

**WRITTEN TESTIMONY OF  
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**FIELD HEARING ON  
FEMA: PREPAREDNESS FOR THE 2009 HURRICANE SEASON**

**BEFORE THE  
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE  
SUBCOMMITTEE ON ECONOMIC DEVELOPMENT, PUBLIC BUILDINGS,  
AND EMERGENCY MANAGEMENT  
U.S. HOUSE OF REPRESENTATIVES**

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Madam Chairwoman and Ranking Member Diaz-Balart, I am Edward Rappaport, Deputy Director of the National Hurricane Center, in the National Weather Service (NWS) at the National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce. Thank you for inviting me here today to discuss NOAA's role in forecasting, warning, and helping the public prepare for hurricanes.

First, I would like to thank you for your support of NOAA, the NWS, and our hurricane program. Your support enables us to make the best forecasts possible and to help the people of our Nation understand the potential effects of hurricanes and the actions they can take to protect their life and property.

The hurricane challenge goes beyond forecasting the track, strength, and size of the storms. Impacts of hurricanes are felt first in the pounding winds, storm surge, waves and rainfall at the coast, but they often extend well inland from where the storm makes landfall. Our first hand experience in Florida with Hurricanes Charley, Frances, Ivan, and Jeanne in 2004, and the following year with Dennis, Katrina, and Wilma, reminded us that hurricane effects can be felt across the entire state. Inland flooding, tornadoes, severe thunderstorms, and strong winds can cause tremendous damage for any part of a coastal state such as Florida, as well as in states as far inland as Ohio, which last year experienced hurricane force winds and flooding rainfall from the remains of Hurricane Ike. These examples demonstrate the critical role education, awareness, and preparedness play in making sure people know what actions to take when threatened by hurricanes.

My testimony today will focus on the NWS role in forecasting hurricanes, how we communicate that information, and our collaboration with emergency managers to inform those in harm's way about the hurricane threat and the actions they need to take.

## **The Role of the National Weather Service in Tracking, Forecasting and Communicating the Threats of Hurricanes**

NOAA provides the nation with services and information to protect lives and property, and improve management of weather and water sensitive sectors, including emergency response. These services and information are built upon an infrastructure which includes satellites, aircraft, buoys, environmental observations, analyses and predictions, forecasts, and sustained user interaction. The mission of the NWS is to issue weather, water, and climate forecasts and warnings for the protection of life and property and the enhancement of the national economy. Nowhere is that more evident than in the hurricane program. Various components of the NWS play important roles in the overall hurricane forecasting and warning process. The National Hurricane Center (NHC), within the NWS, has been the centerpiece of our Nation's hurricane forecast and warning program for over 50 years. The mission of the NHC is to save lives, mitigate property loss, and improve economic efficiency by issuing the best watches, warnings, and forecasts of hazardous tropical weather and by increasing public understanding of these hazards.

NHC tropical cyclone forecasts are issued every six hours, and more frequently during landfall threats. These forecasts include text messages and supporting discussions, as well as a suite of graphical products depicting our forecasts and the accompanying probabilities and “cone of uncertainty,” as it has become known. The NHC is responsible for predicting the path and intensity of the system, issuing coastal hurricane watches and warnings, and describing broadly the weather conditions expected, including projected storm surge levels. (The storm surge is simply water that is pushed toward the shore by the force of the winds swirling around the storm. In addition, wind driven waves ride atop the storm surge.) The NWS Hydrometeorological Prediction Center provides forecasts on the amount of rain expected, while the NWS Storm Prediction Center has responsibility for forecasting the potential for tornadoes.

Local Weather Forecast Offices (WFO) also play a critical role in this forecast and warning process. WFOs use their local expertise to refine NHC advisories and provide specific, detailed information about the impacts from the hurricane, including more details about storm surge inundation levels and local watches, warnings, and advisories to their local forecast area of responsibility. Weather forecast office staffs have detailed knowledge of the local terrain and effects, and provide this information through direct interactions with local emergency managers via frequent online webinars and conference calls, local forecast products including the Hurricane Local Statement, and newer means of instant Internet communication. This detailed information is used by local emergency managers when making their evacuation and other preparedness decisions.

The forecast process begins with collecting data from all sources, including buoys, aircraft, ships, and satellites. This information is incorporated into high performance computer models that project the path and intensity of hurricanes. NWS forecasters interpret this information and issue the official forecasts and warnings for the hurricanes.

NHC forecasters depend heavily on computer models, especially those run by the NWS National Centers for Environmental Prediction, as input to the operational forecasts and warnings. The NHC disseminates its vital information through a broad range of methods including the media, commercial weather sector, and the Internet. This allows the NHC to provide greater public awareness once a hurricane or tropical storm forms and then approaches.

In 1995, there were nineteen tropical storms and hurricanes in the Atlantic and Gulf of Mexico – the second most in any one hurricane season up to that point. It became a challenge for the NHC to communicate with all the different emergency managers and to meet the increase in requests by state and local governments for timely information. To address this concern, the Federal Emergency Management Agency (FEMA) and the NWS established a Hurricane Liaison Team (HLT) in 1996. The HLT has become a Department of Homeland Security (DHS)/FEMA/NWS-sponsored team made up of federal, state, and local emergency managers, and of NWS meteorologists and hydrologists who have extensive hurricane operational experience. The DHS/FEMA HLT leader works full-time at the NHC facility on the campus of Florida International University in Miami, Florida. Other HLT team members deploy to the NHC for a storm threat at the request of the NHC director. The HLT is strategically activated well in advance of potential impact to provide the proper coordination of critical information between the NHC and the emergency management community at the federal and state levels. After consulting with their local weather service offices and the NHC, emergency managers make evacuation and other preparedness decisions. The HLT is a critical effort undertaken to ensure emergency managers and first responders at all levels know what to expect and to help them prepare for their response operations, which may include evacuations, sheltering, and mobilizing equipment and support personnel.

The media is a most essential partner and helps us get the information to the public. It provides an invaluable service to the people of the impacted areas by communicating official NHC forecast and warning information and details provided by the local WFO about potential storm impacts.

### **Inland Effects of Hurricanes**

The effects of hurricanes can reach far inland and it is the responsibility of the appropriate local WFO to issue inland hurricane and tropical storm warnings and to describe the local impacts from the storms. Local WFOs work with NWS River Forecast Centers to forecast and provide warnings regarding floods and flash floods. WFOs also provide forecasts and warnings for all other inland effects, including strong wind and tornadoes, in partnership with the Storm Prediction Center. The WFO's work closely with local emergency managers to ensure they are aware of the potential effects from the storms. Local media relays NWS watch and warning information to the public, providing a critical way to disseminate potential life saving information from the NWS.

### *Wind*

Hurricane-force winds, sustained at 74 miles per hour or more, can destroy buildings and mobile homes. Debris such as signs, roofing material, siding, and small items left outside can become flying missiles in hurricanes. Winds can stay above hurricane strength well inland. Hurricane Hugo in 1989 battered Charlotte, North Carolina—about 175 miles inland—with gusts near 100 miles per hour, downing trees and power lines.

### *Tornadoes*

Hurricanes and tropical storms also produce tornadoes. These tornadoes most often occur in thunderstorms embedded in rain bands well away from the center of the hurricane. Usually, tornadoes produced by tropical cyclones are relatively weak and short-lived, but still pose a threat.

### *Inland/Freshwater Floods*

All tropical cyclones can generate widespread torrential rain. This rain can produce deadly and destructive floods. Heavy rain can trigger landslides and mudslides, especially in mountainous regions. Flooding is the major threat from tropical cyclones to people well inland. For example, Tropical Storm Allison in 2001 was the most costly tropical storm in U.S. history, causing 24 fatalities and more than \$5 billion in flood damage to southeast Texas and southern Louisiana. Allison then moved northeastward and weakened to a depression as it brought heavy rain to South Carolina. Hurricane Floyd in 1999 brought extremely heavy rainfall to many locations in the eastern United States. Last year the remains of Hurricane Ike flooded Ohio with record rains.

Flash flooding, a rapid rise in water levels, can occur quickly due to intense rainfall. Longer term flooding on rivers and streams can persist for several days or even weeks after a storm. Intense rainfall is closely related to how fast the storms are moving and the geography of the area affected. Slow moving storms produce relatively greater rainfall. Mountainous terrain enhances rainfall from tropical cyclones and can lead to mudslides and debris flows. Inland flooding can be a major threat to people hundreds of miles from the coast.

Between 1970 and 2004, more people lost their lives from freshwater floods associated with tropical storms and hurricanes than any other weather hazard. In addition, Hurricane Katrina provides a vivid reminder that potentially the most devastating component of tropical systems is still storm surge.

## **NOAA Encourages Everyone to Prepare**

We work year-round with federal, state, and local emergency managers; we educate them about weather effects from hurricanes and they educate us about response issues and their challenges. It is a constant learning process and the key is working together to ensure the public takes appropriate action. Most preparedness activities and outreach takes place outside hurricane season. Every year, as part of our ongoing mission to enhance economic security and national safety, NOAA conducts Hurricane Awareness Tours, alternating between the Gulf Coast and the East Coast. This year the tour will be along

the East coast and will take place next week. The tour will make stops at Portsmouth, New Hampshire, Raleigh and Wilmington, North Carolina, Farmingdale, New York, and Key West, Florida. The tour helps raise awareness about the potential effects from hurricane landfall. Local NWS WFOs arrange the tour events with FEMA, local governments and emergency managers, schools, the public and the media in a team effort to increase hurricane awareness and encourage preparedness in these vulnerable areas of the Nation. At many of the stops, upwards of 1,000 school-aged children, and many others, tour the NOAA P-3 Orion (Hurricane Hunter) plane and are informed about hurricane preparedness.

One way a community can prepare is to become StormReady. StormReady is a nationwide community preparedness program to help communities develop plans to handle all types of hazardous weather events, from hurricanes to tornadoes. There are today 1,426 sites in 50 states. I am pleased to say that Florida has all 67 counties designated as storm ready, as well as many universities, cities, and other government sites.

The annual Hurricane Awareness Week, around the last week of May, provides another avenue to raise awareness. In most years, DHS/FEMA and NOAA jointly develop educational materials and the week has been accompanied by a Presidential Proclamation. This raises the visibility of our joint preparedness efforts with the goal to educate as many people as possible.

During land-falling storms, it is essential for the emergency management community and the weather community to have one message for the public so businesses and people can take appropriate action. Nowhere is this more critical than in areas most vulnerable to the impact of a hurricane. Our local NWS offices work very closely with local emergency managers to ensure we all speak with one voice. For example, during the past year NWS offices across the state of Florida in Tallahassee, Jacksonville, Melbourne, Tampa, Key West, and here in Miami, gave numerous presentations, online “hurricane chats,” and training classes to people across the state to discuss weather and the potential impact from hurricanes and tropical systems. These outreach efforts raise awareness and are designed to teach people how to prepare for the storms long before they happen.

Let me provide a few other areas where the NWS and DHS/FEMA work together on the preparedness effort. For more than 15 years, DHS/FEMA and NOAA have coordinated to teach an "Introduction to Hurricane Preparedness" course at the NHC for emergency managers and other local decision makers. Each winter, these three one-week long courses provide training on the fundamentals of hurricanes, hurricane forecasts and forecast products, and include an extensive table-top exercise to better prepare participants. The course has trained more than one thousand emergency managers and decision makers since the program began.

The NWS also participates in other state and regional hurricane preparedness table-top exercises. For example, the NHC and local weather forecast offices generate storm based scenarios for the annual State of Florida hurricane exercise. This drill is designed to

build pre-storm expertise for emergency managers. The NWS provides similar scenario development and participation for national level FEMA hurricane exercises as well.

One last area of DHS/FEMA and NOAA partnership I would like to highlight is storm surge prediction. NOAA's Storm Surge Model, known as SLOSH (Sea, Lake and Overland Surge from Hurricanes), provides excellent guidance and is used extensively for emergency management planning purposes. For 25 years, FEMA has helped fund the NHC storm surge team to develop SLOSH-based maps depicting the hurricane storm surge risk across about 40 basins spanning the U.S. coastal flood plain. Thousands of hypothetical hurricane track and intensity simulations are generated for each of about 40 basins from Brownsville, Texas, to Portland, Maine, and Puerto Rico. The information depicts potential water inundation levels based on the track and intensity of hypothetical storms. These data provide a key component of the preparedness and decision making plans of local decision makers. Basin maps are updated to account for local changes, such as new or modified roadways, levees and shorelines. The NHC storm surge team also runs and makes available event-specific storm surge simulations beginning one to two days in advance of a particular storm threat. Local WFOs help disseminate and discuss the graphics associated with these runs with their local emergency managers.

## **Conclusion**

In conclusion, I would like to state that NHC hurricane track forecasts have continued to increase in accuracy. Nevertheless, no matter how accurate our forecasts, our communities need to hear the forecasts and warnings, and then know what actions to take. In this regard, the combined preparedness, education, and communication efforts of the National Weather Service, DHS/FEMA, state and local emergency management officials and decision makers, and the media have been key advances in safeguarding the lives and property of our citizens during the past several decades. These partnerships will remain critical in our efforts to minimize future losses caused by the forces of nature. I will be pleased to answer any questions.

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