaissance flights, satellites, and water-level gauges that transmit their data.

Analyzed fields of maximum surface wind speeds caused by tornadoes, tropical storms, hurricanes, and winter storms also are required. The information in these fields is typically derived from surface observations and available Doppler radar data. Water-level, wind-speed and wind-waterline data have been used to prepare the Hazard Analysis section in Post-Storm Assessment reports following major hurricanes. Wind-waterline data - the line that distinguishes damages caused by water damage versus wind damage - has immediate application for insurance claims. Water-level and wind-speed information from recent tropical storms and hurricanes have been used by the Storm-Surge Group at the Tropical Prediction Center/National Hurricane Center to verify their hurricane and winter-storm computer simulation and prediction models. These studies are sponsored by FEMA and are primarily used to verify the predicted maximum storm-surge heights derived from the NWS's Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model. The SLOSH model is used to make predictions of maximum storm-surge heights for classes of hurricanes striking a given coastal area. Information derived from SLOSH is used to identify vulnerable populations that must be evacuated and critical facilities that need to be protected from storm-surge flooding in coastal communities. These data will continue to be needed in future disasters to verify SLOSH model output and to support other FEMA mission requirements.

Perishable, riverine, and coastal-flooding data are used by the NFIP to calibrate and verify hydrologic and hydraulic models used in Flood Insurance Studies to establish the one-percent chance base-flood elevations shown on Flood Insurance Rate Maps (FIRMs). Flooding information caused by tsunami events affecting the U.S. West Coast and Pacific islands is also needed to prepare tsunami hazard maps. Existing water-level data documenting such events are insufficient and are critically needed to verify computer models used for tsunami run-up predictions.

2.3.6 National Institute of Standards and Technology (NIST)

The mission of NIST is to promote U.S. innovation and competitiveness by anticipating and meeting the measurement science, standards, and technology needs of the U.S. building and fire safety industries in ways that enhance economic security and improve the quality of life.

a. **Background**. NIST, through the Materials and Construction Research Division, conducts laboratory, field, and analytical research in structural engineering, including the investigation of important structural failures, the characterization of building loads during construction and during their service life, and structural response analyses. Extreme events, such as hurricanes and tornadoes, are viewed as opportunities to evaluate the performance of structures subjected to wind loads that may approach or exceed the ultimate limit states of the structure. Beginning with Hurricane Camille in 1969, the Structures Division has conducted post-storm assessments on its own, or in collaboration with other federal agencies, universities, and building research centers.

The Materials and Construction Research Division has conducted post-storm reconnaissance and investigation following notable events such as Hurricanes Alicia, Andrew, Bob, Camille, Elena, Frederic, Hugo, Katrina, and Rita, as well as the Lubbock tornado outbreak of 1970. In recent years, the Structures Division has maintained an informal working relationship with the Research Division of the Atlantic Oceanographic and Meteorological Laboratory of NOAA to document near-surface wind speeds in hurricanes. The availability of reliable wind-speed estimates is crucial to the correct assessment of structural performance in extreme wind events.

b. **Capabilities**. A well-equipped structural testing laboratory and computer facilities for modeling loads and structural response are maintained by the Materials and Construction Research Division. The division's capabilities for predicting and assessing wind effects on buildings and other structures include computer codes for the simulation of extreme wind speeds in atmospheric boundary layers. The division also maintains special equipment and supplies needed for the rapid deployment of investigative teams following major wind and earthquake disasters, structural collapses, and building fires. NIST will notify OFCM via phone if they plan to deploy an investigative team following significant events. OFCM will then notify via phone all appropriate agencies of the NPSDAP about the NIST deployment. This notification should be followed up with coordination among all the agencies involved with PSDA activities.

The Process Measurement Division of the Chemical Science and Technology Laboratory within NIST maintains wind and water tunnels for fluid mechanics research. Of particular interest is the closed-return, low-speed, low-turbulence wind tunnel facility which serves as the U.S. primary standard for anemometer calibration. Interchangeable test sections allow calibrations at wind speeds of up to 67 ms^{-1} (149.87 mph). State-of-the-art flow visualization techniques, hot-wire anemometry, and laser-Doppler velocimetry are available in this laboratory.

c. **Requirements**. In wind-related disasters, all available records of wind speeds (from both ground stations and aircraft), barometric pressure measurements, and radar images from which to reconstruct the surface wind field are essential. In addition, aerial photographs of sufficient resolution to show damage and debris distribution and extent of storm-surge effects are of considerable value. In the case of damage to major structures, detailed site studies, followed by structural analyses, are performed.

d. **Data Disposition.** Personnel at the Building and Fire Research Laboratory at NIST investigate the performance of infrastructure after hazard events and produce reconnaissance reports. These reports can be found at: http://www.bfrl.nist.gov/investigations/investigations.htm.

2.3.7 American Association for Wind Engineering (AAWE)

AAWE is a national, nonprofit, technical society of engineers, meteorologists, architects, planners, public officials, social scientists, manufacturers and constructors. Included among AAWE members are researchers, practicing professionals, educators, government officials, and building code regulators.

a. **Background.** Many universities have teams that explore the post-hurricane or post-tornado damage field to learn about failure mechanism. These institutions include Texas Tech University (TTU), Louisiana State University (LSU), Colorado State University (CSU), University of Florida (UoF), Clemson University and Johns Hopkins University. These institutions are members of AAWE, either in a corporate manner or on an individual basis. Some coordination and minor funding has traditionally occurred through AAWE. The quadrennial conference organized by AAWE serves as a forum to discuss these, and other, wind-engineering issues.

Participants in data collections from AAWE partner institutions frequently observe that they see the same sort of building damage over several decades. They also note that the construction industry has made incremental and insufficient improvements to construction methods in recent decades. Construction methods and standards need substantial improvements. The United States needs to apply stringent and consistent "deemed to comply" rules to wind-susceptible regions. Such an approach has worked well in other counties and needs to be applied in the US.

AAWE is a resource for a broad variety of expertise from structural and wind engineering to atmospheric science. Members will participate in coordinated field data collection expeditions at the direction of investigating Federal agencies, and provide guidance on optimal data collection procedures suitable to a specific event.

b. **Capabilities.** AAWE was originally established as the Wind Engineering Research Council in 1966 to promote and disseminate technical information in the research community. In 1983 the name was changed to American Association for Wind Engineering and incorporated as a nonprofit professional organization. The multi-disciplinary field of wind engineering considers problems related to wind and associated water loads on buildings and structures, societal impact of winds, hurricane and tornado risk assessment, cost-benefit analysis, codes and standards, dispersion of urban and industrial pollution, wind energy, and urban aerodynamics.

Several of the AAWE partner institutions have a coordinated program to place robust and portable weather monitors in the path of hurricanes at land fall. LSU and TTU have also been using before- and after-storm satellite imagery to assess storm damage, developing algorithms and procedures to gather high volume and high quality performance assessment data that complements on-ground data collection efforts.

c. **Requirements.** AAWE affiliation with the NPSDAP is currently limited to coordination with the National Weather Service. For tornadoes suspected of producing greater than EF3 damage, a QRT may be dispatched by the NWS. NWS Headquarters, Office of Climate, Water, and Weather Services (OCWWS), will notify OFCM of the QRT deployment. OFCM will then notify, all appropriate members of the NPSDAP about the deployment, including AAWE. This notification should be followed up with coordination between AAWE and the NWS regarding any PSDA activities. General guidance for NWS PSDA reports is available on page 7 of the policy directive at: http://www.nws.noaa.gov/directives/sym/pd01016004curr.pdf.

Given the breadth of potential services provided by AAWE members for extreme event investigations, specific data needs cannot be delineated. Typically the most pressing requirement will be logistics coordination, support for the data collection, and a supervisory authority to determine the specific data collection mission.

d. **Data Disposition.** If AAWE members collect PSDA data through a coordinated AAWE deployment, AAWE will retain a copy of data collected. AAWE may be contacted to arrange data transfer at the following URL www.aawe.org, and email aawe@aawe.org.

2.3.8 University Wind Research Consortium (UWRC)

Faculty from participating universities including University of Florida (UF), Texas Tech University, Louisiana State University, University of Notre Dame, Clemson University, Florida Institute of Technology, and others, work individually and in partnership to address the vulnerability of infrastructure to extreme wind and water events. Expertise includes wind /structural engineering, coastal process monitoring and modeling (flooding, surge), atmospheric science, field measurement of hurricane winds, and structural vulnerability and mitigation assessments. Members of this consortium are also active in the section 2.3.6 American Association for Wind Engineering. The main contacts for this group are the University of Florida members, who will identify and coordinate with the other the universities on an event-specific basis.

The university activities provide direct real-time field data on overland wind intensity, structural load data, building performance evaluation and damage documentation. They also provide a unique resource for laboratory evaluation of building performance in a controlled full-scale hurricane environment, as ell as surge and flood modeling capabilities.

a. **Capabilities.** The University of Florida manages the Florida Coastal Monitoring Program (FCMP), a research program with the goal of characterizing the intensity and behavior of land falling hurricanes with direct measurement of wind speed, wind direction, pressure, humidity and temperature at multiple ground level (10 meter) locations in the path of land fall via five portable weather monitoring platforms. Texas Tech, Louisiana State University and Clemson University also participate in this project with additional portable monitoring assets. Much of the data is relayed in real-time to a public access web site, and via direct push to NOAA HRD researchers. The high reliability of research grade instrumentation and hurricane hardened portable platforms has yielded the most dependable source of direct-measured overland ground level wind data since 1999. Additional near shore wave and surge monitoring assets have been developed by the University Of Notre Dame, providing water elevation datasets that complement both the wind data collection as well as USGS surge monitoring efforts. UF and the University Of Notre Dame retain faculty that lead the current state-of-the-art in coastal process modeling, including hurricane surge and inland flooding from heavy rainfall. UF and Florida Institute of Technology also deploy pressure measurement packages on the roof and walls of homes along the coast of Florida to directly monitor the wind pressure experienced by structural components during land falling hurricanes. This work is a leading source of information in the refinement of the next generation of wind load provisions for minimum building code standards.

UF also offers an extensive infrastructure of laboratory apparatus to evaluate structural performance characteristics in hurricane winds and wind driven rain. The full-scale hurricane simulator at UF provides a means to develop and evaluate new construction methods as well as retrofit mitigation measures on existing building inventory. Home builders and product manufacturers work with the UF faculty to identify outstanding performance issues and identify cost effective and practical solutions to weaknesses in building performance.

During the process of equipment retrieval in the immediate aftermath of a land falling hurricane, university teams provide an assessment of infrastructure damage prior to data altering activities such as clean up, blue-tarp, etc. In some circumstances (e.g., Charlie in 2004) UF and other university research groups remain in the field after equipment retrieval to conduct a more thorough quantitative building performance study.

b. **Requirements.** The University Wind Research Consortium exists in part to serve the needs of the hazard response community, and provide for the data requirements of the various Federal agencies. The group has no specific data requirements, but does recognize the need to establish a consistent framework for reporting collected field data. Coordination with NOAA HRD and NWS officials is essential for proper placement of portable monitoring assets.

c. **Data Disposition.** The University Wind Research Consortium stores PSDA data (field measurements of land falling hurricane wind data as well as metadata) in the following locations: http://fcmp.ce.ufl.edu/, http://www.atmo.ttu.edu/TTUHRT/.

2.4 Metadata

Metadata for all agency data collection is located at: http://www.ofcm.noaa.gov/wg-ndr-psda/metadata.htm.

2.5 Funding

a. **Pre-Declaration of Disaster Funding.** Leading up to an event, and before the President has declared the area a federal disaster, funding for NPSDAP activities will be more difficult to obtain. FEMA uses a document called a Pre-Scripted Mission Assignment (PSMA) that allows funding for actions before declaration of disaster. During national emergencies, FEMA Federal Coordinating Officers (FCOs) must make a large number of important operations decisions in a short period of time under very stressful conditions. The Pre-Scripted Mission Assignments come in very handy to a FCO because they are a pre-packaged set of actions that can be executed easily and quickly. PSMAs must be validated at FEMA long before a disaster strikes to simplify the tasking and funding process. By instruction, only those actions that prevent loss of life or property can be funded by a PSMA. PSMAs may be a potential funding source for NPSDAP collections activities. An example of a PSMA form as well as a NPSDAP statement of work are located at Appendix I. For more information on PSMAs, please contact the FEMA representatives listed in Appendix C.

b. **Post-Declaration of Disaster Funding.** After the President declares an event location a federal disaster area, DHS/FEMA can more readily release funding using Inter-Agency Agreements (IAAs). IAAs are simply contract agreements between two federal agencies to exchange fees for a service. All NPSDAP agencies should consider building IAAs with DHS/FEMA to help facilitate funding. IAAs should be drafted, approved, and signed long before any disaster event. For more information on IAAs, please contact the DHS/FEMA representatives listed in Appendix C.

c. **Agency Funding.** For many smaller disaster events, it will be up to individual agencies to fund the WG/NDR/PSDA activity. For example, the NWS funds the Quick Response Teams in the event of a tornado. For some unusual riverine events, USGS will fund special sensing missions. For some agencies, such as NOAA, the funding for any operation must be available at the agency before work begins. This is true even if it is fairly certain that the operation will be funded at a later date from outside the agency.

3 CONCEPT OF OPERATIONS AND PROCEDURES

3.1 General

An agency response to an event deemed to be under this plan shall be at the discretion and within the mission authority and resources of that agency. The OFCM serves as the WG/NDR/PSDA's executive agent to coordinate agency responses. The agencies participating in this effort typically have overlapping requirements for the event responses and data types. Agencies often acquire the same data type following an event but may use the data for substantially different purposes. For example, inundation data following a coastal storm may be used by one agency for flood hazard risk assessment purposes while another agency may use the same data for structural performance evaluation purposes. There are other events where one or two agencies may have little or no interest and no mission authority. An example would be a severe tornado outbreak. Unless the event directly affected a DOD installation, the DOD probably would have no justification for a response within the scope of this plan.

3.2 Intent

The plan of operations described herein is formulated to insure that agency responses to mutually examined events are adequate, while minimizing the expenditure of resources on events of interest to a single agency, or events of no common interest. Moreover, the plan has been organized to allow for changes in the scope of responses to particular types of events, and adoption or implementation of emerging technology, without requiring a revision of the entire plan.

3.3 Collaboration and Communication Logistics

3.3.1 PSDA Team Activation Mechanism

The preferred activation mechanism that will be used for all event types is an e-mail to all PSDA members inviting them to join the first meeting or teleconference. Depending on the urgency and lead time, the initiator may need to follow up with phone calls to the PSDA team. The initial e-mail may be sent by any one of the members and should be sent to all of the members. The first member to see the need for data collection should notify the rest of the team. The member e-mail list is located in Appendix D and will be updated by OFCM as needed. The initial e-mail should contain a brief description of the event, any planned data collection, and a date/time/method for the first coordination meeting.

3.3.2 Coordination Meetings

There are two suggested methods for holding a PSDA coordination meeting: teleconference or Homeland Security Information Network (HSIN) virtual meeting using Jabber:

Option 1, Teleconference: A teleconference can be set up through many organizations. One option is to contact OFCM to request use of the teleconference line. The OFCM teleconference number is 888-680-9581, with a user pass code of 535430#. You will need to contact OFCM at (301) 427-2002 to request use of the line.

Option 2, Web-Based Chat: The HSIN chat capability, a program called Jabber, can be used to conduct PSDA meetings. To find to the Jabber chat capability perform the following steps:

- Log in to the HSIN site,
- Navigate to the Emergency Management portal,
- Click on the "Collaboration" tab at the top left of the page,
- Click on the Jabber icon on that collaboration page, and finally,
- Scroll down to the PSDA group

3.3.3 Homeland Security Information Network

To obtain an account on HSIN you will need a sponsor. To gain sponsorship, contact the WG/NDR/PSDA Executive Secretary or Chair. Within HSIN there are several portals, and our PSDA team will use the Emergency Management (EM) portal for most items. All of the PSDA team members that are federal employees should also get an account on the Federal Operations (FO) portal as there is quite a bit of information there that will be beneficial to this group. When you request an HSIN account, ask for both the EM and FO portals. If you are not from a federal office, you will only be allowed an account on the EM portal. The HSIN Help Desk will send you an e-mail when your account is ready. The HSIN login page is at: https://government.hsin.gov/.

All PSDA files are kept in one location on HSIN. To access the files, create new folders, or add new files:

- Log into HSIN,
- Go to the Emergency Management Portal,
- Click on the "Library/Archive" tab at the top right hand side,
- Scroll down to the "Interagency Library" window and
- Find the "- PSDA Archive Documents –" folder

Inside the "Interagency Library" window you will see our "– PSDA Archive Documents – " folder. All PSDA event folders will be inside that one folder. The first WG/NDR/PSDA member to build PSDA content for a new event will simply add a new folder and give it a logical name appropriate for the event.

HSIN facilitates situational awareness of team assets like people and equipment for major events. To track NPSDAP personnel and assets on HSIN:

- Go to the Emergency Management Portal home page,
- Go to the "Common Operating Picture (COP)" page,
- Select the "Reports" icon,
- Click on the "Sitrep" icon,
- Select the "NRCC/JFO/PFO" icon in the middle of the page,
- Select the event of concern from the dropdown menu,
- Select "Assets" from the left hand blue window titled "Sitrep",
- Click the "Create Asset" icon in the middle of the page and define your team or equipment assets

For example, if you are a USGS team deploying three team members to install high-water mark submersible sensors pre-storm, first hit the "New" button at the top of the window and then select "DOI" from the first drop-down menu. Select the most appropriate identifier from the next drop down menu, for example, "Response Team Personnel" and in the "Asset Type" box type in "USGS Personnel". Under "Asset Unit" select "Personnel" and in the "Quantity" window type 3. In the large "Asset Description" window describe the team and what they will be doing in detail. Drop down to the "Current Location" window and describe the location. Be sure to include the city, state, and use the county selector, add in the zip code and click the "Geo-Code Address" button so the system fills in the lat/long for you. Submit your asset description and you will see that it was added to the list of other assets for that event.

HSIN training is available online at the EM portal homepage training icons on the right hand side of the page. FEMA personnel conduct periodic exercises to facilitate HSIN training as well. To obtain HSIN training information contact the help desk number located on the HSIN home page or contact the WG/NDR/PSDA Executive Secretary.

3.4 Activation Criteria

Activation criteria for initiating the agency responses to a particular event depend upon the event. Events for which there is typically adequate warning, such as landfalling storms and inland floods, permit evaluation of the situation as it develops. For other events, such as tsunamis and tornadoes, there may be little or no warning and little time to assess the initial effects of the event. A timely response therefore requires that activation criteria be based upon the presumption of occurrence of a significant event. For reference purposes, the Saffir-Simpson Hurricane Scale and the Enhanced Fujita Tornado Intensity Scale are provided in Appendices D and E, respectively. Table 3.1 shows most of the common activation criteria that would initiate a PSDA team or individual-agency effort.

Table 3-1 NPSDAP Activation Criteria

Activation Criteria or Event **(OFCM or any NPSDAP Agency may activate the NPSDAP team. See paragraph 3.3)**
5-Day tropical forecast indicates land-falling hurricane
NWS Deployment of a QRT (see Appendix F)
An unusually high surge (in an historical context) at a particular coastal location
An unusually prolonged period (e.g., several days) of elevated coastal water levels
An extended reach (hundreds of miles) of affected coastline
Prolonged and/or unusually high surface wind speeds
Unusually long (> 16s) wind-generated wave periods along the Atlantic and Gulf of Mexico coasts
Precipitation rates resulting in total rainfall that could cause potential flooding or flash-flooding
Freezing and/or precipitation to the extent that accumulation of snow/ice on roadways/railways/airports/walkways is expected to cause such modes of transportation to become inoperative
Accumulation of snow/ice on the built environment is expected to become a hazard due to structural failure
Severe convective wind damage
Tornado outbreak
Tsunami reported
Tsunami warning issued based on seismic data of sub-sea earthquake
Ice jamming
Dam or levee failure or potential failure
Flash floods

3.5 Response Procedures

Coordination of agency responses to an event are desired where there are common activities in a common geographic area and common or overlapping data requirements. The specific agency responses following an event will depend to some extent on the nature and characteristics of the event. Table 3.2 lists some the basic response procedures leading up to, during, and after an event. The choice of responses will vary from event to event.

Table 3-2 Response Procedures

Response Procedures	**Tropical**	**Extra-Tropical**	**Severe Convective**	**Tsunamis**	**Riverine Flooding**
Event – 5 Days					
USGS: Run Hurricane Response Plan at Appendix G	X				
Event – 3 Days					
NOAA National Geodetic Survey: Consider/coordinate pre-storm baseline flights leading up to event. (See NOAA NGS internal plans at Appendix F.)	X				X
UWRC: Coordinate sensor placement with other NPSDAP team members.	X				
USGS, USACE, FEMA: Formulate coordinated effort for high-water mark sensor placement plan	X				X
NOAA CSC: Provide mapping support where needed to FEMA for decision briefings using NWS data in GIS formats. Have been based on mission assignments in the past. Tutorial could be used to train FEMA and NOAA staff: http://www.csc.noaa.gov/storm_info/tutorial.html	X				X
NIST, NOAA, AAWE, and UWRC: Begin plan for pre-event sensor placement and post-event assessment of structural damage.	X				X
Event + 0 Days					
All Agencies: Secure lodging near enough to affected area to deploy quickly but far enough away to be safe.	X	X	X	X	X
NOAA National Geodetic Survey: Plan post-storm data collection flights after event. (See NOAA NGS internal plans at Appendix F.)	X	X	X	X	X
Event + 1 Day					
All NPSDAP Agencies: Add or remove personnel from Homeland Security Information Network (HSIN) Common Operating Picture (COP). (See paragraph 3.3.3 above.)	X	X	X	X	X
All NPSDAP Agencies (usually NWS Regional Offices): Request CAP post-event over flight to capture photographs of damage, flooding extent, dam/levee condition etc. (See OFCM website for CAP request form and instructions at: http://www.ofcm.noaa.gov/wg-ndr-psda/reference.htm)	X	X	X	X	X
NWS: If tornado is estimated at EF-3 or stronger, a Quick Response Team may be deployed. (See NOAA internal plans at Appendix F.)			X		
USDA: Provide data on precipitation effects.	X	X	X		X

Table 3-2 Response Procedures (Continued)

Response Procedures	**Tropical**	**Extra-Tropical**	**Severe Convective**	**Tsunamis**	**Riverine Flooding**
Event + 1 Day					
NIST, NOAA, AAWE, and UWRC,: Coordinate field evaluation of structural performance if event warrants.	X	X	X	X	X
NWS: Consider deploying Survey Teams and notify other WG/NDR/PSDA members.				X	X
NWS: Consider deploying Quick Response Team and notify other WG/NDR/PSDA members.	X	X	X	X	X
USACE, USGS, FEMA, and NWS: Collaborate on high-priority sites for flood data collection.					X
USGS, USACE: For riverine flooding, coordinate collection of hydrologic data and discharge rates.					X
Event + 3 Days					
USGS, USACE, and FEMA: Deploy teams to collect high-water marks no later than event + 72 hours if possible.	X				X

3.5 Data Acquisition Procedures

Because all events covered in this plan share some common characteristics, the data acquisition procedures share some similarities. Table 3.3 provides general guidance on procedures, type, and quantity of data. Appendix G contains an example of detailed procedures to be used for high-water mark identification and recovery used by USGS.

Table 3-3 Data Acquisition Procedures

Data Acquisition Procedures	**Tropical**	**Extra-Tropical**	**Severe Convective**	**Tsunamis**	**Riverine Flooding**
ALL NPSDAP Agencies: For federal, state, local, and tribal situational awareness, identify your personnel working in the field using the HSIN COP Asset Tracker. (See paragraph 3.3.3)	X	X	X	X	X
UWRC: Coordinate with other NPSDAP agencies for potential data collections locations.	X				

Table 3-3 Data Acquisition Procedures (Continued)

Data Acquisition Procedures	Tropical	Extra-Tropical	Severe Convective	Tsunamis	Riverine Flooding
UWRC: (Real-Time Collectors) Collect and provide real-time wind speed, wind direction, temperature, humidity, and barometric pressure data to NOAA HRD and the NWS from multiple monitoring assets.					
UWRC: (Non-Real-Time Collectors) Collect other non-real-time assets after it is safe to enter the collections areas and disseminate the data.	X				
USGS, USACE, AAWE, NIST, UWRC : Collect hydrodynamic and structural effects data and available hydrographs acquired at open ocean and affected coastal locations. Estimates of the net sub-sea bottom displacement are desirable.	X			X	X
AAWE: Coordinate with federal agencies to provide post-storm damage assessments as needed.	X	X	X	X	X
USGS, FEMA, NWS, and NIST: Form agency high-water mark collections teams and coordinate collections between agencies.	X	X	X	X	X
USDA: Provide available precipitation, soil erosion, and agricultural damage data.	X			X	X
NIST, NOAA: Provide field teams to assess the storm-induced structural damage. Where possible, prepare charts depicting estimates of the surface wind speeds inferred from structural effects.	X	X	X	X	X
NWS: Assemble and analyze damage survey findings, satellite and radar imagery, videotapes, and other information while determining the structure and organization of the tornadic storm(s).			X		
NWS: Perform post-event surveys documenting maximum inundation and societal impacts (effectiveness of the warning system and mitigation measures).				X	
NWS: Coordinate potential flooding areas with FEMA, USACE, and USGS.					X
NWS: Perform post-storm surveys documenting extreme conditions that led to flooding (precipitation and streamflow).					X
USGS, USACE: Take discharge and current velocity measurements					X

Table 3-3 Data Acquisition Procedures (Continued)

Data Acquisition Procedures	Tropical	Extra-Tropical	Severe Convective	Tsunamis	Riverine Flooding
All Agencies: Store all information about each event in the – PSDA Archives Documents - folder on HSIN. (See paragraph 3.3.3)	X	X	X	X	X
OFCM: After most event actions and data collections are complete, build an event summary in accordance with the guidance in Chapter 4.	X	X	X	X	X

3.6 Data Repository and Retrieval Procedures

The data collected by each agency should be stored and backed up by the agency that collects the data. The WG/NDR/PSDA team will use the following methods to make WG/NDR/PSDA data more discoverable and easier to access.

3.6.1 Metadata

Information from each agency about the data types they collect, a description of the data quality for each data type, and pointers to the location of storage for the data are at the WG/NDR/PSDA Metadata website: http://www.ofcm.noaa.gov/wg-ndr-psda/index.htm.

3.6.2 Current Event Descriptions

For all PSDA events, descriptions of current and ongoing NPSDAP efforts (but not the actual data) will be stored in one place on the HSIN system. To find the current event description, simply go to the Emergency Management home page and click on the Library/Archive tab at the top of the page. Scroll down to the Interagency Library window and all event folders will be contained in the "– PSDA Archive Documents –" folder. Any NPSDAP member may create a new folder for any new event and place it in the "- PSDA Archive Documents -" folder.

3.6.3 Post-Event Summaries

After most collection efforts have been completed for a given event, OFCM will transfer all descriptive event files from HSIN to the OFCM website and build an event summary. (See chapter 4.)

4 EVENT SUMMARIES

4.1 General

OFCM should complete NPSDAP event summaries after the majority of data collection is complete for an event that involves more than one agency. To start the event summary, OFCM will capture all Homeland Security Information Network PSDA files related to the event. Individual agencies should complete event summaries as directed by internal guidance and then forward them to OFCM to be compiled into the overall event summary. The summaries will embody a concise description of the event, interpretive information, and supporting data as well as pointers to where the actual PSDA data resides. Examples include the NWS Service Assessment of the La Plata, Maryland, Tornado Outbreak of April 28, 2002; FEMA BPAT & MAT reports; data gathered by the USACE; and a report of water levels associated with hurricanes and tropical storms from NOS's Center for Operational Oceanic Products and Services (CO-OPS). The interpretive information and supporting data will be directed at satisfying the requirements and needs of secondary users. These include those whose requirements are met by processed data and/or composite images. Users requiring access to unprocessed data (i.e. disk data files) will be directed to the acquiring agency. Many or most of the single agency summaries can be found by accessing the agency's URL listed in Appendix B. The WG/NDR/PSDA summaries can be found at: http://www.ofcm.noaa.gov/wg-ndr-psda/eventsum.htm.

4.2 Content Outline

It is recommended the following sections be included in an event summary report:

a. Executive summary;

b. Event description and its impact;

c. Event analysis;

d. Description of agency responses;

e. Description of data acquired, availability, and deposition status;

f. Supporting documentation (e.g., eyewitness accounts); and

g. Conclusions, findings, and/or recommendations, if appropriate.

APPENDIX A AGENCY AUTHORITY AND MISSION STATEMENTS

Federal Emergency Management Agency

Contained in the agency charter as "... providing the leadership and support to reduce the loss of life and property and protect our institutions from all types of hazards through a comprehensive, risk-based, all hazards emergency program of mitigation, preparedness, response, and recovery."

National Institute of Standards and Technology

Contained in the National Bureau of Standards Authorizing Act of 1986: "The National Bureau of Standards, on its own initiative, ... may initiate and conduct investigations to determine the causes of structural failures in structures which are used or occupied by the general public."

National Resources Conservation Service

Contained in the Rural Development Act of 1972, Public Law 92-419, Sec. 302, Title III (7 USC 1010a) August 30, 1972, which authorizes a land inventory and monitoring program, including studies and surveys of erosion, sediment damage, flood plain identification, and land use changes and trends.

The Watershed Protection and Flood Prevention Act (PL 83-566, Statute 606) authorizes the Secretary of Agriculture to cooperate with state and local governments in planning and conducting improvements for soil conservation and other purposes.

The Snow Survey and Water Supply Forecasting Program, administered by NRCS, is found in the Code of Federal Regulations 7 CFS 612. NRCS is charged with the responsibility of collection snow data to develop monthly water supply forecasts from January through June in partnership with the National Weather Service, and to maintain and make publically available the database.

National Oceanic and Atmospheric Administration

To understand and predict changes in Earth's environment and conserve and manage coastal and marine resources to meet our Nation's economic, social, and environmental needs

NOAA/National Weather Service

The National Weather Service (NWS) provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community.

NOAA/National Ocean Service

The National Ocean Service (NOS) works to observe, understand, and manage our nation's coastal and marine resources. NOS measures and predicts coastal and ocean phenomena, protects large areas of the oceans, works to ensure safe navigation, and provides tools and information to protect and restore coastal and marine resources.

NOAA/NOS Center for Operational Oceanographic Products and Services

The Center for Operational Oceanographic Products and Services (CO-OPS) provides the national infrastructure, science, and technical expertise to monitor, assess, and distribute tide, current, water level, and other coastal oceanographic products and services that support NOAA's misson of environmental stewardship and environmental assessment and prediction. CO-OPS provides operationally sound observations and monitoring capabilities coupled with operational Nowcast Forecast modeling.

NOAA/NOS Office of Response and Restoration

The Office of Response and Restoration (OR&R) protects coastal and marine resources, mitigates threats, reduces harm, and restores ecological function. The Office provides comprehensive solutions to environmental hazards caused by oil, chemicals, and marine debris.

NOAA/National Geodetic Survey

Authority: ***COAST AND GEODETIC SURVEY ACT - 33 U.S.C. 883 et seq, HYDROGRAPHIC SERVICE IMPROVEMENT ACT OF 1998 and 2002 Amendments - 33 U.S.C. 883a et seq***

National Response Framework – ESF's # 1, 11, 13

Mission Statement: The mission of the National Geodetic Survey (NGS) is understood to be: 1) To define, maintain and provide access to the National Spatial Reference System (including the National Shoreline) to meet our nation's economic, social, and environmental needs, and 2) To be a world leader in geospatial activities, including the development and promotion of standards, specifications, and guidelines.

US Army Corps of Engineers

Public Law 71 (Coastal and Tidal Areas - Survey - Damages), 84th Congress, 1955.

US Air Force

Memorandum of Agreement between the USAF Reserve and NOAA dated May 4, 1992.

Civil Air Patrol

The Civil Air Patrol (CAP) is chartered under 36 U.S.C. 201 et. seq. and is a civilian auxiliary of the USAF. The USAF is authorized under 10 U.S.C. 9441 to use the services of the CAP to fulfill its non-combat missions. The 5-year umbrella Memorandum of Understanding between the DoD and OFCM was signed 4 May 2007.

US Geological Survey

The Water Resources Division of the USGS is responsible for the coordination of the water-data acquisition activities of all federal agencies as mandated by Office of Management and Budget Memorandum No. M-92.01.

The American Association for Wind Engineering

The American Association for Wind Engineering (AAWE) was originally established as the Wind Engineering Research Council in 1966 to promote and disseminate technical information in the research community. In 1983 the name was changed to American Association for Wind Engineering and incorporated as a nonprofit professional organization. The multi-disciplinary field of wind engineering considers problems related to wind and associated water loads and penetrations for buildings and structures, societal impact of winds, hurricane and tornado risk assessment, cost-benefit analysis, codes and standards, dispersion of urban and industrial pollution, wind energy and urban aerodynamics. AAWE membership consists of academic and industry experts in wind effects on structures, and stands ready to assist in the event of wind disasters.

University of Florida Wind and Surge Research Group

The Department of Civil and Coastal Engineering at the University of Florida retain faculty with expertise in extreme wind events, surge and flood events, and the construction of hazard resistant infrastructure. The faculty are experienced in post disaster field investigations of structure performance, and provide during-event real-time monitoring of extreme winds during land falling hurricanes.

APPENDIX B UNIFORM RESOURCE LOCATOR (URL) ADDRESSES

FOR
PARTICIPATING FEDERAL AGENCIES AND GROUPS

American Association for Wind Engineering	www.aawe.org
Department of Homeland Security	http://www.dhs.gov/index.shtm
Homeland Security Information Network	https://government.hsin.gov
Federal Emergency Management Agency	www.fema.gov
Building Performance Assessment Team	www.fema.gov/mit/bpat/bp_faqs.htm
National Institute of Standards and Technology	www.nist.gov
National Oceanic and Atmospheric Administration	www.noaa.gov
National Weather Service	www.nws.noaa.gov
National Geodetic Survey	www.ngs.noaa.gov
National Ocean Service	www.nos.noaa.gov
Center for Operational Oceanic Products and Services	www.co-ops.nos.noaa.gov
Coastal Services Center	www.csc.noaa.gov
Office of the Federal Coordinator for Meteorological Services and Supporting Research	www.ofcm.gov
Civil Air Patrol Request Form	http://www.ofcm.noaa.gov/wg-ndr-psda/reference.htm
All Agency Metadata	http://www.ofcm.noaa.gov/wg-ndr-psda/metadata.htm
Event Summaries	http://www.ofcm.noaa.gov/wg-ndr-psda/eventsum.htm
National Resources Conservation Service	www.nrcs.usda.gov
University Wind Research Consortium	http://fcmp.ce.ufl.edu/ http://www.atmo.ttu.edu

US Air Force	www.af.mil www.hurricanehunters.com
US Army Corps of Engineers	www.usace.army.mil
US Department of Agriculture	www.usda.gov
US Department of Transportation	www.dot.gov
Federal Highway Administration	www.fhwa.dot.gov
US Geological Survey	www.usgs.gov

APPENDIX C MEMBERSHIP LIST

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Status Codes:

CH = Chairperson
ES = Executive Secretary
M = Member
CC = Info Copy

APPENDIX D SAFFIR-SIMPSON HURRICANE SCALE

The Saffir-Simpson Hurricane Scale is a 1-5 rating based on the hurricane's present intensity. This is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the scale, as storm surge values are highly dependent on the slope of the continental shelf and the shape of the coastline, in the landfall region. Note that all winds are using the U.S. 1-minute average.

Category One Hurricane:

Winds 74-95 mph (64-82 kt or 119-153 km/hr). Storm surge generally 4-5 ft above normal. No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Some damage to poorly constructed signs. Also, some coastal road flooding and minor pier damage. Hurricane Lili of 2002 made landfall on the Louisiana coast as a Category One hurricane. Hurricane Gaston of 2004 was a Category One hurricane that made landfall along the central South Carolina coast.

Category Two Hurricane:

Winds 96-110 mph (83-95 kt or 154-177 km/hr). Storm surge generally 6-8 feet above normal. Some roofing material, door, and window damage of buildings. Considerable damage to shrubbery and trees with some trees blown down. Considerable damage to mobile homes, poorly constructed signs, and piers. Coastal and low-lying escape routes flood 2-4 hours before arrival of the hurricane center. Small craft in unprotected anchorages break moorings. Hurricane Frances of 2004 made landfall over the southern end of Hutchinson Island, Florida as a Category Two hurricane. Hurricane Isabel of 2003 made landfall near Drum Inlet on the Outer Banks of North Carolina as a Category 2 hurricane.

Category Three Hurricane:

Winds 111-130 mph (96-113 kt or 178-209 km/hr). Storm surge generally 9-12 ft above normal. Some structural damage to small residences and utility buildings with a minor amount of curtainwall failures. Damage to shrubbery and trees with foliage blown off trees and large trees blown down. Mobile homes and poorly constructed signs are destroyed. Low-lying escape routes are cut by rising water 3-5 hours before arrival of the center of the hurricane. Flooding near the coast destroys smaller structures with larger structures damaged by battering from floating debris. Terrain continuously lower than 5 ft above mean sea level may be flooded inland 8 miles (13 km) or more. Evacuation of low-lying residences with several blocks of the shoreline may be required. Hurricanes

Jeanne and Ivan of 2004 were Category Three hurricanes when they made landfall in Florida and in Alabama, respectively.

Category Four Hurricane:

Winds 131-155 mph (114-135 kt or 210-249 km/hr). Storm surge generally 13-18 ft above normal. More extensive curtainwall failures with some complete roof structure failures on small residences. Shrubs, trees, and all signs are blown down. Complete destruction of mobile homes. Extensive damage to doors and windows. Low-lying escape routes may be cut by rising water 3-5 hours before arrival of the center of the hurricane. Major damage to lower floors of structures near the shore. Terrain lower than 10 ft above sea level may be flooded requiring massive evacuation of residential areas as far inland as 6 miles (10 km). Hurricane Charley of 2004 was a Category Four hurricane made landfall in Charlotte County, Florida with winds of 150 mph. Hurricane Dennis (pdf) of 2005 struck the island of Cuba as a Category Four hurricane.

Category Five Hurricane:

Winds greater than 155 mph (135 kt or 249 km/hr). Storm surge generally greater than 18 ft above normal. Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. All shrubs, trees, and signs blown down. Complete destruction of mobile homes. Severe and extensive window and door damage. Low-lying escape routes are cut by rising water 3-5 hours before arrival of the center of the hurricane. Major damage to lower floors of all structures located less than 15 ft above sea level and within 500 yards of the shoreline. Massive evacuation of residential areas on low ground within 5-10 miles (8-16 km) of the shoreline may be required. Only 3 Category Five Hurricanes have made landfall in the United States since records began: The Labor Day Hurricane of 1935, Hurricane Camille (1969), and Hurricane Andrew in August, 1992. The 1935 Labor Day Hurricane struck the Florida Keys with a minimum pressure of 892 mb--the lowest pressure ever observed in the United States. Hurricane Camille struck the Mississippi Gulf Coast causing a 25-foot storm surge, which inundated Pass Christian. Hurricane Katrina (pdf), a category 5 storm over the Gulf of Mexico, was still responsible for at least 81 billion dollars of property damage when it struck the U.S. Gulf Coast as a category 3. It is by far the costliest hurricane to ever strike the United States. In addition, Hurricane Wilma (pdf) of 2005 was a Category Five hurricane at peak intensity and is the strongest Atlantic tropical cyclone on record with a minimum pressure of 882 mb.

APPENDIX E ENHANCED FUJITA SCALE FOR TORNADO DAMAGE

The original Fujita Scale was updated by a team of meteorologists and wind engineers and implemented in the U.S. on 1 February 2007.

FUJITA SCALE			DERIVED EF SCALE		**OPERATIONAL EF SCALE**	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	**EF Number**	**3 Second Gust (mph)**
0	40-72	45-78	0	65-85	**0**	**65-85**
1	73-112	79-117	1	86-109	**1**	**86-110**
2	113-157	118-161	2	110-137	**2**	**111-135**
3	158-207	162-209	3	138-167	**3**	**136-165**
4	208-260	210-261	4	168-199	**4**	**166-200**
5	261-318	262-317	5	200-234	**5**	**Over 200**

***** IMPORTANT NOTE ABOUT ENHANCED F-SCALE WINDS:** *The Enhanced F-scale still is a set of wind estimates (not measurements) based on damage.* Its uses three-second gusts estimated at the point of damage based on a judgment of 8 levels of damage to the 28 indicators listed below. These estimates vary with height and exposure. **Important**: The three-second gust is not the same wind as in standard surface observations. Standard measurements are taken by weather stations in open exposures, using a directly measured, "one minute mile" speed.

For Enhanced F Scale damage indicators, see the NOAA Storm Prediction Center website: http://www.spc.noaa.gov/efscale/ef-scale.html

APPENDIX F NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION INTERNAL PROCEDURES

National Weather Service policy for tsunami surveys is available at:
http://www.nws.noaa.gov/directives/sym/pd01007003curr.pdf

National Weather Service policy for Service Assessments is available at:
http://www.nws.noaa.gov/directives/sym/pd01016006curr.pdf

National Weather Service policy for Post Storm Data Acquisition is available at:
http://www.nws.noaa.gov/directives/sym/pd01016004curr.pdf

National Ocean Service Support for Post-Storm Data Acquisition and Mapping

1.) Via the NOAA Emergency Response Program (EMR) the NOAA Coastal Services Center provides training modules on how to access, process, and use NOAA forecast and observation data in geospatial formats before, during, and after a storm event . Primary audience for training module is DHS/FEMA personnel, NOAA ICC staff, and NOAA HSOC staff for creation of situational awareness maps for decision briefings. http://www.csc.noaa.gov/storm_info/tutorial.html

2.) The NOAA Tides Online Web page provides users with immediate graphical and tabular water-level and meteorological data from NOS water-level stations located along the projected path of severe storms such as hurricanes. Products include time series graphs of observed vs. predicted astronomical tides and various other meteorological variables, including wind speed and direction. This information is updated hourly during calm conditions, and every eighteen minutes in storm surge mode. The CO-OPS Continuous Operational Real-Time Monitoring System (CORMS) program monitors the operational status and data quality of all stations in both the national Physical Oceanographic Real-Time System (PORTS) and the National Water Level Observation Network (NWLON). CORMS is manned 24 hours a day by contract watchstanders on 12-hour shifts. Once the NHC/TPC identifies a tropical storm, CORMS watchstanders begin tracking the storm and reporting its progress to CO-OPS personnel. As soon as the storm approaches the coast, the watchstanders manually call the data collection platforms (DCPs) at stations within the projected track, and trigger the DCPs to transmit data every 18 minutes rather than the typical one- or three-hour intervals. Once triggered, a station becomes listed as currently active on the page. Stations may also become listed if water levels exceed predetermined upper and lower limits coded into the software (site specific). This “storm surge mode” is an automatic process. CO-OPS also provides a series (at least once per day) of storm surge "Quicklook" Web-based products during each event that shows summaries of significant storm surges and meteorological data observed at NOAA-operated and NOAA-partnership stations within the areas affected. http://tidesandcurrents.noaa.gov/quicklook.shtml

3.) The NOAA National Geodetic Survey provides aerial remote sensing support for hurricane recovery and rebuilding efforts including data acquisition, processing, and dissemination.

4.) Under the NOAA Emergency Response Program (EMR) NOS provides technical assistance for disaster response, recovery and rebuilding efforts to include coastal resource management, support to application of Geographic Information System and remote sensing data, planning process support, (includes community participation process design and facilitation,) assist with recovery project development.

5.) Under the NOAA Emergency Response Program (EMR) NOS provides real-time water levels, currents, winds and other oceanographic and meteorological measurements for major US port areas." Center for Operational Oceanographic Products and Services (CO-OPS). This infrastructure acquires and disseminates observations and predictions of data and information necessary to ensure secure, safe, efficient environmentally sound maritime commerce. The real-time tides and current critical infrastructure supports national security, safe navigation, sustainable coastal communities, and disaster response. Real-time water levels and current information are essential to post-incident environmental impacts and waterway evacuation.

6.) Under the NOAA Emergency Response Program (EMR) NOS coordinates and/or conduct side scan and multi-beam surveys in impacted regions to identify marine debris fields and other obstructions in-navigable areas, including navigation channels, approaches to impacted ports, and critical fishing habitat areas.

7.) Under the NOAA Emergency Response Program (EMR) NOS responds to and mitigate the consequences of spills and other hazards that threaten coastal environments." ...providing accurate, timely and relevant scientific advice to organizations charged with responding to and mitigating the consequences of spills and other hazards that threaten coastal environments and communities. The HAZMAT scientific team provides key technical advice during spills of oil or hazardous materials in the coastal zone. To do this, the HAZMAT team is on-call 24-hours a day, every day of the year. HAZMAT also responds to other technological and natural coastal hazards such as hurricanes and airplane crashes. HAZMAT carries out these functions under the National Response Plan and the National Oil and Hazardous Substances Pollution Contingency Plan. This group operates CAMEO, a well known NOAA software program which is in use at over 10,000 places. CAMEO (Computer Aided Management to Emergency Operations) provides first responders and emergency planners with information to quickly respond to chemical accidents.

APPENDIX G UNITED STATES GEOLOGICAL SURVEY INTERNAL PROCEDURES

Generic Flood Plan for Documenting Storm-Surge High-Water Marks

I. PROJECT ORGANIZATION

A. Project Oversight and Coordination

1. Water Science Center (WSC) Flood Coordinator

a. Monitor network - Determine status of satellite link and data collection platforms. Determine status of other gaging stations in affected area.

b. Flood measurement - Determine if flooding has occurred and oversee the organization of field crews and technicians to make flood measurements on streams impacted by heavy precipitation if needed.

c. Storm surge - Organize personnel for the collection of high-water marks in the impacted area. Assign someone the duty of project chief and authorize to direct other personnel as needed.

e. Survey contacts - Determine the need for additional personnel and make appropriate contacts to temporarily obtain personnel from other WSCs.

f. Other contacts - Notify appropriate agencies as per the decisions of the OFCM Post-Storm Data Acquisitions Working Group.

II. STORM-SURGE DOCUMENTATION

A. Advance Planning

1. Maps - Several sets of quad maps of coastal areas could be obtained and kept on hand in case of a hurricane event.

2. Transects - Coastal transacts can be defined prior to a hurricane event.

3. Bench marks - Information for benchmarks located in coastal counties can be obtained prior to the hurricane event. Sources include the National Geodetic Survey and county engineers.

4. Other agencies - Information about other agencies that would be involved in a hurricane event could be compiled prior to a hurricane event. This would include local agencies such as levee districts and county engineers.

B. Equipment

1. Transportation and lodging - At least one vehicle is needed for each field crew. Personnel on loan from neighboring WSCs should be encouraged to bring a vehicle if needed. Boats may be needed to reach remote areas. Lodging in the impacted are may be difficult to obtain due to the influx of insurance adjusters, utility repairmen, etc. Reservations for a lodging as close as possible to the impacted area should be made immediately after the storm.

2. Maps, transacts, and benchmarks - Each field crew should be given a set of quad maps for their assigned area. If available, maps and information about benchmarks in their area should also be given to each crew.

3. Surveying equipment - Each field crew should have at least one field notebook, level, tripod, rod, 50-ft. steel tape, and folding engineers rule for surveying. They should also have an adequate supply of spray paint, chalk, magic markers, flagging, stakes, nails, cold chisel, and a hammer for flagging and surveying the high-water marks. A carpenters level is also handy for carrying marks around comers.

4. Cameras - Each field crew should have a camera. The disposable cameras work well, but each photograph should be documented in the field book. Polaroid cameras, that give you the photo on the spot, also work well because you can put information directly on the photo. However, getting reprints of these can be costly.

5. Mobile phones - Mobile phones can be useful to field crews. The field crews need to make daily contact with the project chief, at least in the initial stages of the investigation, and the impacted areas have often lost phone services.

6. Global Positioning Systems - The portable "Pathfinder" units work extremely well for documenting high-water mark locations. Elevation measurements made using the larger GPS systems may not produce the level of accuracy required for the study.

7. Other - Field crews may need rubber boots, rain gear, insect repellent, shovels, and machetes. In addition, field crews may need documents or permits from appropriate agencies authorizing passage through roadblocks into stricken areas.

C. High-water Mark Data Collection

1. Project Chief

   a. Assignment of duties - The project chief is responsible for the assignment of areas or transacts to the field crews and the designation of a leader for each crew. The project chief is also responsible for providing the field crews with benchmark information and necessary maps.

b. Data checks - The project chief is responsible for collecting and checking field data from the crews as it becomes available. Make copies of field notes as they become available. Transfer data from field maps to a master set and check for completeness of coverage and cohesiveness of adjacent high-water mark elevations. The project chief is also responsible for collecting all field notebooks, maps, and film at the end of the surveying phase of the project.

c. Field perspective - The project chief should spend most of his time in the field collecting data so that he becomes completely familiar with the situation, and can be in constant contact with the other field crews.

d. Local agencies - The project chief should meet with local, State, and federal agencies with common interests in storm-surge documentation and compare notes and ideas.

2. Field crews

a. Equipment - Field crews should be responsible for obtaining and maintaining the necessary vehicles and equipment.

b. Lodging - Field crews should make the necessary lodging arrangements as soon as possible after they receive their assignments.

c. Documentation - Each crew is responsible for the full and complete documentation of the storm-surge in their assigned area.

3. Flagging high-water marks

a. Locating marks - Talking to locals in the area is the best way to find out about the storm-surge in an area. Stop and ask when you see someone outside of his or her house or business. Once you've identified one high-water mark, it is not too difficult to track the highwater along the remainder of the transect.

b. Transits –Try to establish a transit lines so that transits are grouped closely (every mile or so) near the area of center of the landfall and every 5-10 miles along remainder the landfall area. Near shores and beaches try to locate marks every 200-500 yards with increasing distance between inland marks up to a mark along the transect until the marks edge of highwater.

c. River sections –Once the transects have been flagged, focus on moving inland along rivers and streams. For very wide water bodies, flag marks on both shores. Emphasize flagging marks near bridges and constrictions or at breaks in stream slopes with multiple marks leading up to, under, and away from the bridge so that still water and drawdown conditions are documented.

d. The best marks are found inside closed structures, or other places that are sheltered from wave action. Always try to find other marks nearby that will corroborate with the one you found.

b. Documenting marks

(1) Location - Note the mark's location on the map and in the field notes. Identify the transect, quad map, street address, and latitude and longitude, if available, in the field notes. Notes should be taken of the location of the mark in or on the structure, and a sketch should be made. Detailed descriptions should be made so that another person could find the mark using the notes. An identifying mark should be made with chalk, magic marker, paint, flagging, etc. in case the actual mark is destroyed by cleaning or rain. The mark should also be assigned a number which is noted at the site, in the notes, and on the map. Preliminary measurements from the floor or ground to the mark should be made using a steel tape or engineer's rule.

(2) Classification – Based on circumstances and physical evidence determine whether the mark is the result of wave action, still-water surge, or riverine flooding and so indicate on the field form. The notes should also indicate whether the mark is inside or outside of a structure.

(3) Characterization -The mark should be classified by line type, such as debris, seed, stain, wash, drift, etc. The quality of the line should also be noted as a function of the spread or scatter of highwater mark material and the continuity of the mark: Excellent +/1 .05 ft., Good +/- 0.1 ft., Fair +/- 0.25 ft., Poor > 0.25 ft.

(3) Photographs - At least one photo should be taken of each high-water mark. Because the lines defining high-water marks can often be faint, the line should be pointed to or otherwise marked for ease in identification in the photo. A photo of the structure should also be taken to facilitate finding it again at a later date. Keep a log of photos taken.

(4) Other - For each high-water mark, identify the members of the flagging crew, the day, and the time of day.

4. Surveying high-water marks -Deferential surveying

a. Peg test - Conduct a 2-peg test once a week. Note the serial number of the level, the type of rod used, the persons conducting the test, and the date.

b. Survey procedures – In general, follow survey standards for indirect flow determinations as described by USGS TWRI Book 3, Chapter A1 (http://pubs.usgs.gov/twri/twri3-a1/html/pdf/twri_3-A1_a.pdf). Run a survey loop from a temporary benchmark (TBM) to each high-water mark using standard surveying rules for accuracy (+/- 0.01 ft for highwater marks). Make at least one ground shot for a representative ground elevation and one water-surface shot for a representative water-surface elevation (if possible). Also survey the tops of levees or roads and ground surfaces on each side. Note the TBM identification, high-water mark number, transect, surveying crew, date, and time of day. Keep standard surveying notes.

c. Sketches - Make a detailed sketch or sketches showing location of bench mark, high-water marks, presence of bridges, dunes, etc., and approximate surveying route.

d. Maps - Transfer the high-water mark elevations to maps and note similarity to elevations of nearby marks. If elevations differ significantly, try to find out why.

III. WATER QUALITY DATA COLLECTION

A. Manpower - The WSC Water-Quality Specialist is responsible for organizing the collection of water quality data from areas impacted by the storm. Crews should be made up of two persons each, one to drive the boat, and another to collect samples and conduct measurements. The number of crews used will depend on the size of the impacted area, the sampling coverage desired, and funding.

B. Equipment - Each crew will require a vehicle, boat, sample bottles, Hydrolab, maps, and field notebook. A camera should also be used to record significant effects of the storm, such as damaged trees and fishkills.

C. Sampling Parameters - Dissolved oxygen and biochemical oxygen demand are the important parameters to measure immediately after the storm's passage, especially in wetlands. Nutrient information is also desirable to further document the effects of the storm. Chloride concentration, or specific conductance, is good indicators of the extent of salt-water intrusion into freshwater areas.

D. Sampling frequency - The number of sites sampled is dependent on the availability of funds, the size of the area covered, and the level of coverage desired. The sites should be resampled at a rate sufficient to determine the storm's impact on water quality and the recovery of water quality to normal conditions. The resampling rate will often be higher during the first weeks after the storm, then slow down later as recovery rates are determined.

APPENDIX H CIVIL AIR PATROL FORMS

Civil Air Patrol (CAP) over flight support	
Name of requester:	*<your name>*
Agency:	*<your office goes here>*
Office location:	*<please give city, state>*
Telephone:	*<best way(s) to reach you>*
Fax:	*<your local office/ICP fax goes here>*
Email:	*<your e-mail>*
Significant weather/event type:	*<some options are: coastal pre-storm assessment; hurricanes; severe convective outbreaks, including tornadoes, hail, and high winds; wildfires; tsunamis; river flooding; winter storms; volcanic eruptions; long term inland flooding, long term ice movement, etc.)*
Date of occurrence of event:	*<when will or did this event occur?>*
Time of occurrence of event:	*<when will or did this event occur?>*
state(s):	*<where will or did this event occur?>*
County(ies):	*<where will or did this event occur?>*
nearest populated area(s):	*<where will or did this event occur?>*
Location and description of flight support required *<attach simple map showing flight route>*	
state(s) of flight:	*<location of flight>*
County(ies) of flight:	*<location of flight>*
nearest population area(s):	*<location of flight>*
Identify action to be taken on flight: *<Flight only, photography>*	
estimated flight time:	
estimated flight distance:	
Any other information (e.g., additional contacts, additional Federal passengers): If flight could prevent loss of life and/or property explain that here in detail. **E-mail to:nws.ofcm.cap@noaa.gov (subject = *"CAP Request"*) or fax to 301-427-2007; then call 301-427-2002.**	

Post Civil Air Patrol (CAP) Flight Form	
Month/Date/Year of CAP flight:	*<mm/dd/yy>*
Type of aircraft utilized:	*<Type of CAP aircraft used during mission>*
Location of CAP flight:	*<general description of where flight took place>*
Total Flight Hours:	*<CAP crew can provide this info>*
CAP cost (if known):	*<CAP crew might be able to provide this info>*
Office(s) affected:	*<list local offices participating on flight>*
Personnel onboard:	*<list local office personnel onboard with job title>*
What was learned from this overflight mission/other pertinent details:	*<some options are: final EF-scale rating; if other federal passengers were onboard; any direct benefit(s) from doing overflight (vs. a ground survey); key insights for damage assessment or coastal pre-storm assessment; etc.>*

Upon completion of the mission utilizing CAP, and no later than 14 days after, e-mail this completed form to **nws.ofcm.cap@noaa.gov** **(with subject = *"CAP mission report"*).**

If this was a *NWS mission, e-mail* to: nws.metwatch@noaa.gov (with subject = *"CAP mission report"*)

*** OFCM is the federal lead for tracking, coordinating and reimbursing CAP flight costs.

APPENDIX I PRE-SCRIPTED MISSION ASSIGNMENT

<table>
<tr><th colspan="6">MISSION ASSIGNMENT PROPOSED STATEMENT 0F WORK (PSOW)</th></tr>
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<tr><td colspan="3">Federal Department/Agency:</td><td>ESF #:
Supporting Mitigation Operations</td><td colspan="2">Tracking No.:</td></tr>
<tr><td colspan="4">I. Title:</td><td colspan="2">Date: MM-DD-YYYY</td></tr>
<tr><td colspan="6">II. Description of Requested Assistance</td></tr>
<tr><td colspan="6">IV. Justification/Statement of Work</td></tr>
<tr><td colspan="6">IV. Cost Estimate:
Total Estimated Cost: TBD</td></tr>
<tr><th colspan="6">FEMA COORDINATION</th></tr>
<tr><th>Organization</th><th>Date</th><th>Approve/Disapprove</th><th>Organization</th><th>Date</th><th>Approve/Disapprove</th></tr>
<tr><td>Response Div.</td><td></td><td></td><td>OCC</td><td></td><td></td></tr>
<tr><td>Recovery/PA Div.</td><td></td><td></td><td>CFO</td><td></td><td></td></tr>
<tr><td>Logistics</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Mitigation</td><td></td><td></td><td></td><td></td><td></td></tr>
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PSDA Statement of Work For Potential PSDA Pre-Scripted Mission Assignment

Federal Agencies: US Army Corps of Engineers (USACE), National Oceanographic and Atmospheric Administration (NOAA) and the United States Geological Survey (USGS)

Title: Collection of Storm Surge Water Level, High Water Mark, and Real-time Overland Wind Data

I Introduction

The purpose of this Mission Assignment is to enhance the capabilities of ESF #5, 9 and 14 coordinators with real time data to be used in a pre- and post disaster environment. Real time data will enable **Emergency Management, ESF #5**, coordinators to significantly augment emergency management operations by providing accurate and reliable scenarios for life safety operations and Incident Management decision making. **Urban Search & Rescue, ESF #9,** coordinators and **Hazard Performance and Analysis Teams** will be able to use the information to delineate damage areas to better organize their reconnaissance. This will enable the teams to respond with the appropriate technical members for each area to be investigated. Finally, **Long Term Community Recovery, ESF #14,** coordinators can begin to work with community officials to re-enact the event and offer accurate planning mitigation practices. The immediate use of this and other data can support critical re-entry planning or response decision making as well as to support **HMGP**, **NFIP** and other FEMA programs. This data can be analyzed to show the findings and trends.

The Office of Federal Coordinator for Meteorological Service and Supporting Research has established the Working Group for Natural Disaster Reduction and Post-Storm Data Acquisition (WG/NDR/PSDA) to ensure a coordinated effort to collect environmental data that is imperative to properly monitor and characterize storms and floods. The WG/NDR/PSDA consists of elements from NOAA, USACE, USGS, and FEMA. A detailed data-collection plan is available at http://www.ofcm.gov/homepage/text/pubs.htm. In general, this plan outlines the process to deploy new technologies that transmit real-time reporting of some water elevations and wind data. This Mission Assignment tasks the WG/NDR/PSDA, through its constituent agencies, to accomplish the specific elements of the plan that support FEMA response and recovery operations under Section 402(3) of the Amended Stafford Act.

II Description of Requested Assistance

This PSMA tasks:

(1) The USGS with pre-positioning telemetered and non-telemetered sensors to record stream, river, and overland flood depths and the USACE for the pre-positioning of similar equipment to record near shore depths and wave heights during storm-induced flooding, especially storm surge;

(2) NOAA with pre-positioning multiple, portable overland weather monitoring stations to record vital wind speed, wind direction, temperature, and barometric pressure data, and relay this data in real-time to NOAA and emergency managers;
(3) USGS, NOAA, and USACE for support of FEMA and FEMA contractors for the post-storm acquisition and analysis of high water mark and wind data

III Justification

The purpose of the above three tasks is to facilitate an improvement in forecasting, disaster management, and recovery activities by the deployment of real-time and post-storm monitoring equipment (wind, surge and flood data) in the path of the storm prior to landfall and to expedite the computation of advisory flood elevations and claims settlements by gathering high water mark and wind data. These data can also be used by Hazard Performance and Analysis Teams to rapidly quantify damage in support of disaster assessment.

Emergency managers depend greatly on wind and river data for planning and managing hurricane and flood-disaster response and recovery operations. But often, there are too few hardened stations to adequately monitor wind and flood conditions to support operations before, during, or after a disaster.

In recent years the USGS, NOAA, USACE, and university researchers have developed mobile wind and water sensors that can be rapidly deployed to monitor hurricane impacts along the coast and inland. While these sensors were originally developed for research, some can provide real-time data that can be used by forecasters and emergency planners to assess pending damages and monitor evacuation routes and potential staging areas.

IV Statement of Work

(1) The USGS will deploy mobile sensors to form a network that will transmit tidal surge or inland water elevation data as frequently as every 15 minutes. These sensors will be strapped to selected bridge piers, power poles and fire hydrants at approximately 30-70 locations along the coast, in rivers, or in low lying areas. While most instruments will provide data for post-storm purposes, selected units will provide real time data. These real-time units will be placed along hurricane evacuation routes, near important infrastructure (roads, bridges, water and waste-water facilities, hospitals), and at other potential response-recovery staging facilities. This will provide emergency managers with reconnaissance level information about the storm’s maximum and current water depths and the associated rates of rise and fall. This real-time data will allow response teams to rapidly assess the pending disaster area for staging areas and to estimate the duration of flooding at pre-determined critical facilities or shelters. Following the storm, the USGS will recover the instruments and download the data for the non-telemetered sites and place it on a USGS webpage (Waterdata.usgs.gov/XX/nwis/rt where “XX” is the 2-letter abbreviation for the state of interest). The USGS will also survey all of the instruments to a common elevation datum so that the data can be used to aide in the development of a flood map. A detailed work plan is available at http://www.ofcm.gov/homepage/text/pubs.htm.

(2) NOAA has contracted with the University Wind Research Consortium, headed by the University of Florida to pre-position portable weather monitoring stations to record vital wind speed, wind direction, temperature, and barometric pressure data in and around the area of hurricane landfall. This data will then be relayed in real-time to NOAA monitoring stations consisting of 6 trailer mounted instrument

towers that can be deployed and set up prior to landfall. Typically, several towers are clustered near the area of projected landfall, while others are spread along the coast. This provides a recording of both the peak and the breadth of intensity. The specific deployment strategy can be altered within hours of landfall to optimize the dataset, which is a function of specific storm parameters (size, intensity, translation speed). Instrument deployment teams have historically worked closely with NOAA HRD personnel to jointly plan deployments. The program has been operational since 1999, and has been providing real-time data streams since Isabel in 2003. The real-time data stream has been used by HRD to refine intensity forecasting just prior to landfall (example: Dennis, 2005).

(3) USGS and USACE will support FEMA and FEMA contractors by deploying personnel to flooded areas to identify, characterize, and denote high water locations. In addition, if requested by FEMA, they will survey the high water marks to a common datum. At its own expense, the USGS will determine the high water elevations and report the magnitude of flood flows at current USGS stream gauges and will attempt to assign a recurrence interval to those flows. If FEMA tasks them, the USGS will also flag high water marks at discontinued stream gauges, flood-peak gauging stations, and other locations of significant interests (bridges, dams, etc.). If hydraulic conditions are favorable, the USGS will determine peak flows to aide in assigning a recurrence interval to the flood flows at these locations. USGS and USACE operations for denoting high water mark locations and the subsequent surveying will be performed in a manner consistent with FEMA protocols, except at stream gauging stations and flood-peak gauging stations where high water marks, river profiles, and stream cross-sections will be surveyed to more stringent USGS protocols to permit the computation of flows.

APPENDIX J FEMA NATIONAL RESPONSE COORDINATION CENTER CRITICAL PHONE NUMBERS

AREA A

Position	Phone 202-646-xxxx	E-mail
FEMA NRCC Activation Team Box	n/a	FEMA-NRCC-activationteam@dhs.gov
DOD-NGB Liaison	2438	FEMA-NRCC-dodngb@dhs.gov
DOD Liaison	2438	FEMA-NRCC-dod@dhs.gov
DHS HSIN Liaison	2460	FEMA-NRCC-hsin@dhs.gov
NRCC Activation Team Officer	2425*	FEMA-NRCC-teamofficer@dhs.gov
NRCC Deputy Team Officer	2496	FEMA-NRCC-teamdeputy@dhs.gov
ESF 1	2441	FEMA-NRCC-esf01@dhs.gov
ESF 1 a	2441	FEMA-NRCC-esf01a@dhs.gov
Admin Specialist Leader	2424 / 2425*	FEMA-NRCC-adminlead@dhs.gov
Admin Assistant Specialist	2428	FEMA-NRCC-adminasst@dhs.gov
External Affairs PAO	2456	FEMA-NRCC-esf15pao@dhs.gov
External Affairs CLO	2457	FEMA-NRCC-esf15clo@dhs.gov
ESF 13	2490	FEMA-NRCC-esf13@dhs.gov
Security Specialist	2465	FEMA-NRCC-security@dhs.gov
Infrastructure Branch Director	3324	FEMA-NRCC-infradirector@dhs.gov
ESF 12	3201	FEMA-NRCC-esf12@dhs.gov
Logistics TAV Liaison	2435	FEMA-NRCC-logtav@dhs.gov
Logistics Support Deputy	2440	FEMA-NRCClogsupportdeputy@dhs.gov
Logistics Section Chief	2405	FEMA-NRCC-logsecchief@dhs.gov
ESF 8 a	2993	FEMA-NRCC-esf08a@dhs.gov
ESF 8 b	2468	FEMA-NRCC-esf08b@dhs.gov
ESF 8	2448	FEMA-NRCC-esf08@dhs.gov
Emergency Services Branch Director	2444	FEMA-NRCC-emdirector@dhs.gov
ESF 3 b	2762	FEMA-NRCC-esf03b@dhs.gov
ESF 3 a	2459	FEMA-NRCC-esf03a@dhs.gov
ESF 3	2443	FEMA-NRCC-esf03@dhs.gov
ESF 7 (GSA)	3382	FEMA-NRCC-esf07@dhs.gov
ESF 7 b (Liaison to LRC)	2429	FEMA-NRCC-esf07b@dhs.gov
ESF 11 a	2451	FEMA-NRCC-esf11a@dhs.gov
ESF 11	2413	FEMA-NRCC-esf11@dhs.gov

Area A (Continued)

Position	Phone 202-646-xxxx	E-mail
ESF 10 (EPA)	2466*	FEMA-NRCC-esf10epa@dhs.gov
ESF 10 (USCG)	2466*	FEMA-NRCC-esf10uscg@dhs.gov
ESF 4	2458*	FEMA-NRCC-esf04@dhs.gov
ESF 4 a	2458*	FEMA-NRCC-esf04a@dhs.gov
ESF 2	2442	FEMA-NRCC-esf02@dhs.gov
US Coast Guard Liaison	2431	FEMA-NRCC-uscg@dhs.gov
ESF 1 (Aviation)	3200	FEMA-NRCC-esf01avia@dhs.gov
Operations Deputy	2461	FEMA-NRCC-opsdeputy@dhs.gov
Operations Section Chief	2430	FEMA-NRCC-opschief@dhs.gov
ESF 14	2518	FEMA-NRCC-esf14@dhs.gov
Mitigation Planner	2467	FEMA-NRCC-mitigation@dhs.gov
Mitigation Planner b	2454	FEMA-NRCC-mitigationb@dhs.gov
F/A Admin Specialist	2420	FEMA-NRCC-financeadmin@dhs.gov
Donations Specialist	2453	FEMA-NRCC-donations@dhs.gov
NOVAD Specialist	2452	FEMA-NRCC-novad@dhs.gov
ESF 6 (Disaster Assistance Directorate)	2450	FEMA-NRCC-esf06@dhs.gov
Red Cross	2446	FEMA-NRCC-redcross@dhs.gov
Human Services Branch Director	2988	FEMA-NRCC-humsdirector@dhs.gov
Mission Assignment Coordinator	2464	FEMA-NRCC-mac@dhs.gov
Operations Action Tracker	2437	FEMA-NRCC-opsacttracker@dhs.gov
F/A Section Chief (Comptroller)	2491	FEMA-NRCC-comptroller@dhs.gov
F/A Financial Specialist	2476	FEMA-NRCC-financespec@dhs.gov
ESF 9 SAR Team Leader	2449	FEMA-NRCC-esf09sar@dhs.gov
ESF 9 Ops Specialist	2492	FEMA-NRCC-esf09ops@dhs.gov
ESF 9 Admin Specialist	2483	FEMA-NRCC-esf09admin@dhs.gov
FEMA Logistics Response Center (LRC)	**3226**	**FEMA-LRC-Chief@dhs.gov**

AREA B

Position	Phone 202-646-xxxx	e-mail
NRCC Watch Officer	2828	FEMA-NRCC@dhs.gov
Current Ops Plans Leader	2439*	FEMA-NRCC-curopsplan@dhs.gov
Planning Section Chief	2470*	FEMA-NRCC-planchief@dhs.gov
Deputy Planning Chief	2470*	FEMA-NRCC-plandeputy@dhs.gov
Current Ops Planner a	4512	FEMA-NRCC-curopsplan@dhs.gov
Current Ops Planner b	4580	FEMA-NRCC-curopsplan@dhs.gov
Current Ops Planner c	4560	FEMA-NRCC-curopsplan@dhs.gov
Current Ops Planner d	4551	FEMA-NRCC-curopsplan@dhs.gov
Documentation Reports Specialist	3476	FEMA-NRCC-docrpts@dhs.gov
NRCC Assistant Can answer 2470 / 2439*	2992	FEMA-NRCC-assistant@dhs.gov
Situation Status Unit Leader	2473	FEMA-NRCC-sitstatlead@dhs.gov
Situation Status Information Specialist a	2474*	FEMA-NRCC-sitstatinfoa@dhs.gov
Situation Status Information Specialist b	2474*	FEMA-NRCC-sitstatinfob@dhs.gov
NRCC Watch Analyst a (24/7)	2482	FEMA-NRCC@dhs.gov
NRCC Watch Analyst b (24/7)	2481	FEMA-NRCC@dhs.gov
NRCC Watch Analyst c (24/7)	2472	FEMA-NRCC@dhs.gov
NRCC Watch Analyst d (24/7)	3244	FEMA-NRCC@dhs.gov
Resource Tracking Specialist (LRC supports)	hold	FEMA-NRCC-restracking@dhs.gov
NOAA Liaison	2479	FEMA-NRCC-NOAAlno@dhs.gov
Resource Unit Leader	3248	FEMA-NRCC-reslead@dhs.gov
Documentation Unit Leader	2473	FEMA-NRCC-doclead@dhs.gov
VIP Briefing Specialist	3003	FEMA-NRCC-vipbriefer@dhs.gov
Situation Status Information Specialist c	2477	FEMA-NRCC-sitstatinfoc@dhs.gov
Situation Status Information Specialist d	2485	FEMA-NRCC-sitstatinfod@dhs.gov
Situation Status Information Specialist e	2463	FEMA-NRCC-sitstatinfoe@dhs.gov
CONOPS OMT Coordinator	2460	FEMA-NRCC-conops@dhs.gov
VACANT	4520	n/a
Pat Pritchett	3411	n/a
ESF 09 reports Specialist	2489	FEMA-NRCC-09reports@dhs.gov
Safety	2480	FEMA-NRCC-safety@dhs.gov
Secret Service Liaison	2413	FEMA-NRCC-secretsvc@dhs.gov
GIS Coordinator	2486	FEMA-NRCC-giscoord@dhs.gov
NOC Liaison	2747	FEMA-NRCC-NOClno@dhs.gov
Movement Coordination Branch	2989	FEMA-NRCC-mcb@dhs.gov
HR Admin	2747	FEMA-NRCC-hradmin@dhs.gov

Area B (Continued)

Position	Phone 202-646-xxxx	e-mail
TSA Liaison	2495	FEMA-NRCC-tsa@dhs.gov
EMAC State Support	2547	FEMA-NRCC-emacstate@dhs.gov
EMAC NGB	2547	FEMA-NRCC-emacngb@dhs.gov
DHS-IP Liaison (Infrastructure Protection)	2423	FEMA-NRCC-dhsiplno@dhs.gov
VACANT	2462	n/a
Remote Sensing (Technical Specialist)	2556	FEMA-NRCC-remotesensing@dhs.gov
MERS (Not a manned station – virtual contact)	n/a	FEMA-NRCC-mers@dhs.gov

APPENDIX K ABBREVIATIONS AND ACRONYMS

-A-

AAWE	American Association for Wind Engineering

-B-

BPAT	Building Performance Assessment Team

-C-

CAP	Civil Air Patrol
CO-OPS	Center for Operational Oceanic Products and Services
CSC	Coastal Services Center

-D-

DOC	Department of Commerce
DOD	Department of Defense
DOI	Department of Interior
DOT	Department of Transportation

-E-

ERDC	Engineering Research and Development Center

-F-

FCMP	Florida Coastal Monitoring Program
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Maps

-G-

GD	Geologic Division
GPS	Global Positioning System

-N-

NCEP	National Centers for Environmental Prediction
NCMP	National Coastal Mapping Program
NESDIS	National Environmental Satellite, Data, and Information Service
NGS	National Geodetic Survey
NIST	National Institute of Standards and Technology
NMAO	NOAA Marine and Aviation Operations
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPSDAP	National Post-Storm Data Acquisition Plan
NRCS	Natural Resources Conservation Service
NWS	National Weather Service

-O-

OCWWS	Office of Climate, Water, and Weather Services
OFCM	Office of the Federal Coordinator for Meteorological Services and Supporting Research
OR&R	Office of Response and Restoration

-P-

PSDA	Post-Storm Data Acquisition
PSMA	Pre-Scripted Mission Assignment

-Q-

QRT	Quick Response Team

-S-

SLOSH	Sea, Lake, and Overland Surges from Hurricanes model
SPC	Storm Prediction Center

-U-

URL	Uniform Resource Locator
US	United States
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UWRC	University Wind Research Consortium

-W-

WCM	Warning Coordination Meteorologist
WG/NDR/PSDA	Working Group for Natural Disaster Reduction and Post-Storm Data Acquisition
WICP	Water Information Coordination Program
WRD	Water Resources Division
WRS	Weather Reconnaissance Squadron