

CO-OPS Contribution to NOAA's Response to the 2005 Hurricane Season





As shown above, Dauphin Island, Alabama was devastated by Hurricane Katrina. The NOAA Dauphin Island tide gauge shown on the front cover continued to operate and provide critical real-time storm tide information throughout the hurricane.

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“Protecting Lives and Livelihoods”

NOAA's Core Values

*People, Integrity, Excellence, Teamwork, and Ingenuity
Science, Service and Stewardship*

NOAA's Vision

An informed society that uses a comprehensive understanding of the role of the oceans, coast, and atmosphere in the global ecosystem to make the best social and economic decisions.

CO-OPS' Vision

A Nation where everyone has ready access to tide, current, water level, and other coastal oceanographic products and services required for informed decision-making.

FOREWORD

NOAA plays a vital role during the hurricane season by compiling satellite observations, meteorological and oceanographic data, and numerical modeling results in order to provide critical information to stakeholders; including citizens and federal, state, and local decision makers. Each hurricane season presents an increased challenge for the National Oceanic and Atmospheric Administration (NOAA). The 2005 hurricane season proved to be not only an extremely busy season, but also a destructive one. Hurricane Katrina produced particularly large areas of devastation, overwhelming Federal, State, and local agencies, as well as residents of the Gulf Coast.

The National Ocean Service (NOS) Center for Operational Oceanographic Products and Services (CO-OPS) is one office that contributes to the NOAA effort by providing critical water level information. During the 2005 hurricane season CO-OPS personnel played a key role in providing real-time information on storm tide and in assisting the ports and industries within the Gulf Coast region to resume their operations as quickly as possible. Through their planning, observation, and response efforts, these dedicated folks gave far beyond what is normally required to maintain high quality products and services. This document is a tribute to those individuals and teams who played a vital role in our preparation for and response to the hurricanes of the season, especially Hurricanes Katrina, Rita, and Wilma. The 2005 season proved to be a challenge for many—from CO-OPS personnel to Gulf Coast residents—all of whose lives were forever changed.

As time passes, the details of the 2005 season may become a distant memory. So that we will always remember some of the extraordinary efforts of those who “went the second mile”, we have highlighted the experiences of these personnel during the unusually active 2005 season. This document is based on a series of interviews with those who were involved in tracking storm tide, supporting hydrographic surveys, and restoring vital services. Several other sources were used to pro-

vide historical perspective and information concerning the impact of the hurricanes, particularly Katrina. These sources of information, combined with personal interviews, tell the story of the energy, professionalism, and dedication of those who contribute so much to NOAA's success.

Thanks to all CO-OPS personnel for a job well done and for the following employees for sharing their observations.

John Abbitt	Chris Parish
Carl Cecere	William Popovich
Monica Cisternelli	Jason Standridge
Virginia Dentler	Allison Stolz
Mark Erickson	Joe Taylor
Lori Fenstermacher	Cary Wong
Anthony Godette	Darren Wright
Gerald Hovis	Brad Wynn
Rick James	Warren Krug
Heidi Keller	Mark Bushnell
Carolyn Lindley	Richard Edwing
Craig Martin	David MacFarland
Sarah Mrozek	Mike O'Hargan



Director
Center for Operational Oceanographic Products & Services

INTRODUCTION

What a difference 105 years makes! If only Isaac Cline had had our present-day observation capabilities back in 1900, more than 6,000 (some say 8,000) Galveston residents might not have perished in one of the deadliest storms in our nation's history. Galveston residents still refer to "the storm" when describing the weather event that devastated Galveston Island on the evening of 8 September 1900. Cline, who was Chief of the U.S. Weather Service Bureau in Galveston when "the storm" hit the Gulf Coast, began to realize the danger during the same afternoon that the storm made landfall. Higher than normal tides, dropping barometric pressures, and steady increases in wind velocity were his only clues of the impending danger. However, by this time, there was little opportunity for Galveston's 37,000 residents to evacuate safely.

A center of commerce, Galveston's highest ground in 1900 was only 8-9 feet above sea level. There were no seawalls or levees to protect the city from the storm surge produced by "the storm", which was estimated at over 15 feet. Galveston's population had never experienced a hurricane (or tropical cyclone), and most residents were quite secure without investments in such infrastructure, even though the idea had been discussed. After the horrific event, meteorologist Cline estimated that the wind reached speeds of 120 miles-per-hour (mph) during "the storm", and most now agree that winds of 120-140 mph would have been required to produce that kind of extreme tide and storm surge.

Since that time, hurricanes have continued to be the bane of coastal living. With our burgeoning coastal populations, people are more vulnerable than ever to the whims of nature – especially from early June through late November. Inland populations are also vulnerable to damage from wind and flood. However, the risk of losing human lives is mitigated by sophisticated and extensive observation tools that we now have at our disposal. Today, the many instruments placed strategically along the coastal U.S. and Great Lakes, provide data that serve as the backbone for our weather observations and predictions, giving us the time to prepare for impending hurricanes—time that Isaac Cline did not have.

We have been in a period of high hurricane activity since 1995. The 2005 hurricane season was particularly active, with 28 named storms and 15 hurricanes (7 major ones). Six hurricanes (Cindy, Dennis, Katrina, Ophelia, Rita, and Wilma) struck the U.S., but Katrina was by far the most devastating. There were at least 1,300 casualties, with damage estimates exceeding \$80 billion. The NOAA National Hurricane Center (NHC) forecasted that Katrina would hit the New Orleans/Gulf Coast area approximately 60 hours before the storm actually came ashore, and the predicted track was stunningly ac-

curate. Hurricane Katrina made her first landfall as a Category 1 hurricane on 25 August 2005 near Miami, Florida. A slow-moving storm, Katrina dumped about 16 inches of rain on Florida, causing several deaths, flooding, and widespread power outages.

Katrina made her second landfall at Grand Isle, Louisiana, located in the southeastern part of the state in Southern Plaquemines Parish, on 29 August 2005, with sustained winds of 135-145 mph and gusts of over 165 mph. The huge storm ravaged a multi-state area resulting in major damage to over 93,000 square miles in Louisiana, Mississippi, and Alabama.

Less than a month later, the second Category 5 hurricane of the 2005 season began brewing. Hurricane Rita began as the 18th tropical depression of the 2005 season, forming on 17 September east of Turks and Caicos Islands. Rita moved west, sideswiped the Florida Keys, moved into the Gulf of Mexico, and on 24 September made landfall near the Texas/Louisiana border at Sabine, Texas as a Category 3 hurricane. The storm brought 125-mph sustained winds and a 15-foot storm surge. Although Rita's path tracked southwest of where Katrina had been, the paths of the two expansive storms overlapped, hitting some vulnerable areas twice. In the path of many storms lie the very instruments that collect the oceanographic and meteorological data that form the basis of NOAA's products and services. The Gulf Coast region has 32 tide stations that are part of the 187-station National Water Level Observation Network (NWLON or the network). To supplement these 32 tide stations, CO-OPS personnel added another 31 partner stations to the network before Hurricane Rita to increase the number of water level sensors available to use during emergencies. Some were reactivated stations belonging to private and public sector partners with whom CO-OPS interacts; other stations were relocated from areas on the East Coast where projects had previously been completed.

In addition to producing the real-time data that the National Weather Service (NWS) uses for forecasting, the network also helps to provide decision-support for marine transportation, emergency response and evacuation. The users of these data products and services that are derived from the network encompass the entire U.S. marine transportation system, including commercial vessel operators using U.S. ports, the fishing industry, coastal zone managers, public and private sector hydrographic surveyors, recreational mariners, and many others.

With the intensity of these storms, it is not surprising that CO-OPS' extensive network of tide stations, exposed to the harsh environment of the Gulf Coast, would be impacted by the hurricanes' wrath. Katrina completely destroyed four tide stations and a GPS tide

station buoy, and damaged another four stations. Rita destroyed two tide stations and damaged four, one of which had already been damaged in Katrina.

All six hurricanes that affected the U.S. made a significant impact on both the users of data and those who maintain that critical data stream. Users of CO-OPS data depend on the products and services generated from these data, and those products and services help to ensure safe navigation and economic growth and commerce. Those who maintain the critical data stream that comprises the network are accustomed to increased workloads during and after hurricane seasons. However, 2005 was a season to remember for those who are part of the CO-OPS teams that made efforts far beyond the normal duty requirements.

Let us take a closer look at the experiences of some of those who worked tirelessly during the 2005 season to ensure that CO-OPS products and services were available.





Calcasieu Pass: Ground zero for
Hurricane Rita

CO-OPS PERSONNEL AND STAKEHOLDERS

Their Stories

The chronicle of Hurricane Katrina's impact on CO-OPS personnel begins with the realization of the magnitude and track of the storm and ends with restoration of tide stations to their full functionality. First we'll glimpse the Quicklook Team, who facilitated storm tracking by providing a Web page "Quicklook" at the storm status. Then we'll examine how the Hydrographic Planning Team provided critical support to hydrographic survey teams so that ports and harbors could re-open safely after the hurricanes. We'll go out to the field with personnel who repaired and replaced instruments, as well as those who helped hurricane survivors on a more personal level.



All of them, whether as a team or individually, exemplify what it means to care deeply about the quality of CO-OPS products and services, as well as those whose lives have been disrupted by nature's wrath. These CO-OPS personnel, putting aside the "individual" in favor of the "team", remind us that the whole is indeed often greater than the sum of its parts. They have valuable insights and wisdom to share about their experiences that serve as superb examples for coping with future hurricane seasons.



Bridges destroyed
in Ocean Springs,
Mississippi

QUICKLOOK TEAM

Hurricane Isabel in September 2003 served as a catalyst for Bill Popovich to expand his idea for a product that would bring together data from a variety of sources, offering users a snapshot of any hurricane likely to hit the U.S. This product, Quicklook, was used for the first time in the 2004 hurricane season and provides a storm alert Web page that coincides with the six-hour NWS hurricane advisory cycle. It also integrates information from National Environmental Satellite Data and Information Services (NESDIS) satellites, CO-OPS water level gauges, and NWS data. In the busy 2005 season, Quicklook provided storm tide analysis that helped the NWS, port managers, and others users of CO-OPS data track storms around the clock, including Hurricanes Katrina, Rita and Wilma.

Popovich (an oceanographer) worked with Darren Wright (a meteorologist) to develop requirements, and with the information services personnel to create the tools that provide snapshots of a storm progression. During the 2005 season, Quicklook enabled the team to offer up-to-the-minute storm tide analysis by providing an accurate survey of what was happening at the gauges at the 12 long-term monitoring stations along the Gulf Coast. Quicklook will eventually be integrated into the NOAA Storm Page, NOAA Watch, as a one-stop shop for monitoring all hazards, including hurricanes.

The Quicklook team is a hybrid group—volunteers from the Datums and Hydrographic Team—consisting of oceanographers Jerry Hovis, Virginia Dentler, Lori Fenstermacher, Heidi Keller, Carolyn Lindley and Kathleen Fisher. The team tracks every hurricane that the NHC predicts will come ashore, and begins posting Quicklook reports every six hours around the clock approximately three days before storm makes landfall. Postings are made at 0500, 1100, 1700, and 2300 each day. This 24/7 schedule demanded a particularly intense commitment during the active 2005 season.

Aside from the technical skills and the time commitment required, the ability to function effectively as a part of the team is an individual's most important quality. Each team member had the chance to develop leadership and technical skills by serving as the "team leader" and performing detailed analysis work. Team members rotated the leadership responsibilities, not only to provide everyone the opportunity to be a leader, but also as insurance against "burnout". The team is also responsible for interacting with others, such as the NOAA Navigational Response Team, the Office of Coast Survey's (OCS) Hydrographic Survey Team, CO-OPS Field Office and Information Systems Divisions.

In the 2005 hurricane season, the team experienced a 50% increase in their normal workload. "The 2004 hurricane season was challenging with the flurry of storms striking Florida, and seemed like the ultimate storm tide workload. The 2005 season surprised us

Quicklook team members
(l-r) Jerry Hovis, Heidi
Keller, Lori Fenstermacher,
Kathleen Fisher,
Virginia Dentler, and
Carolyn Lindley.



all with both the volume and intensity of landfalling tropical cyclones. It definitely stretched the Quicklook team to its maximum limits,” noted Popovich.

In addition to the toll of intense and heavy workloads, the team witnessed dramatic destruction of a variety of instruments and even entire shorelines during the 2005 hurricane season. In fact, 5 of the 12 tide stations on the Gulf Coast were either damaged or destroyed during Hurricane Katrina. As Quicklook team member Lori Fenstermacher notes, “I had just been to New Orleans for the first time only months before Katrina, and saw with my own eyes the city below sea level. It was hard not to imagine the same streets I had walked on covered with battering waves, as I analyzed which stations were getting the greatest impacts. It was disturbing to see water levels start rising when the hurricane was still hundreds of miles from the coastline, practically in the middle of the Gulf! It was even more disturbing when we estimated that Katrina’s landfall was forecasted during the high tide. Katrina hit during high tide, for even greater impacts. And then we watched as the water still kept rising, hours after landfall, near the heart of New Orleans, at East Bank, Louisiana.”

All told, the Quicklook team radiates a satisfaction that comes from knowing that they’ve put forth their best efforts—they’ve mastered the software, fine-tuned their storm tide analysis skills, and have done their best teamwork ensure that Quicklook reaches its full potential as a tool to assist in planning for extreme events such as Hurricanes Katrina and Rita.

HYDROGRAPHIC PLANNING TEAM

When CO-OPS refers to a “team”, it does not use the term lightly. Effective teamwork is essential to CO-OPS’ success, and the Hydrographic Planning Team (HPT) is a stunning example of how the right people make the sum of its parts greater than its whole. The HPT supports the Field Operations Division (FOD), Office of Coast Survey (OCS), and others, by laying the groundwork for them to perform their own vital missions.

The oceanographers on the HPT—Cary Wong, Monica Cisternelli, Carolyn Lindley, Craig Martin, and Allison Stolz—laid the foundation for OCS by supporting hydrographic survey platforms through crucial planning and data application. CO-OPS network of water level stations in the Gulf of Mexico were used to create areas of similar tidal characteristics, or Discrete Tidal Zones. This tidal zoning uses water level information derived from datum calculations to reduce bathymetric data to chart datum (Mean Lower Low Water or MLLW). This tide corrected sounding data must be provided for the areas of commerce that may have been affected by the storms, such as obstructions blocking a channel for commercial traffic or even shoaling that occurred as a result of the storm. Without this corrected data, ports could only be opened to a certain depth; therefore, they could not accommodate the large container ships that are so vital to the U.S. economy.

Team members make decisions based on many pieces of information that can change rapidly, depending upon the storm track line, its intensity, and other factors. Knowing which areas need correction, and prioritizing those areas properly require experience and finesse are a major challenge under the best of conditions—not to mention the extra burden created by these super storms of 2005. For example, there was a large influx of information during Hurricane Katrina (sometimes every 10 minutes) that resulted in the ever-changing priorities. The HPT made decisions about where people and equipment would be needed based on this information. The accuracy of assumptions made by the team depended greatly on staying on top of all this almost unmanageable volume of information. Additionally, everyone on the team worked an average of 25% overtime as a result of Katrina, Rita, and Wilma. During August and September 2005, the team put aside their regular operations to support the demands the particularly active hurricane season.

Much of the team’s effort goes to support other groups. For example, the HPT provides information to six National Response Teams (NRT) that are part of the Office of Coast Survey, to the CO-OPS Field Office in Chesapeake, and to the NOAA vessels THOMAS JEFFERSON and NANCY FOSTER, as well as the Time Charter (a vessel operated by the contractor Science Applications International Corporation or SAIC).



Hydrographic Planning Team members (l-r) Cary Wong, Craig Martin, Allison Stolz, and Carolyn Lindley.

Data quality is another big concern for the HPT. With the stress of shifting priorities, long hours, and the number of platforms requiring critical information, the team members have developed specific quality control procedures for ensuring data accuracy. Each team member is responsible for checking the calculations of other team members before the data are released. The HPT also takes pride in seamless communication with each other, which is an important factor not only in data quality but also for resolving many issues before they become major problems.

When asked about their work during the 2005 hurricane events, the HPT members recall the chaotic nature of the meetings and the different directions in which they were pulled both during and after the storms. Says Cary Wong, who lead the HPT during Hurricane Katrina, “The thing that I remember most about the hurricane response was how fast things developed. As I sat in the teleconference meetings with the folks in the field and in the command centers or in transit to the affected area, our priority areas changed by the minute based on need, logistics, infrastructure, personnel requirements and safety issues.” The reason for the chaos is tied directly to the critical and basic role that the HPT plays in promoting safe navigation. The ports within the Gulf Coast region could not re-open until the hydrographic surveys (by OCS) were completed. Each group depends upon the efforts of others to ensure that the NOAA mission is fulfilled. “It’s amazing the extra effort the Hydrographic Planning Team put in when we knew the information we provided could help get basic necessities like food and water to those impacted by Hurricane Katrina,” according to Craig Martin, who currently leads the team.

The HPT members agree that the word “no” is not in their vocabulary. They always find a way to respond to the requests from the field. “In the end the Hydro Planning Team managed to provide all the zoning required for each survey in a timely fashion and direct the CO-OPS and other field teams to install or repair the critical water level gauges where they would have the most impact in support of the hurricane response,” reflects Wong. Team members are also very aware that the entire mission does not depend solely on them, but upon a large network of people. No one team, office, or agency can do the job alone. Each person has his or her specific responsibilities that help to ensure the successful support of the users of CO-OPS products and services.

CO-OPS FIELD RESPONSE

The aftermath of the destruction left by Hurricanes Katrina and Rita required response from a multitude of organizations—some to provide humanitarian aid, others to deal with destroyed and damaged infrastructure. CO-OPS personnel who provided field response had a significant amount of work waiting for them. Their primary objectives were to perform reconnaissance and damage assessments of the network, support hydrographic survey operations, and repair/replace equipment that was damaged or lost as a result of the storms.

Personnel who regularly perform field work travel extensively to discharge those duties. Some spend as much as four months (or even more) out of the year performing maintenance, repairs, and other tasks associated with the network of 187 National Water Level Observation Network (NWLON) stations around the U.S. coastal and Great Lake areas. The extensive travel requirements of field response personnel alone make their jobs challenging even under normal circumstances; however, when you factor in the lack of basic amenities—such as reasonable hotel accommodations, electrical power, the availability of food and water, and the ability to purchase any equipment or components required—you begin to imagine how difficult this was for personnel who deployed into the Gulf Coast region.

Nine personnel based at the Chesapeake, Virginia facility deployed to the Gulf Coast after Hurricanes Katrina and Rita. Eight of those performed work on various tide stations in the region, and one was part of the Federal Disaster Volunteer Program. Others worked hard to support field personnel by ensuring that they had the proper equipment to perform their field tasks.

These personnel, sometimes working alone, but often times functioning as a team, were challenged during their deployment to the region in ways not generally encountered. One of the first dilemmas was obvious before they even left Chesapeake: what supplies would be needed? They had no way to know for sure what kinds of repairs or replacements would be required until a damage assessment was performed. They knew which stations had ceased transmitting data, but did not know why, or whether those stations would have to be replaced or repaired, or what kind of repairs would be necessary.

Once in the Gulf Coast, teams were pulled in a multitude of directions. Calls were constantly flowing in from the wide geographic area that had been devastated by both Katrina and Rita. The large volume of requests from long distances away made the prioritizing of projects difficult. “Where do we go next?” was a question often asked by field response personnel. “Where is the greatest need?” was the next question, the answer to which was not immediately apparent.

Transporting and storing equipment at secure sites were also common obstacles that had to

be overcome. Security was an issue both for equipment storage and for personal concern. In some areas like Waveland, Mississippi, there were simply no physical structures left for secure storage. Personnel found some pretty creative ways of working around these impediments—from packing everything into a sport utility vehicle for long commutes to working with the crew of the NOAA Ship THOMAS JEFFERSON to secure equipment.

Personnel faced many other challenges in their efforts to repair and replace tide stations, but one of the largest was the sheer distance between the jobs. Because of these long commutes from lodging to the work sites, completion of repairs or replacements took much longer than they ordinarily would have. Pensacola, Florida was one of the closest areas where reliable food and lodging were available, but it was not particularly close to any of the damaged and/or destroyed tide stations. Commuting time from Pensacola to Gulfport was approximately two hours each way.

Several common themes emerged as CO-OPS personnel told their individual and collective stories. They revealed strikingly similar observations about the whole experience—how the lack of things that most of us take for granted made their jobs more difficult and time-consuming. Some of the lodging lacked what most of us consider essential—hot, running water; food; cleanliness; adequate equipment and supplies to ensure quality work; telephones; e-mail; and personal security. None of these “necessities” were guaranteed, or even likely to be available, especially in the first few weeks after Katrina and Rita hit.

Personnel overcame several daunting obstacles to successfully perform their mission. Their efforts were enhanced by the cooperation of many individuals and agencies, but none was mentioned more often than Tim Osborn. Tim, a navigation manager for Gulf of Mexico Region, and his family opened their home to field personnel, not only providing a safe place to stay, but also as “logistics managers” of sorts—arranging for rental cars, transportation to/from the airport, and helping CO-OPS field response personnel find lodging as close as possible to various work sites. Those who performed many of the field operations expressed sincere gratitude to Tim for his dedication and commitment.

Personnel traveled to the Gulf Coast region in a variety of ways: by air, by water, and by highway. Some traveled alone; others went in pairs. None had ever experienced such devastation, and all were touched in some way by the toll that Katrina and Rita took on the residents of the Gulf Coast. Their stories offer a glimpse of how planning and perseverance helped them cope with this devastation.



This NOAA helicopter greatly assisted CO-OPS personnel in performing damage assessments along the Gulf Coast after Hurricane Katrina.

CO-OPS FIELD RESPONSE: PERSONAL STORIES

Warren Krug

When talking with Warren Krug, you get a sense that all of the work during the 2005 hurricane season was business as usual. “We have routine conference calls with CO-OPS headquarters to discuss the status of instruments in the field,” says Krug. In addition to the constant monitoring, personnel perform a communication analysis before every hurricane season to ensure that equipment is working properly, and they almost always find things that must be replaced or repaired. As each storm approaches landfall, the frequency of conference calls increases. Communication within the entire CO-OPS organization, as well as with other agencies, is critical for every organizational function, whether it is a Category 5 hurricane bearing down on the coast or routine maintenance to ensure that instruments are transmitting data properly.

According to Krug, a weekly operations meeting is held to discuss each station, especially those that may need maintenance. One of the challenges the team faced after Hurricane Katrina was that, because they were (and are) in the process of upgrading the network with equipment that can transmit larger amounts of data, there were three or four different systems to support – many with very different parts. After the storm, there were daily calls to assess the network and make decisions about how to respond, identifying specific equipment and components for each response.

Everyone’s first priority was to ensure that all the ports and harbors were open to navigation. Krug cited his contact with Texas A & M, a NOAA partner who plays an important role in the Houston/Galveston PORTS® network . Krug sent equipment to help ensure that PORTS® was up and running. They did lose some phone lines, but otherwise fared well in Houston.

Some stations, like Morgan City, Louisiana, simply had no electrical power, so Krug and those supporting field personnel ensured that generators were shipped to that area. In some cases, auxiliary tanks were required to keep the generators running for longer periods of time.

The logistics required to ensure that instruments are on the shelf, in good working order, with the most up-to-date software installed, are pretty extensive. According

to Krug, the whole culture is one of not entertaining failure. “On Saturday morning (the day after Katrina hit) there were ten people in the warehouse preparing equipment to be shipped to the Gulf Coast. Nobody asked anyone to be there – they just came because they don’t like to fail. We do this all the time.”

Krug clearly articulates that everyone inherently understands that how they do their job affects others both inside and outside of CO-OPS. “NRT (National Response Teams) couldn’t do their surveys unless we did our job. Everybody did what they were supposed to do.”



The CO-OPS field party approaches a National Guard checkpoint, their vehicle loaded with instruments that have been carefully inspected, calibrated, and packed for transport to the field.

LT Sarah Mrozek and Mark Erickson

Hydrographic Survey Coordinator LT Sarah Mrozek and environmental technician Mark Erickson were among the first to leave for the Gulf Coast, departing from Norfolk, Virginia aboard the NOAA Ship THOMAS JEFFERSON on Saturday, 3 September, arriving on Friday, 9 September in Pascagoula, Mississippi. The lack of communications coming out of the Gulf Coast immediately after the hurricane created uncertainty about the conditions there. Field response personnel were concerned about the rumors of “martial law”, and that concern was a major factor in the decision to travel by sea. Mrozek and Erickson were initially tasked to support emergency hydrographic survey operations. The crew of NOAA Ship THOMAS JEFFERSON provided assistance in the field, as well as other important logistical support, such as land transportation.

Their first critical mission was the installation of two tide stations: one in Gulfport and the other in Pascagoula, both of which were totally destroyed by Hurricane Katrina. The logistical challenges were numerous. In order to get to the shore from the ship, Mrozek and Erickson spent 1.5 hours traveling on a small boat (similar to a Zodiac) each way. Transporting the equipment necessary for these station installations was not particularly easy. However, in some ways it was easier than being constantly surrounded by



Mrozek, Erickson, and crew from NOAA ship THOMAS JEFFERSON work to restore the station at Pascagoula



I felt like I was just one member of a team
who was just there doing my job ...

Mark Erickson

total destruction. Both Gulfport and Pascagoula communities and their infrastructure were essentially destroyed. Often the lone pilings were the only clues that remained where a pier had once stood.

After performing the installations in Gulfport and Pascagoula, Mrozek and Erickson detached from NOAA Ship THOMAS JEFFERSON and stayed in Pensacola, where they formed another CO-OPS team with Brad Wynn, Anthony Godette and Jason Standridge. Their next mission was to support the hydrographic survey team by completing repairs and surveys in Gulfport, Mississippi. This involved a two-hour commute (one way) from Pensacola to Gulfport. Mrozek, reflecting on the trip, says, “Though the commutes and travel made long days longer, we were fortunate to have a place to stay. Many people had lost their homes, their cars and their lives.”

The lack of lodging made the commute a necessary, albeit an energy-draining evil. It wasn’t always so much about the commute itself as it was the unpredictability of it all. Because many bridges were closed or destroyed, Mrozek and others often had to find alternate routes to worksites.

After installations at Gulfport, the team proceeded to Biloxi, Mississippi, Dauphin Island, Alabama, and Port Fourchon, Louisiana for more repair and survey work. Although Mrozek and Erickson performed their work under more challenging conditions than usual, they found that this made them pull together even more. “I felt like I was just one member of a team who was just there doing my job and helping out as much as we could,” says Erickson. They journeyed home on 19 September out of Lafayette Louisiana.

Brad Wynn

Brad Wynn, an engineering technician with the Chesapeake Facility, departed on 8 September to perform a damage assessment of the Gulf Coast water level measuring stations. His task was to investigate the condition of each station, and to determine the reliability of the data being received from the surviving stations.

Of his 16 days in the region, Wynn spent the first week on NOAA's Bell 212 helicopter performing low-level aerial reconnaissance along 300 miles of coastline—from the coast of Pensacola, west to Baton Rouge, and south through the Mississippi Delta to Grand Isle, Louisiana. The helicopter was operated by NOAA's Marine and Aviation Operations - Aircraft Operations Center and arranged for by Richard Edwing at CO-OPS Headquarters. Its use enabled Wynn to visit nine stations—assessing damage, prioritizing station repairs, and determining the resources needed to initiate those repairs.

Aboard the NOAA helicopter, Wynn also captured over 20 hours of video, which documents the aftermath of the storm that destroyed fishing fleets in Alabama, quiet vacation communities along the Mississippi coast, major gambling and entertainment industries in Biloxi, commerce and industry in New Orleans, and petrochemical industries in the Mississippi Delta. He has compiled and edited the video into a documentary of the Gulf Coast devastation.

After his reconnaissance of the coast, Wynn joined other field response personnel dispatched to the area—Anthony Godette and Jason Standridge in the Mississippi Delta, and then Sarah Mrozek and Mark Erickson from the NOAA Ship THOMAS JEFFERSON in Pascagoula. After responding to separate emergency needs the previous week, the individual teams came together to address the remaining issues. Wynn served as the team point of contact and worked with them (based on the coastal reconnaissance and other available information) to formulate a comprehensive plan to repair or replace the remaining stations in the region. Wynn observes that, although the teams were exhausted and still faced formidable challenges, joining resources provided a much needed morale boost that raised everyone's spirits. Working in desolate areas that were devoid of inhabitants had taken its toll. The beaches were eerily silent, and there was an uncomfortable stillness amid the vast destruction. Working together proved to be productive and beneficial for all.

Another issue that had an overarching impact on the team's mission was the coinciding launch of the CO-OPS Indefinite Delivery Indefinite Quantity (IDIQ) Environmental Field Services contract. Negotiations had been in progress for over a year; the contract was within days of being awarded when Katrina hit. The fact that an unknown number of stations had been damaged or destroyed greatly increased the scope and urgency of the post-hurricane response. Getting stations operational was paramount; therefore, there was significant pressure on the team to quickly document the stations, identify problems, and find creative solutions. Contract modifications had to be considered and requirement changes written—all of which affected the team's daily movements and activities. The NWLON stations along the Florida and Gulf Coast were among

the first task orders awarded under this new contract.

At the end of his trip, Wynn reflected on the human side of the disaster and volunteered to spend a couple of days as a relief worker assisting storm victims. He worked with Operation Blessing preparing and distributing meals at a temporary relief center in

I was amazed at the sheer magnitude of the storm ...

Brad Wynn



Slidell, Louisiana. After an intense two weeks focused on technical and logistical challenges, he felt compelled to connect to the people upon whom the storm had inflicted such great damage.

“The scale of human suffering was enormous and the need was great. Although the details were unique, the same story was repeated often. Families from all walks of life were displaced and living in cars. Many had lost loved ones. Most were confused and uncertain. All were overwhelmed and worn out,” Wynn reflects.

As basic services and utilities were slowly being restored, the realities for the victims began to settle in. Stores were opening, but many victims had no money. Personal and financial records were gone. Homes were destroyed and their workplaces no longer existed. Even prescriptions could not be filled, as medical records had been destroyed along with pharmacies and doctors’ offices. Recovery would be a slow, difficult process.

Contrary to the negative news centered on New Orleans during the weeks following the storm, Wynn observed an exceptional (yet under reported) response by dedicated relief workers and volunteers who had come from all over the nation. He assumed that working as a volunteer would allow him to slow down and process the experience before departing the area. This could not have been further from the truth. The volunteers worked tirelessly around the clock. They cheerfully pushed on despite oppressive heat, humidity and austere accommodations. They were there because they cared, and they made a significant difference in a way that no government program could ever do.

Wynn notes, “When you go into an area after a hurricane, the expectations are tied to your frame of reference. My past experience with post-hurricane assessment was that the significant or extraordinary damage was limited to small pockets within specific geographic areas. This storm was different. I was amazed at the sheer magnitude of the storm, and astonished at the path of destruction it left behind”. There’s really no way to capture the extent; however, Wynn’s video footage shows what the written word cannot. He headed home on 24 September.

Sarah Mrozek, Joe Taylor, and John Abbitt

John Abbitt, a field technician from the Chesapeake Facility, and Mrozek returned to the area at the end of October to perform reconnaissance work at New Canal (New Orleans), Bay Waveland, Mississippi, and the Atchafalaya River Basin, in Louisiana. These areas, already damaged by Hurricane Katrina, had also sustained damage from Hurricane Rita.

The work at New Canal required a full installation of new tide stations and was a high priority. The Army Corps of Engineers had requested this installation to support their work rebuilding the levees. Bay Waveland, a 1.5-hour commute (from New Orleans) was generally destroyed. Abbitt and Mrozek note that the area was laden with debris – every bridge and house was gone, and there were clothes strewn in the trees that were left. They installed a tide gauge and surveyed during their visit to this forlorn place.

Part of Louisiana's charm centers around the large network of islands, bridges, and wetlands. While somewhat isolated even before the storm, many areas were almost impossible to access afterward because of the destruction of so many bridges. Abbitt describes the challenge of getting to the Louisiana Wildlife Management Area (LWMA) headquarters in the Atchafalaya Delta, where he and others needed to travel to perform the necessary survey and/or repairs. The wildlife management personnel kindly provided rides from the

I was just glad to do my part in getting the Gulf Coast up and running.

Joe Taylor



Berwick Boat Ramp, located at the end of the Atchafalaya River. They would then launch a small boat from the boat ramp to travel to the wildlife management area, located about 19 miles south of Morgan City, Louisiana.

During November, Abbitt and Mrozek again traveled to the Gulf Coast to install gauges for New Canal, Bay Waveland, and LWMA—this time joined by Joe Taylor, a field technician from the Chesapeake facility. They noted that, although the building supplies were still scarce in the Gulf Coast region, the availability of food and lodging became easier than it had been in September. Abbitt stayed in New Orleans, which was close to his work, during this time, and departed just before Thanksgiving.

In the end, those from the CO-OPS Chesapeake facility who responded to the disaster expressed many of the same thoughts about their post-hurricane experience. Mrozek's comment was representative of those thoughts. "The sense of teamwork and selflessness that came about post-Katrina will always stand out in my mind; the personnel from my office 1,000 miles away, the NOAA Pascagoula Lab, the NOAA Ships and, of course, from the hotels and restaurants across the Gulf Coast. Each group was being pulled in every direction and yet was so kind and willing to assist us".



The sense of teamwork and selflessness that came about post-Katrina will always stand out in my mind ...

Sarah Mrozek

Anthony Godette and Jason Standridge

Godette and Standridge both electronics technicians, left the Chesapeake Facility for Lafayette, Louisiana on 10 September. Their mission was to repair or replace tide gauges at Port Fourchon, Grand Isle, Gulf Shores, Louisiana, and Pascagoula, Mississippi. Generally, their work needed to be completed before the hydrographic survey personnel arrived.

As they packed equipment in preparation for the trip, Godette remembers the challenges involved with packing – not knowing exactly what the requirements would be – and knowing that, once they arrived, they may not be able to locate a forgotten item, given the destruction they knew awaited them. They prepared for every scenario that they could anticipate and, looking back on their trip, were pleased with their preparations.

Upon arrival, the first stop was Port Fourchon, Louisiana. For the first three days of their stay, they had very unusual accommodations—they bunked at the local jail. Because this was so soon after Hurricane Katrina, there was literally no place else to stay, so Tim Osborn had arranged for them to stay at the Port Fourchon jail. The good news was that they did not have to share the cells with anyone else. The tide gauge at the Port Fourchon station had been ripped out of the bracket, so Godette and Standridge replaced the gauge and it was operational the same day.

Godette and Standridge were complimentary of the accommodations and hospitality offered by Port Fourchon law enforcement personnel. According to Godette, the cells were clean and there were showers available. The biggest inconvenience was travel time (more than one hour) required to obtain food. However, the hospitality also included an escort to the next stop, Grand Isle. There were extreme safety concerns at this point, so this courtesy was much appreciated. It took two days to perform the necessary work at Grand Isle, where they rebuilt the housing for that gauge, put a blue tarp on it, repaired the gauge, replaced the solar panels, and reinforced the roof with plywood.

For the next two days, Godette and Standridge joined Sarah Mrozek and Mark Erickson to visit the tide station at Dauphin Island, Alabama, so they moved out of the jail and went to Pensacola. The water levels here had been extremely high, and the team wanted to ensure that everything was still intact. Even though the station was still returning data, there was no precise way to know if there was damage, so the team decided it was wise to conduct reconnaissance. They replaced the battery, not realizing that nature had more excitement (Hurricane Rita) in store for Dauphin Island.

The following day the team headed to Gulfport, Mississippi to replace water level gauge. This area was the west side of the storm and sustained catastrophic damage. Godette recalls seeing the church steeple and the four outside walls left standing, with everything inside washed away. The aquarium was also destroyed; however, the dolphins swam close by, and people would come out to feed them.

The next two days were spent checking levels in Gulfport and Pascagoula. After follow-up work at these locations, Godette and Standridge returned home on 19 September.

Godette made two additional trips on 3-10 December and 21-24 January. During December, he repaired three gauges on the New Orleans Canal, repaired a gauge on Big Island. At New Canal, Anthony repaired the program on the Xpert 9210, which was not transmitting properly and arranged for a contractor to repair the Dauphin Island station before departing on 10 December.

The next trip Godette revisited Dauphin Island, replacing the Vitel with an Xpert 9210 and making sure that the gauges were transmitting properly. This area had sustained extensive damage in a storm before Hurricane Katrina, and the area was covered with sand approximately three feet deep. The solar panels on the primary gauge were destroyed, and the platform was knocked 30 feet off the water. He returned home on 24 January 2006.



Anthony Godette points to the I-95 bridge, connecting Biloxi to Ocean Springs Mississippi, which was destroyed by Hurricane Katrina.

Rick James and John Abbitt

Rick James and John Abbitt departed from Chesapeake on 26 September, the Monday after Hurricane Rita made landfall. Upon arrival, they were fortunate for the hospitality of Tim Osborn and his family, where they stayed for several days. Osborn also helped set them up with a rental car and supplies needed for their journey.

James and Abbitt performed various tasks in the area—driving 2,000 miles during their ten-day deployment—from Gulfport, Lake Charles /Calcasieu Pass, and New Iberia, Louisiana to Dauphin Island, Alabama. At Lake Charles, they performed their first installation—a temporary water level station to replace the original station, which was completely destroyed. They noticed a strong U.S. Coast Guard presence at Lake Charles, and made it a point to chat with them. James and Abbitt learned that the unit was out of Miami, Florida.

“I have to give the U.S. Coast Guard a big thank-you for helping us complete our mission,” says James. The Coast Guard, there to secure and protect the harbor at Lake Charles, agreed to transport James and Abbitt up Lake Charles to reach Calcasieu Pass, which was ground zero for Hurricane Rita. The Coast Guard had small inflatable launches that were ideal for the 25-mile trip to transport them to the tide station.

Upon arrival, they found that the concrete pier containing the well was heavily damaged. Because a large section of the pier near the shoreline was missing, James and Abbitt found that they could not perform the leveling from the well to the benchmarks. Here is where the creativity and “can do” teamwork makes all the difference. “We were all looking at the size of the opening that was missing and thought the boat would just fit in between the two sections. So the captain of the small boat very carefully steered the boat between the opening in the pier, avoiding the rocks on shore. With the boat tied up in between the missing section, we were able to cross over from one side to the other on the roof of the boat,” recalls James.

Once they inspected the damage, they found that the gauge shelter and stand were destroyed,



Damaged pier at Calcasieu Pass

as well as the mast for the wind bird. Part of the AquaTrak well remained, so they replaced the top section of the well that had been destroyed, reusing what remained. They installed a new shelter with gauges and surveyed the well.

Their original plan had been to install the two stations at Lake Charles and Calcasieu Pass. After completing this work, they also visited six additional stations where they identified equipment that they needed but didn't have. These stations were located at Morgan City (St. Mary Parish), Tesoro Marine, and LeBranche Bayou, which was the only one that survived Hurricane Katrina. At LeBranche Bayou, the only repair required was changing the batteries in the inside box. Even though water had infiltrated the box, the data collection platform had an abundance of historical data, which they were able to download. This data was later used to assess the extent of the storm tide in Lake Pontchartrain in connection with the U.S. Army Corps of Engineers' study of the New Orleans levees.

As he reflects on his response to Hurricane Rita, James says, "The one thing that sticks out in my mind about the whole experience is this: a disaster brings everyone together to help each other, no matter how rich or poor, or what color or creed".

I have to give the U.S. Coast Guard a big thank-you for helping us complete our mission.

Rick James



People really just came together to help each other.

John Abbitt

Chris Parish

Chris Parish was actually the first employee to leave for the Gulf Coast region; however he did not go in an official capacity initially. Parish, an engineering technician and diver, had not been able to reach his elderly parents in Hattiesburg, Mississippi, and he was worried about how they had weathered Hurricane Katrina. He took annual leave and left on 31 August, with his truck packed to the hilt with chain saws, food, water, and other supplies that he thought his parents and others might need. He returned on 13 September exhausted after working 14 18-hour days and spending approximately \$8,000 of his own money to help others. About 10 days of that time was spent working with local law enforcement (he was actually deputized by the Hattiesburg Police Department) carrying out numerous enforcement activities. He was thrilled at the prospect of returning to the area as part of the Federal Disaster Volunteer Program (DVP).

After a month of recuperation from the Hattiesburg experience, Parish, activated by FEMA, became a volunteer with the DVP on loan from CO-OPS, first reporting to the processing center in Atlanta on 10 October, then to the Joint Field Office (JFO) Operations Center in Baton Rouge, Louisiana. Parish spent from mid-October until just before Christmas in this role.

His Hattiesburg experience left him feeling that FEMA may have been stretched beyond its operational limits as it tried to respond to the needs of a huge geographic area. Even as he was preparing to leave the Hattiesburg area, he was painfully aware that Hattiesburg and other areas far beyond New Orleans still had received no attention from FEMA or the Red Cross. With 15 years of operations experience, Parish felt confident that he could help FEMA and contribute to the relief effort as part of the DVP.

Many of the DVP personnel were assigned to jobs at the JFO based on where the most help was needed – not based upon the individual’s skill sets. However, both of the Operations Chiefs had requested Parish by name (called a “name request”) because of his extensive operations experience. This enabled him to function within his area of expertise. He became the Liaison Officer (LNO) for the St. Charles Parish and later also became the LNO for St. James and St. John the Baptist Parishes as well.

As the LNO, Parish spent his time at the



Chris Parish with Hattiesburg public officials

Mobile Disaster Recovery Center, which was a large motor coach parked behind the Disaster Recovery Center (also known as the Bingo Hall). He “hit the ground running” with little time to shadow his predecessor. He received a two-inch high stack of reports and a handshake as an orientation; therefore, his operations experience was critical to his ability to function effectively. As the LNO and Division Supervisor, he became responsible for hundreds of people the same day he arrived. As he absorbed the reports’ content and began to understand the complexity of the operation, the FEMA personnel turnover problem (people rotating in/out every 30 days) became apparent. It was difficult to plan/budget without knowing what your resources would be.

Providing another big challenge was the rampant rumor mill. With no access to media or reliable communications, many people received their “news” at the local bar or restaurant, which may not have always produced the most accurate information. Many of the rumors involved alleged violence that made people fear for their personal safety.

Parish attended one or two scheduled meetings each day, which “could morph into five or six on any given day”. Even so, these meetings were valuable and necessary to address the major issues at hand, which were mostly related to debris removal and housing. More than 50 people generally attended staff meetings, which involved about 12 different programs coordinating through FEMA in St. Charles Parish.

Parish also received a commission to a local law enforcement agency while working in this area. In fact, security played a vital role in returning to a “normal” society, making demands on everyone, but especially those, like Parish, who were responsible on so many different levels. He notes, “I never knew that I had the strength or the courage to do what I did. You can’t help by just feeling bad—you have to act and do so quickly. Never let others talk you out of doing what is right and never stop believing in yourself in being able to carry those convictions out. We are all stronger than we think.”

Before leaving the area, Parish helped to orchestrate a festive holiday celebration for 500 families in Jefferson Parish. Santa came to the local high school via a Black Hawk helicopter that Parish arranged for, followed by 18-wheelers full of toys. Each family, in addition to toys for the children, received a Toys-R-Us gift certificate and a cooked ham. A local railroad company and representatives from the St. Charles Parish business community sponsored the event. This certainly helped to prepare Parish for the holiday season as he headed home on Tuesday, 20 December.

Carl Cecere: U.S. Public Health Service Officer

As a program management officer for information systems, Carl Cecere plays a role in ensuring that users can access CO-OPS products and services with the support of the latest information technology. However, he is also a U.S. Public Health Service (PHS) officer detailed to NOAA. It was in this role that Cecere deployed to the Gulf Coast from 27 December 2005 until 20 January 2006 as Chief of Finance and Administration for Emergency Support Function (ESF) 8 Health and Medical Services at the JFO in Baton Rouge, Louisiana. He was among the approximately 15 PHS officers serving at the JFO, supporting nearly 60 PHS clinicians and federalized volunteers serving at the network of PHS clinics in Louisiana at that time.

After the Gulf hurricanes, the PHS clinics served as a lifeline back to civilization for the people of Louisiana and Mississippi. Cecere recalls that hundreds of people came to the clinics every day. The PHS clinics dealt with a diverse caseload, since they were the only medical facility available in some locations. Everything from life-threatening emergencies, broken bones, and severe lacerations to requests for prescription refills, pediatric checkups, routine immunizations, and “Katrina cough” – a common respiratory ailment that likely resulted from the air polluted with mold, mildew, and other toxins. Some folks would come by just to chat with the staff and get news of what was happening outside their world.



CDR Carl Cecere is greeted by CAPT Ron Berry at the PHS clinic in Cameron, Louisiana.

Trained as an electrical engineer, Cecere's problem-solving skills served him well as he arranged for the procurement of supplies, from paper towels to pharmaceuticals. Although this may not sound exciting, he found that the process required more than a solid knowledge of logistics and procurement procedures. The lack of basic infrastructure and services—electric power, water, sewer, security, and food—forced Cecere to focus on the people who desperately needed the supplies and those with whom he could connect to obtain them.

Procuring controlled substances posed special challenges. For example, DEA numbers, typically associated with a facility or an individual provider, are required to purchase these substances. However, the PHS was in temporary quarters, and most of the individual providers were from out of state, rendering their DEA numbers useless. The JFO staff researched Federal policy and found an exception for uniformed service members, solving this problem but uncovering another. Most of the pharmaceutical vendor's software would not accommodate the format of the temporary DEA numbers. The JFO staff then contacted pharmaceutical executives, urging them to expedite upgrades to their software systems. While this was being done, PHS clinics continued to serve patients by supply swapping—one clinic using another's excess supplies.

Procuring high demand items, such as paper towels, toner cartridges, hand sanitizer, and medical records jackets (those little special color-coded file folders unique to medical records) posed a different set of issues. Cecere found ways to locate these items, which sometimes required thinking "outside the box". For example, some critical supplies could not be delivered to PHS clinic locations, so volunteers (sometimes living in other states) would have the supplies shipped to their homes and drive them to the PHS clinics.

Although the "red tape" was not excessive, some barriers resulted because there was no standard system for communication from various clinics to the JFO and no standard format for either requesting supplies or describing what was needed. To meet this challenge, the JFO staff obtained copies of the pharmaceutical supply lists that FEMA used to restock supply caches for emergency operations. These lists were then forwarded to both ends of the logistics chain—the providers ordering supplies and the vendors processing those orders. Providers verified that they could use supplies from the list and vendors verified that they could use those lists to fill orders. These supply lists became standard templates for ordering pharmaceutical and medical supplies.

Although Cecere spent most of his time in Baton Rouge, he also visited several clinics in other areas. The Wal-Mart parking lot in St. Bernard Parish served as the host for this clinic, the only one serving that geographic area. All private sector medical facilities in St. Bernard Parish had been destroyed. A new clinic was being built with Federal dollars, with the hope that, in partnership with the Federal and state agencies, the local community would gradually assume operational responsibility.

The living conditions were less than ideal for many of the PHS staff. Security was provided for the clinics because of the pharmaceuticals kept onsite; however, some staff stayed in tents within base camps, sharing their space with alligators and mosquitoes. There was still no power, water, or sewer in most places, although Cameron Parish was beginning to get water and sewage service by the end of January 2006 – five months after Katrina. Despite this, Cecere’s daily interaction with the other volunteers reflected their happiness and positive attitudes. Most were on their second or third tour of duty in the region. The work was hard and long – 12 hours was considered a short day.

Cecere is grateful for the opportunity to serve and to experience the plight of the Gulf Coast residents firsthand. “I would like to specifically say a special thank you to CO-OPS management for all of the wonderful support that they have shown in recognizing my obligations as a PHS officer, not only during the Katrina/Rita response, but in past responses as well. I consider it a privilege to have had the opportunity to serve during one of our Nation’s most devastating disasters.



Cecere soon learned that it is always a good idea to check under your cot before turning in for the night! This little guy seemed to have an affinity for the PHS tent. Duct tape provided courtesy of the U.S. Army.



The structure in the foreground is what was left of the elementary school in Cameron, Louisiana after Katrina. It was also one of the few buildings that was left standing where it was originally located.

CO-OPS USERS/STAKEHOLDERS FEEDBACK

The experiences of CO-OPS personnel tell an awesome story of how individuals and teams worked for a common good, whether for safe and efficient commerce within the Gulf Coast region or for humanitarian causes. In personal interviews, most CO-OPS personnel recognized the importance of their work in supporting the work of others. There is a true interdependence among CO-OPS and its partners; the work of one individual or team supports the work of others until the final product is generated.

Those who use CO-OPS final products and services are represented on the Hydrographic Services Federal Advisory Committee, a 15-member panel consisting of experts in tides and currents, hydrographic surveying, port administration, vessel piloting, and other marine transportation areas. At a meeting held on January 2006, several committee members spoke highly of the Physical Oceanographic Real-Time System (PORTS®) and its value to mariners and praised CO-OPS personnel for the excellent work during Hurricane Katrina.

Captain Mike Morris of the Houston Pilot's Association, in his public statements at the January 2006 meeting said, "Today, PORTS® is a great safety tool for pilots in our area. We use the system and monitor the data from both our dispatch office and our pilot boats continuously. ...Having real-time measurements enriched by forecast are critical



requirements for safe navigation for us. Knowing when we're going to have low water is important. So accurate and timely water level and current information certainly results in safer and more efficient port operation for us."

Captain Sherri Hickman, also of the Houston Pilots Association, describes situations where PORTS data was critical to safe passage. "But I can't tell you how many times we've had close-calls.If the current is coming in and they're inbound, they can't turn. They're going to come right across the channel in front of me. And that's where they use that PORTS system so much."

Mr. Jim Robinson, the Director of Navigation and Security for the Lake Charles Harbor and Terminal District stated, "Our survival and rapid reconstitution of Calcasieu River Waterway navigation were enabled thanks to valued contributions and professional NOAA and NOAA-contracted support."

Katrina's devastating effects served as a reminder to those who depend upon the conscientious work that all of our personnel do every day to help ensure safe and efficient navigation. These users and stakeholders, and others as well, seemed ever mindful of how many people are required to ensure marine safety.



EPILOGUE

NOAA is a successful organization because of quality products and services that meet the needs of those who require them; however, products and services do not sustain themselves. People drive products and services—the teams and individuals who develop and maintain our products as well as the users/consumers of those products. There are no individuals or teams within NOAA who can single-handedly accomplish all that is required for organizational success. It takes the combined skill and commitment of everyone who is part of CO-OPS to support NOAA's mission. Those individuals and teams highlighted in this document clearly demonstrate the attributes needed to meet and exceed expectations for quality work under normal as well as less-than-ideal conditions.

The perilous storms of 2005 compelled us to reflect on our core business practices, discovering fresh approaches to recurring issues, while reaffirming the important role of alliances with those both in and outside of our agency. Evidence of the influence of this reflection can be seen in our approach to pre-storm planning. There is a heightened emphasis on anticipation of the requirements for tidal corrector data, equipment to support rapid repair of water level and PORTS® stations likely to be damaged, and personnel required to accomplish these tasks. This approach has raised the standard for response time from weeks to hours, enabling the OCS Hydrographic Survey Team to begin surveys immediately after the storm so that ports and harbors can be quickly opened.

Alliances with other agencies and organizations helped to enhance available resources, allowing the nation to accomplish goals that a single organization could not. An effective partnership of NOAA offices emerged from this effort. The National Weather Service, Marine and Aviation Operations, and NOS supported each other in ways that they never had before. Each office had a separate and distinct mission, but each also took advantage of the opportunity to better

understand the others' missions and work together toward a common goal: helping the Gulf Coast recover from the worst natural disaster in modern memory. The U.S. Coast Guard, the Louisiana Wildlife Management Area, and others worked in concert with NOAA to support common goals.

Such an example of interagency cooperation was the establishment of the Interagency Performance Evaluation Task Force (IPET) in response to Hurricane Katrina on 19 October 2005 by the U.S. Army Corps of Engineers (USACE). NOAA's National Geodetic Survey (NGS) and CO-OPS were asked to provide critical information and expertise for this report. The mission of this combined effort was to present credible, objective scientific and engineering answers to fundamental questions about the performance of the hurricane protection and flood damage reduction system in the New Orleans metropolitan area.

One of the results of NOAA's participation in this effort was the establishment of a water level gauge at Lake Pontchartrain. This station will become the point of reference for determining sea level in New Orleans and will also serve as a critical source of information for re-designing the levees. In addition, this report made the recommendation that all geodetic and tidal datums need to meet NOAA standards. By using NOAA standards we will help ensure that the levees are adequately designed for future storms.

The fundamental element driving our results, whether it is our response to the Gulf Coast crisis or some other event, is each individual who makes up the NOAA organization. Individuals thrive on the teamwork and the ensuing synergy that develops when there is a problem waiting to be solved. In the end, it is the people who make things happen. The human spirit triumphs in good and bad times alike.

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