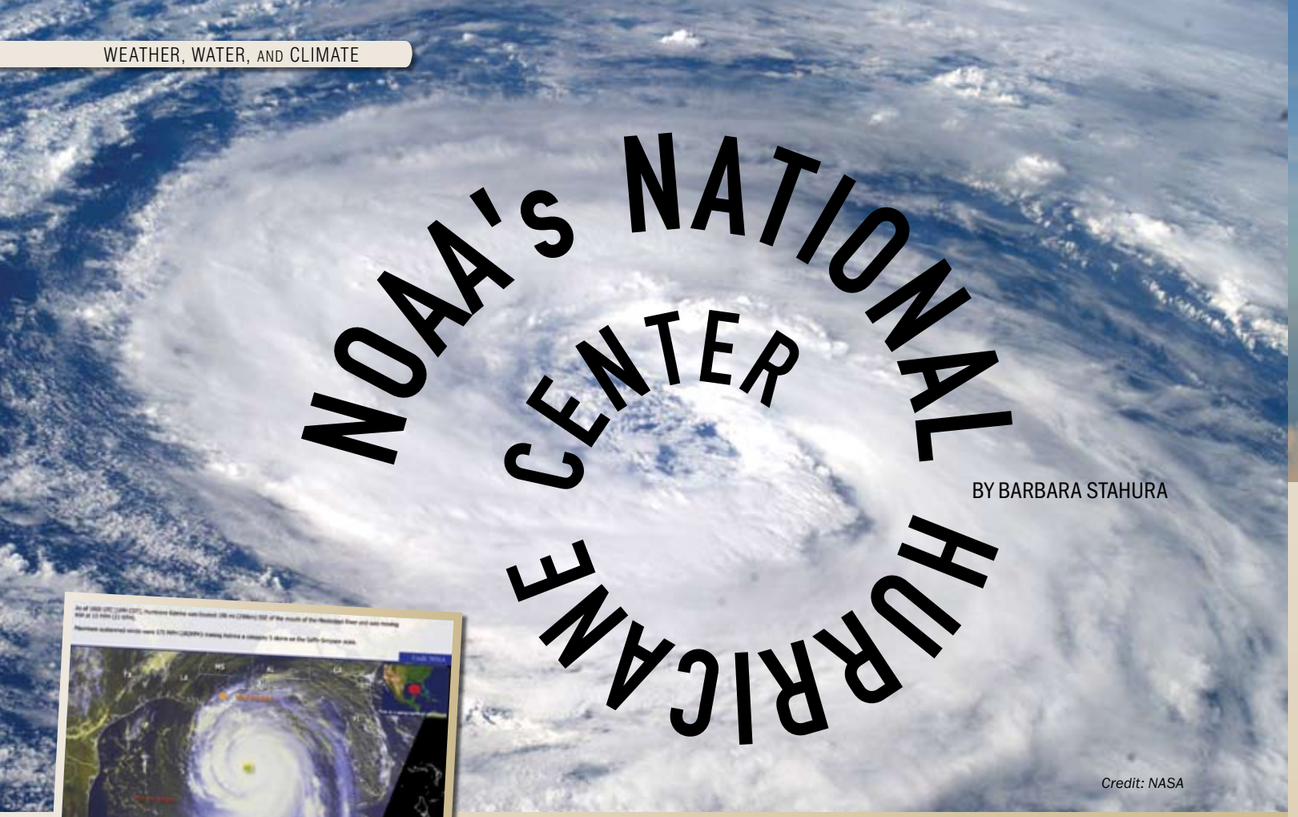
NOAA's NATIONAL HURRICANE CENTER

BY BARBARA STAHURA



Credit: NASA

Left: GOES-12 satellite imagery of Hurricane Katrina over the Gulf of Mexico at peak intensity of 175 mph. *Credit: NOAA Satellite Services Division*

As a hurricane barreled toward Galveston, Texas, in September 1900, local U.S. Weather Bureau forecasters closely monitored the threatening weather using the best tools available — experienced observation of skies and tides, barometers, and anemometers. Despite forecasters' warnings to move to higher ground, many people in the seaside community ignored them. Additionally, given their limited data, the forecasters could not accurately predict the horrific intensity of the storm. Eight thousand people died, making this the worst natural disaster in U.S. history.

Today, three NOAA National Weather Service (NWS) Centers monitor the tropics from Guam to the west coast of Northern Africa employing sophisticated technology far superior to that available a century ago. The National Hurricane Center/Tropical Prediction Center, Central Pacific Hurricane Center, and the NWS Joint Typhoon Warning Center on Guam use satellites, supercomputers, ocean buoys, and hurricane-hunting aircraft (see sidebar) to detect the wispy beginnings of a hurricane in the open ocean. They create accurate models of storms as they develop, and predict direction and landfall. They use data from space, land, and sea to protect people and property.

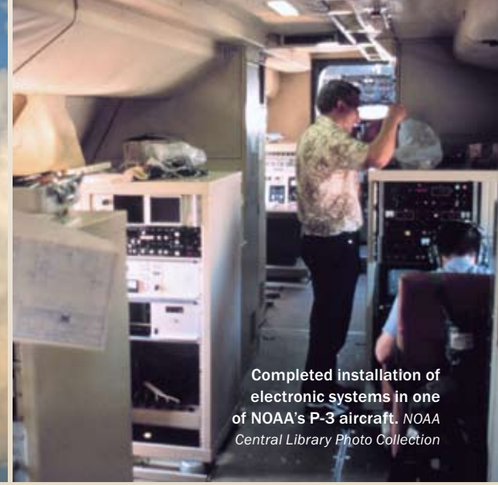
The United States launched its first weather satellite on April 1, 1960. Its descendants have grown increasingly more complex, enabling highly skilled forecasters to analyze weather systems, including hurricanes, in intricate detail and make better forecasts. From the Earth, NOAA's Doppler radars scan the atmosphere around hurricanes and typhoons, reading wind data, precipitation intensity, and movement, giving forecasters a cross-section analysis of the storm. Scattered in the ocean, floats and buoys transmit data from their watery locations to satellites, sending information on air and water temperature, wave height, and wind direction and speed.

Data from all these sources and more are funneled into NOAA's supercomputers, which perform more than 450 billion calculations per second. Using richly-layered mathematical representations, these technological workhorses model a hurricane's interactions with the ocean and the atmosphere, producing more accurate forecasts. In the 1980s, NOAA was able to issue two-day hurricane predictions. Today, thanks to its supercomputers, NOAA makes accurate hurricane predictions five days in advance.

The impacts of hurricanes — the costliest natural disasters in the United States — can be tremendous: billions of dollars in economic and property losses, damage to near-shore ecosystems, and especially human lives disrupted and lost. NOAA's continued investment in research and operations, along with partnerships with other agencies and public education and outreach, help to ensure that a tragedy on the scale of Galveston will not happen again.

National Hurricane Center – www.nhc.noaa.gov

A NOAA P-3 and NOAA's Gulfstream GIV-SP (foreground). *Credit: NOAA Marine and Aviation Operations*



Completed installation of electronic systems in one of NOAA's P-3 aircraft. *NOAA Central Library Photo Collection*

HURRICANE HUNTERS

Thomas Jefferson never heard of Miss Piggy, Kermit, or Gonzo, but all three are aircraft in the NOAA Hurricane Hunter story. NOAA, the National Oceanic and Atmospheric Administration, traces its roots back to President Jefferson. A very curious and scientific man, Jefferson established the Survey of the Coast in 1807, the first time the young nation made a concerted effort to chart its waterways and shorelines. This was the foundation of today's NOAA Corps, the smallest U.S. uniformed service, comprising 300 officers serving throughout NOAA.

Now, 200 years later, Miss Piggy, Kermit, and Gonzo are not only as known as Muppets, but also are mechanical members of NOAA, sturdy aircraft flying into and around the swirling environs of hurricanes to study and monitor these massive atmospheric phenomena.

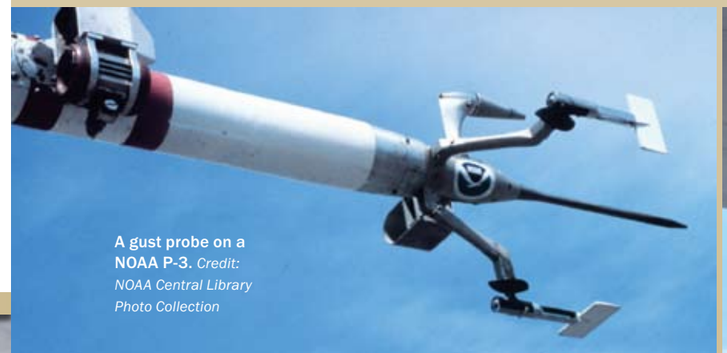
Civilian and NOAA Corps personnel of the NOAA Aircraft Operations Center (AOC) based at MacDill Air Force Base near Tampa, Fla., fly in conjunction with the Air Force Reserve 53rd Weather Reconnaissance Squadron from Keesler Air Force Base, Miss. While the 53rd, flying the Lockheed Martin WC-130J aircraft, tracks the hurricanes, AOC's aircraft study, monitor, and fly the landfall missions of both East and West Coast hurricanes every year between June 1st and November 30th.

Today, satellites locate and identify hurricanes – so no one actually has to "hunt" them. However, satellites cannot yet gather the data needed to measure hurricane intensity or to forecast their directions. The Hurricane Hunters are heavily instrumented, flying weather laboratories, capable of performing this service that can be accomplished in no other way ... up close and personal. The data gathered by these intrepid aircraft and crew save countless lives, protect property, and advance our knowledge of hurricane structure to improve the forecasting ability of the scientists of the National Hurricane Center.

Although several types of aircraft flew into hurricanes as early as 1947, the first NOAA/NWS Hurricane Hunter aircraft were McDonnell Douglas DC-6B aircraft, which started flying regularly in 1961. The DC-6s were replaced by the Lockheed WP-3D Orion aircraft, which first flew in 1976 through Hurricane Bonny. Thanks to a lot of care and meticulous maintenance, NOAA's Aircraft Operations Center is still operating the venerable WP-3D, even though Lockheed discontinued manufacturing the P-3 in 1990. In 1996, the AOC's Gulfstream GIV-SP was acquired. With high-altitude capability and "long legs," the GIV (Gonzo) flies completely around the outside of the storm dropping GPS dropwindsondes that measure temperature, barometric pressure, relative humidity, wind speed, and wind direction. The WP-3D aircraft (Miss Piggy and Kermit) work through the storm into the eye using the same GPS dropwindsondes and an array of sophisticated instruments, sensors, and radar to gather data and measure the dynamics of these massive weather systems.

Using the combination of the WC-130J tracking the path of the hurricane, the GIV measuring the atmospheric conditions around the circumference of the storm, and the WP-3D aircraft measuring and studying the interior of the weather system, NOAA's National Hurricane Center acquires a cornucopia of data to predict what a hurricane may do. In turn, this saves the lives and property of millions of people living along our beautiful shorelines. We've come a long way in 200 years.

NOAA Aircraft Operations Center – www.aoc.noaa.gov



A gust probe on a NOAA P-3. *Credit: NOAA Central Library Photo Collection*

Wing sensors on a NOAA P-3. *Credit: NOAA Central Library Photo Collection*