WRITTEN TESTIMONY OF
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U. S. DEPARTMENT OF COMMERCE

OVERSIGHT HEARING ON NOAA HURRICANE FORECASTING

BEFORE THE
COMMITTEE ON SCIENCE
U. S. HOUSE OF REPRESENTATIVES

SEPTEMBER 21, 2005

Mr. Chairman and Members of the Committee, I am Max Mayfield, Director of the Tropical Prediction Center/National Hurricane Center. The National Hurricane Center is a part of the National Weather Service (NWS), of 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, and warning the public about hurricanes, as well as NOAA's essential role and activities following landfall.

The devastation along the Gulf Coast from Hurricane Katrina is like nothing I have witnessed before. It is catastrophic. Words cannot convey the physical destruction and personal suffering in that part of our Nation. However, without NOAA's forecasts and warnings, the devastation and loss of life would have been far greater.

NOAA's forecasts and warnings for Hurricane Katrina pushed the limits of the state of the art of hurricane prediction. Our continuous research efforts at NOAA, and in partnership with other federal agencies, have led to our current predictive capabilities and improved ways of describing uncertainty in prediction. But NOAA's work does not end there. NOAA does extensive work assessing damage from storms and evaluating waterways to assist dredging operations, to open our Nation's ports and waterways impacted by the storm. NOAA also assesses the impact to the areas' fisheries, supports hazardous materials containment and abatement efforts, and provides necessary data critical for post storm recovery operations.

Tracking and Forecasting Hurricane Katrina

The National Hurricane Center (NHC) within the NWS has been the centerpiece of our Nation's hurricane forecast and warning program for 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 the public's understanding of these hazards.

NHC tropical cyclone forecasts are issued every six hours and include text messages as well as a suite of graphical products depicting our forecasts and the accompanying probabilities and "cone of uncertainty," as it has become known. Hurricane Katrina began as a tropical depression near the southeastern Bahamas on Tuesday, August 23. The National Hurricane Center accurately predicted it would become a Category 1 hurricane before making landfall near Miami. The storm deluged southeast Florida with 16" of rain in some places, causing downed trees, flooding, and extended power outages as it passed across the southern portion of the state.

Once Katrina re-emerged into the Gulf of Mexico, NOAA hurricane forecasters correctly predicted re-intensification of the storm. Katrina intensified more quickly and became stronger than initially predicted. Within nine hours, Katrina intensified from a tropical storm, with winds of 70 miles per hour, to a Category 2 storm with 100 mile per hour winds.

As you can see in the graphic below, our forecast track from Saturday morning, August 27, about two days before landfall, had the storm curving northward and headed directly toward southeastern Louisiana and Mississippi. The projected path of Katrina aimed directly at southeast Louisiana, and the prediction was for Katrina to make landfall as a Category 4 hurricane. The actual track would deviate little from this and subsequent forecasts for the rest of Katrina's approach. On average, NOAA forecasts of where Katrina would go were more accurate than usual, with all of the forecast tracks during the last 48 hours lining up almost directly on top of the actual track. This forecast beats the Government Performance and Results Act goal established for NOAA hurricane forecasts this year.

At 10:00 am Central Daylight Time (CDT) Saturday morning, August 27, the National Hurricane Center posted a hurricane watch for southeast Louisiana, including the city of New Orleans. The watch extended eastward to Mississippi and Alabama that afternoon. A hurricane watch means hurricane conditions are possible in the specified area, usually within 36 hours. Messages from the National Hurricane Center highlighted the potential for this storm to make landfall as a Category 4 or Category 5 storm.

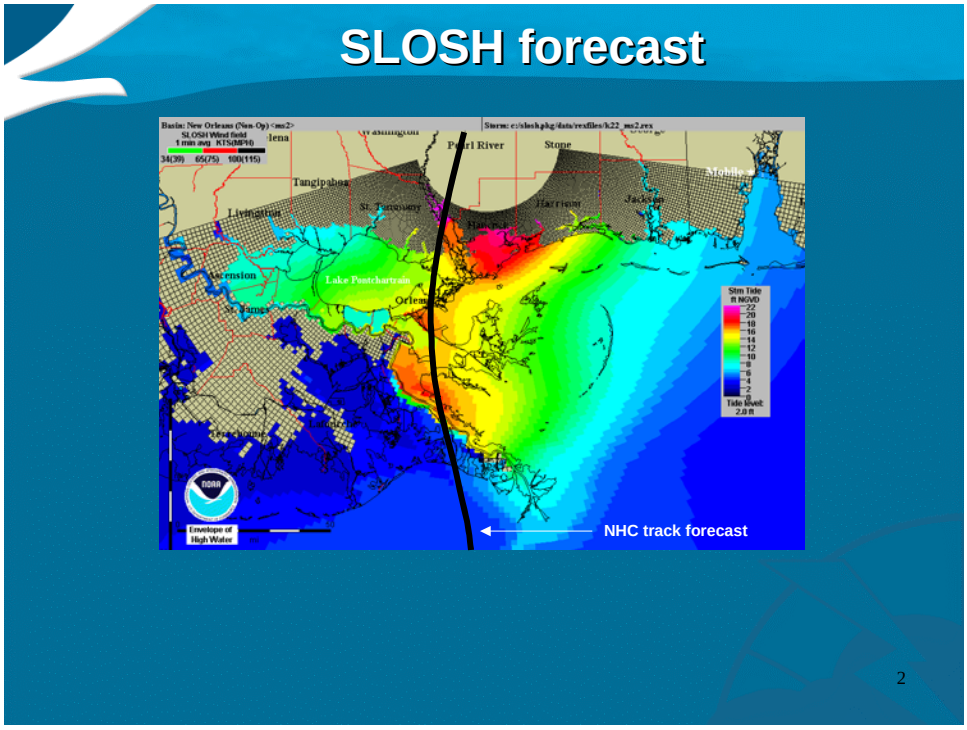
Predicting hurricane intensity remains a challenge. Even though we knew conditions were favorable for the storm to intensify, there was some error in the intensity forecast for the eastern Gulf due to its rapid intensification. While we accurately predicted the intensity at landfall, there is still more work to be done in improving intensity prediction, especially for rapidly intensifying or rapidly weakening storms.

Storm Surge

Storm surge has caused most of this country's tropical cyclone fatalities, all too vividly evident in the past two weeks, and still represents our greatest risk for a large loss of life in this country. Following Hurricane Camille in 1969, NOAA established a group that developed and implemented a storm surge model called SLOSH (Sea, Lake, and Overland Surges from Hurricanes). The SLOSH model calculates storm surge heights resulting either from historical, hypothetical or actual hurricanes. SLOSH incorporates bathymetry and topography, including bay and river configurations, roads, levees, and other physical features that can modify the storm surge flow pattern. Comprehensive evacuation studies, conducted jointly by the Federal Emergency Management Agency (FEMA), the U.S. Army Corps of Engineers, NOAA, and state and local emergency managers, are based on the simulated surges computed by SLOSH.

The National Hurricane Center introduced storm surge forecasts for the Gulf Coast in public advisories at 10:00 am CDT Saturday – 32 hours prior to Katrina's landfall in Louisiana. The initial forecast (10:00 am CDT, Saturday, August 28) for storm surge was predicted at 15 to 20 feet, locally as high as 25 feet, and that forecast was updated the following morning to a range of 18 to 22 feet, locally as high as 28 feet, when the forecast intensity for landfall was increased. "Large and battering" waves were forecast on top of the surge. In addition, the 4:00 pm CDT public advisory issued by the National Hurricane Center on Sunday, August 28, stated that some levees in the greater New Orleans area could be overtopped. Actual storm surge values are being determined at this time.

I know there have been recent news reports that I notified FEMA that the New Orleans' levees would be breached. In fact, I did not say that. What I indicated in my briefings to emergency managers and to the media was the possibility that some levees in the greater New Orleans area could be overtopped, depending on the details of Katrina's track and intensity. This possibility was also indicated in our advisory products.



First SLOSH forecast based on the National Hurricane Center's forecast track of Hurricane Katrina. This information was available on the Internet at 9:20 a.m. CDT Sunday, August 29. The graphic depicts the predicted high water level above mean sea level. Additional SLOSH model forecasts were available following each advisory issued by the National Hurricane Center.

Communicating Our Forecasts

The FEMA/NWS Hurricane Liaison Team (HLT), which is activated at NHC a few days in advance of any potential U.S. hurricane landfall, coordinates communications between NOAA and the emergency management community at the federal and state levels. The HLT was established in 1996. After consulting with our local weather service offices and the National Hurricane Center, emergency managers make evacuation and other preparedness decisions. The HLT provides an excellent way to communicate with the large number of emergency managers typically impacted by a potential hurricane. This is a critical effort to ensure emergency managers and first responders know what to expect.

The media is our most essential partner and helps us get the information to the public. Without the media, it would be very difficult to get the information as widely distributed. The media provided an invaluable service to the people of the impacted Gulf Coast by communicating National Hurricane Center forecast and warning information about Hurricane Katrina. From Thursday, August 25, through Katrina's landfall in Mississippi on Monday, August 29, NOAA's Tropical Prediction Center/National Hurricane Center provided a total of 471 television and radio interviews, through their media pool or via telephone.

On Saturday evening, August 27, I personally called the Chief of Operations at the Alabama Emergency Management Agency, as well as the Governors of Louisiana and Mississippi and the Mayor of New Orleans, to communicate the potential meteorological and storm surge impacts from Hurricane Katrina. In addition, the National Hurricane Center web activity, as supported by NOAA's web-mirroring project, registered 900 million hits during Katrina.

NOAA Support Efforts

NOAA is focused on improving the forecasting of hurricane frequency, track, and intensity as well as predicting hurricane impacts on life and property. Using a combination of atmospheric and ocean observations from satellites, aircraft, and all available surface data over the oceans, NOAA conducts experiments to better understand internal storm dynamics and interactions between a hurricane and the surrounding atmosphere and ocean. Through greater understanding of physical processes and advanced hurricane modeling, NOAA continually improves models for predicting hurricane intensity and track, in collaboration with federal partners, academic researchers, and commercial enterprises. These numerical modeling improvements, once demonstrated, are transitioned into operations at the National Hurricane Center.

NOAA Aircraft, the W-P3 Orions and the Gulf Stream IV, provided essential observations critical to the National Hurricane Center forecasters and supplement U.S. Air Force Reserve Command's 53rd Weather Reconnaissance Squadron flights. A specialized instrument flown on one of the W-P3s, the Stepped Frequency Microwave Radiometer (SFMR), provided essential hurricane structure, surface wind and rain rate data to hurricane forecasters right up to and following landfall in Louisiana and Mississippi. The Military Construction Appropriations and Emergency Hurricane Supplemental Appropriations Act, 2005 (P.L. 108-324) provided $10.5M to the Air Force to outfit the complete fleet of Hurricane Hunters with this instrument, the first of these additional units should be available during the 2006 Hurricane Season.

The Military Construction Appropriations and Emergency Hurricane Supplemental Appropriations Act, 2005 also provided funding to NOAA for seven hurricane buoys, which NOAA deployed this past year in the Caribbean, the Gulf of Mexico, and the Atlantic. Those new buoys provided us with critical information during this active hurricane season.

NOAA's Activities After Hurricane Katrina's Landfall

Immediately following Hurricane Katrina's second landfall, several NOAA ships and aircraft were tasked with assisting in the hurricane response. Our aircraft flew damage assessment flights using a sophisticated digital camera to collect imagery to assess damage. Over 5,000 high-resolution images collected by NOAA aircraft are assisting emergency managers and other agencies in recovery operations and long-term restoration and rebuilding decisions.

It is also NOAA's responsibility to assess the damage to the commercial fishing industry in that section of the Gulf of Mexico. We are working closely with each of the impacted state resource agencies and commercial entities to assess the storm's impacts to the longer-term social and economic viability of local fishing communities. NOAA employees also are assisting recovery efforts by working with other Federal agencies in planning, organizing, and conducting oil spill and hazardous material response and restoration in the impacted areas of the Gulf.

NOAA ships are tasked with surveying critical ports and waterways for depths, wrecks and obstructions for navigational safety. NOAA Navigation Response Teams were on scene before the hurricane hit to survey for hazards and help the U.S. Coast Guard and the Army Corps of Engineers re-open waterways to commercial and emergency traffic. The THOMAS JEFFERSON, a highly specialized hydrographic survey ship equipped with multibeam and side scan sonar and two 28-foot launches for near shore and mid-water surveys will be surveying the entrances to Pascagoula and Gulfport, Mississippi. Another NOAA ship, the NANCY FOSTER, is outfitted with survey technology and is presently conducting wreck and obstruction surveys in Mobile Bay, Alabama. The efforts of these NOAA ships are critical to rebuilding the Gulf's economic infrastructure by enabling vessels of all sizes to pass safely through these waterways thereby allowing emergency materials, oil, and commercial goods to make it to their destinations. Other NOAA ships and aircraft are assisting directly with the recovery effort by providing fuel, communications, and supplies to NOAA facilities as well as temporary office space for local emergency responders.

Outlook for the Future

Today is September 21, near the historical peak of the hurricane season. To date we have had fifteen tropical storms, seven of which have become hurricanes, four of those have been major hurricanes at Category 3 or stronger. We believe we will continue to have an active season, with a total of l8-21 tropical storms. We believe this heightened period of hurricane activity will continue due to multi-decadal variance, as tropical cyclone activity in the Atlantic is cyclical. The 1940's through the 1960's experienced an above average number of major hurricanes, while the 1970's into the mid-1990's averaged fewer hurricanes. The current period of heightened activity could last another 10-20 years. The increased activity since 1995 is due to natural fluctuations/cycles of hurricane activity, driven by the Atlantic Ocean itself along with the atmosphere above it and not enhanced substantially by global warming. The natural cycles are quite large with on average 3-4 major hurricanes a year in active periods and only about 1-2 major hurricanes annually during quiet periods, with each period lasting 25-40 years.

While we have made significant progress in hurricane forecasting and warnings, we believe we have more work to do. From a scientific standpoint, the gaps in our capabilities fall into two broad categories: first, our ability to assess the current state of a hurricane and its environment (analysis), and second, our ability to predict a hurricane's future state (the forecast). Finally, we would like to improve public preparedness.

Conclusion

The government's ability to observe, predict, and respond quickly to storm events is critical to public safety. We must also now look ahead to post-storm redevelopment strategies for communities impacted by Katrina and future storms to help manage and anticipate these extreme events. NOAA has the expertise in coastal management and hazard mitigation, and is committed to working with out partners in reducing vulnerability to hurricanes and other coastal storm events. It is critical that we work to protect and restore natural features along the Gulf Coast, such as dunes, wetlands, and other vegetated areas that offer protection against coastal flooding and erosion.

While we must focus our energy on addressing the impacts of Hurricane Katrina, we also need to look to the future. Katrina will not be the last major hurricane to hit a vulnerable area, and New Orleans is not the only location vulnerable to a large disaster from a land-falling hurricane. Houston/Galveston, Tampa Bay, southwest Florida, Florida Keys, southeast Florida, New York City/Long Island, and believe it or not, New England, are all especially vulnerable. And New Orleans remains vulnerable to future hurricanes.

At NOAA we will continue our efforts to improve hurricane track, intensity, and storm surge forecasting, as well as provide technical tools and planning expertise to states and local governments.

With that, I'll be glad to answer any questions Members may have.

NOAA National Hurricane Center
Hurricane Katrina Forecast Timeline

TUESDAY, AUGUST 23, 2005
1600 CDT: Katrina forms as a Tropical Depression 12, near Nassau in the Bahamas. Tropical Depression 12 Advisory 1 issued: "A TROPICAL STORM OR HURRICANE WATCH MAY BE REQUIRED FOR PORTIONS OF SOUTHERN FLORIDA LATER TONIGHT."

WEDNESDAY, AUGUST 24, 2005
0400 CDT: The National Hurricane Center's 5-day forecast puts the projected path of Katrina in the southeast Gulf of Mexico (as the system is still a tropical depression in the central Bahamas).
0700 CDT: Katrina is elevated to a Tropical Storm.
1000 CDT: Tropical Storm Katrina Advisory 4 is issued: "...A TROPICAL STORM WARNING AND A HURRICANE WATCH HAVE BEEN ISSUED FOR THE SOUTHEAST FLORIDA COAST..."

THURSDAY, AUGUST 25, 2005
1430 CDT: Katrina is elevated to a Category 1 Hurricane.
1730 CDT: Katrina makes landfall in Florida as a Category 1 Hurricane.

WEDNESDAY/THURSDAY, AUGUST 24/25: Hurricane Liaison Team conference calls were conducted both days, and included Florida emergency managers, FEMA Headquarters (FEMA HQ), and Region IV.

FRIDAY, AUGUST 26, 2005
0200 CDT: Katrina entered the Gulf of Mexico as a Tropical Storm.
0400 CDT: Katrina is elevated to a Category 1 Hurricane.
1000 CDT: Hurricane Katrina Advisory Number 12 is issued: "KATRINA IS A CATEGORY ONE HURRICANE ON THE SAFFIR-SIMPSON SCALE. SOME STRENGTHENING IS FORECAST DURING THE NEXT 24 HOURS...AND KATRINA COULD BECOME A CATEGORY TWO HURRICANE ON SATURDAY."
1015 CDT: Hurricane Liaison Team Coordination Audio Conference with FL.
1030 CDT: Katrina is elevated to a Category 2 Hurricane. Hurricane Katrina Advisory Number 13 is issued: "...KATRINA RAPIDLY STRENGTHENING AS IT MOVES SLOWLY WESTWARD AWAY FROM SOUTH FLORIDA AND THE FLORIDA KEYS...KATRINA IS MOVING TOWARD THE WEST NEAR 7 MPH...AND THIS MOTION IS EXPECTED TO CONTINUE FOR THE NEXT 24 HOURS...RECENT REPORTS FROM AN AIR FORCE RESERVE UNIT HURRICANE HUNTER AIRCRAFT NOW INDICATE MAXIMUM SUSTAINED WINDS ARE NEAR 100 MPH...WITH HIGHER GUSTS. KATRINA IS NOW A CATEGORY TWO HURRICANE ON THE SAFFIR-SIMPSON SCALE. SOME STRENGTHENING IS FORECAST DURING THE NEXT 24 HOURS...AND KATRINA COULD BECOME A CATEGORY THREE OR MAJOR HURRICANE ON SATURDAY."

1100 CDT: Hurricane Liaison Team Coordination Video Conference with FEMA HQ, Region IV, FL, AL, and GA.
1600 CDT: Hurricane Katrina Discussion Number 14 is issued: "...THE MODELS HAVE SHIFTED SIGNIFICANTLY WESTWARD AND ARE NOW IN BETTER AGREEMENT. THIS HAS RESULTED IN THE OFFICIAL FORECAST TRACK BEING SHIFTED ABOUT 150 NMI WEST OF THE PREVIOUS TRACK...HOWEVER...PROJECTED LANDFALL IS STILL ABOUT 72 HOURS AWAY...SO FURTHER MODIFICATIONS IN THE FORECAST TRACK ARE POSSIBLE. KATRINA IS EXPECTED TO BE MOVING OVER THE GULF LOOP CURRENT AFTER 36 HOURS...WHICH WHEN COMBINED WITH DECREASING VERTICAL SHEAR...SHOULD ALLOW THE HURRICANE TO REACH CATEGORY FOUR STATUS BEFORE LANDFALL OCCURS."
1615 CDT: Hurricane Liaison Team Coordination Audio Conference with FL.
2200 CDT: Hurricane Katrina Discussion Number 15 is issued: "THE OFFICIAL FORECAST BRINGS THE CORE OF THE INTENSE HURRICANE OVER THE NORTH CENTRAL GULF OF MEXICO IN 48 HOURS OR SO. IT IS WORTH NOTING THAT THE GUIDANCE SPREAD HAS DECREASED AND MOST OF THE RELIABLE NUMERICAL MODEL TRACKS ARE NOW CLUSTERED BETWEEN THE EASTERN COAST OF LOUISIANA AND THE COAST OF MISSISSIPPI. THIS CLUSTERING INCREASES THE CONFIDENCE IN THE FORECAST."

SATURDAY, AUGUST 27, 2005
0400 CDT: Katrina is elevated to a Category 3 Hurricane. Hurricane Katrina Advisory Number 16 is issued: "KATRINA BECOMES A MAJOR HURRICANE WITH 115 MPH WINDS...SOME STRENGTHENING IS FORECAST DURING THE NEXT 24 HOURS...RECONNAISSANCE AIRCRAFT DATA AND SURFACE OBSERVATIONS INDICATE THAT KATRINA HAS BECOME A LARGER HURRICANE..." Hurricane Katrina Discussion Number 16 is issued: "DUE TO THE DECREASING SPREAD IN THE MODELS...THE CONFIDENCE IN THE FORECAST TRACK IS INCREASING."
1000 CDT: Hurricane Katrina Advisory Number 17 is issued: "A HURRICANE WATCH IS IN EFFECT FOR THE SOUTHEASTERN COAST OF LOUISIANA EAST OF MORGAN CITY TO THE MOUTH OF THE PEARL RIVER...INCLUDING METROPOLITAN NEW ORLEANS AND LAKE PONCHARTRAIN...A HURRICANE WATCH WILL LIKELY BE REQUIRED FOR OTHER PORTIONS OF THE NORTHERN GULF LATER TODAY OR TONIGHT. INTERESTS IN THIS AREA SHOULD MONITOR THE PROGRESS OF KATRINA...SOME STRENGTHENING IS FORECAST DURING THE NEXT 24 HOURS...AND KATRINA COULD BECOME A CATEGORY FOUR HURRICANE..." Hurricane Katrina Discussion Number 17 is issued: "...IT IS NOT OUT OF THE QUESTION THAT KATRINA COULD REACH CATEGORY 5 STATUS AT SOME POINT BEFORE LANDFALL..."
1015 CDT: Hurricane Liaison Team Coordination Audio Conference with FL.
1100 CDT: Hurricane Liaison Team Coordination Video Conference with FEMA HQ, Region IV and VI, FL, LA, MS, AL, and GA.

1600 CDT: Hurricane Katrina Advisory Number 18 is issued: "THE HURRICANE WATCH IS EXTENDED WESTWARD TO INTRACOASTAL CITY LOUISIANA AND EASTWARD TO THE FLORIDA-ALABAMA BORDER. A HURRICANE WATCH IS NOW IN EFFECT ALONG THE NORTHERN GULF COAST FROM INTRACOASTAL CITY TO THE ALABAMA-FLORIDA BORDER. A HURRICANE WARNING WILL LIKELY BE REQUIRED FOR PORTIONS OF THE NORTHERN GULF COAST LATER TONIGHT OR SUNDAY. INTERESTS IN THIS AREA SHOULD MONITOR THE PROGRESS OF KATRINA." Hurricane Katrina Discussion Number 18 is issued: "THE INTENSITY FORECAST WILL CALL FOR STRENGTHENING TO 125 KT AT LANDFALL...AND THERE REMAINS A CHANCE THAT KATRINA COULD BECOME A CATEGORY FIVE HURRICANE BEFORE LANDFALL."
1615 CDT: Hurricane Liaison Team Coordination Audio Conference with FL.
1925 CDT: Louisiana Gubernatorial Briefing: Max Mayfield, Director of NOAA's Tropical Predication Center/National Hurricane Center provides a briefing to Kathleen Babineau Blanco.
1935 CDT: Max Mayfield, Director of NOAA's Tropical Predication Center/National Hurricane Center provides a briefing to Bill Filter, Chief of Operations, Alabama Emergency Management Agency.
1945 CDT: Mississippi Gubernatorial Briefing: Max Mayfield, Director of NOAA's Tropical Predication Center/National Hurricane Center provides a briefing to Haley Barbour.
2000 CDT: New Orleans Mayoral Briefing: Max Mayfield, Director of NOAA's Tropical Predication Center/National Hurricane Center provides a briefing to Ray Nagin.
2200 CDT: Hurricane Katrina Advisory Number 19 is issued: "...DANGEROUS HURRICANE KATRINA THREATENS THE NORTH CENTRAL GULF COAST...A HURRICANE WARNING ISSUED...AT 10 PM CDT...0300Z...A HURRICANE WARNING HAS BEEN ISSUED FOR THE NORTH CENTRAL GULF COAST FROM MORGAN CITY LOUISIANA EASTWARD TO THE ALABAMA/FLORIDA BORDER...INCLUDING THE CITY OF NEW ORLEANS AND LAKE PONCHARTRAIN...PREPARATIONS TO PROTECT LIFE AND PROPERTY SHOULD BE RUSHED TO COMPLETION...COASTAL STORM SURGE FLOODING OF 15 TO 20 FEET ABOVE NORMAL TIDE LEVELS...LOCALLY AS HIGH AS 25 FEET ALONG WITH LARGE AND DANGEROUS BATTERING WAVES...CAN BE EXPECTED NEAR AND TO THE EAST OF WHERE THE CENTER MAKES LANDFALL...HEAVY RAINS FROM KATRINA SHOULD BEGIN TO AFFECT THE CENTRAL GULF COAST SUNDAY EVENING. RAINFALL TOTALS OF 5 TO 10 INCHES...WITH ISOLATED MAXIMUM AMOUNTS OF 15 INCHES...ARE POSSIBLE ALONG THE PATH OF KATRINA." Hurricane Katrina Discussion Number 19 is issued: "...DESPITE THESE CHANGES IN THE INNER CORE...THE BOTTOM LINE IS THAT KATRINA IS EXPECTED TO BE AN INTENSE AND DANGEROUS HURRICANE HEADING TOWARD THE NORTH CENTRAL GULF COAST...AND THIS HAS TO BE TAKEN VERY SERIOUSLY."

1500-2230 CDT: Media pool operated; TPC/NHC provided 12 television and 2 radio interviews. In addition, TPC/NHC participated in 51 telephone briefings or media contacts on August 27th.

SUNDAY, AUGUST 28, 2005

0040 CDT: Katrina is elevated to a Category 4 Hurricane.

0100 CDT: Hurricane Katrina Special Advisory Number 20 is issued: "...KATRINA STRENGTHENS TO CATEGORY FOUR WITH 145 MPH WINDS..."

0400 CDT: Hurricane Katrina Discussion Number 21 is issued: "THE SPREAD IN THE MODEL TRACKS ALONG THE NORTHERN GULF COAST IS AT MOST 90 MILES...SO CONFIDENCE IN THE OFFICIAL FORECAST IS RELATIVELY HIGH."

0615 CDT: Katrina is elevated to a Category 5 Hurricane.

0700 CDT: Hurricane Katrina Advisory Number 22 is issued: "...KATRINA...NOW A POTENTIALLY CATASTROPHIC CATEGORY FIVE HURRICANE...HEADED FOR THE NORTHERN GULF COAST...MAXIMUM SUSTAINED WINDS ARE NEAR 160 MPH...WITH HIGHER GUSTS. KATRINA IS A POTENTIALLY CATASTROPHIC CATEGORY FIVE HURRICANE ON THE SAFFIR-SIMPSON SCALE. SOME FLUCTUATIONS IN STRENGTH ARE LIKELY IN THE NEXT 24 HOURS."

1000 CDT: Hurricane Katrina Advisory Number 23 is issued: "...POTENTIALLY CATASTRPHIC HURRICANE KATRINA...EVEN STRONGER...HEADED FOR THE NORTHERN GULF COAST...REPORTS FROM AN AIR FORCE HURRICANE HUNTER AIRCRAFT INDICATE THAT THE MAXIMUM SUSTAINED WINDS HAVE INCREASED TO NEAR 175 MPH...WITH HIGHER WIND GUSTS...HURRICANE FORCE WINDS EXTEND OUTWARD UP TO 105 MILES FROM THE CENTER AND TROPICAL STORM FORCE WINDS EXTEND OUTWARDS UP TO 205 MILES...COASTAL STORM SURGE FLOODING OF 18 TO 22 FEET ABOVE NORMAL TIDE LEVELS...LOCALLY AS HIGH AS 28 FEET ALONG WITH LARGE AND DANGEROUS BATTERING WAVES...CAN BE EXPECTED NEAR AND TO THE EAST OF WHERE THE CENTER MAKES LANDFALL. Hurricane Katrina Discussion Number 23 is issued: "…HURRICANE FORCE WINDS ARE FORECAST TO SPREAD AT LEAST 150 N MI INLAND ALONG PATH OF KATRINA. CONSULT INLAND WARNINGS ISSUED BY THE NATIONAL WEATHER SERVICE FORCAST OFFICES…"

1015 CDT: Hurricane Liaison Team Coordination Audio Conference with FL.

1100 CDT: Hurricane Liaison Team Coordination Video Conference with FEMA HQ, Region IV and VI, FL, LA, MS, AL, GA, TX.

1300 CDT: Hurricane Katrina Advisory Number 23A is issued: "SIGNIFICANT STORM SURGE FLOODING WILL OCCUR ELSEWHERE ALONG THE CENTRAL AND NORTHEASTERN GULF OF MEXICO COAST."

1600 CDT: Hurricane Katrina Advisory Number 24 is issued: "KATRINA IS MOVING TOWARD THE NORTHWEST NEAR 13 MPH...AND A GRADUAL TURN TO THE NORTH IS EXPECTED OVER THE NEXT 24 HOURS. ON THIS TRACK THE CENTER OF THE HURRICANE WILL BE NEAR THE NORTHERN GULF COAST EARLY MONDAY. HOWEVER...CONDITIONS ARE ALREADY BEGINNING TO

DETERIORATE ALONG PORTIONS OF THE CENTRAL AND NORTHEASTERN GULF COASTS...AND WILL CONTINUE TO WORSEN THROUGH THE NIGHT...KATRINA IS A POTENTIALLY CATASTROPHIC CATEGORY FIVE HURRICANE ON THE SAFFIR-SIMPSON SCALE. SOME FLUCTUATIONS IN STRENGTH ARE LIKELY UNTIL LANDFALL. KATRINA IS EXPECTED TO MAKE LANDFALL AT CATEGORY FOUR OR FIVE INTENSITY. WINDS AFFECTING THE UPPER FLOORS OF HIGH-RISE BUILDINGS WILL BE SIGNIFICANTLY STRONGER THAN THOSE NEAR GROUND LEVEL...SOME LEVEES IN THE GREATER NEW ORLEANS AREA COULD BE OVERTOPPED."
1615 CDT: Hurricane Liaison Team Coordination Audio Conference with FL.
2200 CDT: Hurricane Katrina Advisory Number 25 is issued: "A HURRICANE WARNING IS IN EFFECT FOR THE NORTH CENTRAL GULF COAST FROM MORGAN CITY LOUISIANA EASTWARD TO THE ALABAMA/FLORIDA BORDER...INCLUDING THE CITY OF NEW ORLEANS AND LAKE PONCHARTRAIN. PREPARATIONS TO PROTECT LIFE AND PROPERTY SHOULD BE RUSHED TO COMPLETION."

MONDAY, AUGUST 29, 2005
0200 CDT: Hurricane Katrina is downgraded to a Category 4.
0400 CDT: Hurricane Katrina Advisory Number 26 is issued: "EXTREMELY DANGEROUS CATEGORY FOUR HURRICANE KATRINA MOVING NORTHWARD TOWARD SOUTHEASTERN LOUISIANA AND THE NORTHERN GULF COAST...SOME FLUCTUATIONS IN STRENGTH ARE LIKELY PRIOR TO LANDFALL...BUT KATRINA IS EXPECTED TO MAKE LANDFALL AS A CATEGORY FOUR HURRICANE."
0600 CDT: Hurricane Katrina Advisory Number 26A is issued: "KATRINA REMAINS A VERY LARGE HURRICANE. HURRICANE FORCE WINDS EXTEND OUTWARD UP TO 120 MILES FROM THE CENTER...AND TROPICAL STORM FORCE WINDS EXTEND OUTWARD UP TO 230 MILES."
0610 CDT: Hurricane Katrina makes landfall in southeastern Louisiana as a Category 4 hurricane.
0800 CDT: Hurricane Katrina Advisory Number 26B is issued: "...THE CENTER OF HURRICANE KATRINA WAS LOCATED...ABOUT 40 MILES SOUTHEAST OF NEW ORLEANS LOUISIANA AND ABOUT 65 MILES SOUTHWEST OF BILOXI MISSISSIPPI...MAXIMUM SUSTAINED WINDS ARE NEAR 135 MPH...WITH HIGHER GUSTS. KATRINA IS AN EXTREMELY DANGEROUS CATEGORY FOUR HURRICANE ON THE SAFFIR-SIMPSON SCALE. WEAKENING IS FORECAST AS THE CIRCULATION INTERACTS WITH LAND TODAY...COASTAL STORM SURGE FLOODING OF 18 TO 22 FEET ABOVE NORMAL TIDE LEVELS...ALONG WITH LARGE AND DANGEROUS BATTERING WAVES...CAN BE EXPECTED NEAR AND TO THE EAST OF THE CENTER. STORM SURGE FLOODING OF 10 TO 15 FEET...NEAR THE TOPS OF LEVEES...IS POSSIBLE IN THE GREATER NEW ORLEANS AREA. SIGNIFICANT STORM SURGE FLOODING WILL OCCUR ELSEWHERE ALONG THE CENTRAL AND NORTHEASTERN GULF OF MEXICO COAST."

1000 CDT: Hurricane Katrina makes a second landfall at the LA/MS border as a Category 3 hurricane.
1015 CDT: Hurricane Liaison Team Coordination Audio Conference with FL.
1100 CDT: Hurricane Liaison Team Coordination Video Conference with FEMA HQ, Region IV and VI, LA, MS, AL, FL, TX.
1615 CDT: Hurricane Liaison Team Coordination Audio Conference with FL.

TUESDAY, AUGUST 30, 2005
1000 CDT: Katrina is downgraded to a tropical depression with winds of 35 mph, 25 miles south of Clarksville, TN. The final TPC/NHC advisory is issued at this time; the Hydrometeorological Prediction Center assumes inland public advisories.

WEDNESDAY, AUGUST 31, 2005
2200 CDT: Hurricane Katrina has dissipated; remnants absorbed by a front in southeast Canada.

NOTES:

- Timeline highlights the major aspects of NOAA's Tropical Prediction Center/National Hurricane Center (TPC/NHC). All advisories (graphic and text) are available on the Katrina archive page: http://www/nhc.noaa.gov/archive/2005/KATRINA/shtml?
- Storm surge is a consistent concern and associated threat with any land-falling hurricane, especially a major hurricane.
- Hurricane Liaison Team Coordination calls included the state emergency management officials for the states listed; calls with the State of Florida included both local and state emergency management officials.
- For Katrina (including for Florida) NOAA's Tropical Predication Center/National Hurricane Center provided a total of 471 television and radio interviews, through their media pool or via telephone.