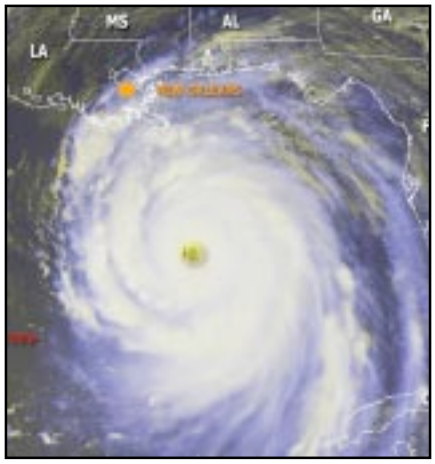
NOAA REPORT

Vol. XIV, no. 10 www.publicaffairs.noaa.gov/nr October 2005

One NOAA Responds to Hurricane Katrina

NOAA

A quick response team inspects damage.



NOAA

Hurricane Katrina nears landfall.

NOAA

A contracted boat surveys Gulf waters.

NOAA Scientific Assessments Guide Katrina Response

—By Glenda Powell

In the aftermath of Hurricane Katrina, NOAA scientists provided a steady stream of critical environmental assessments for the entire Gulf of Mexico region to help mitigate the impact of the storm.

As soon as search and rescue efforts wound down, NOAA aircraft began conducting overflights to survey the area impacted by the hurricane. These overflights, conducted at a low altitude, helped experts see details that may not be picked up by normal aerial photography.

Charlie Henry, scientific support coordinator for the Gulf of Mexico with NOAA's Office of Response and Restoration, was one of the

continued on page 6

NOAA Forecast of Hurricane Katrina Is On the Mark

—By Christopher Vaccaro

Hurricane Katrina, with 140-mph winds driving a surge of water towering to heights of a three-story building, decimated vast areas of Louisiana, Mississippi and Alabama and established itself as one of the most lethal and destructive storms to strike the United States.

Katrina's fury began innocently enough from a cluster of thunderstorms brewing over the Bahamas that organized into a tropical depression—the first life stage of a tropical cyclone—on Aug. 23.

When winds with the tropical depression soon increased to 40 mph, the tropical cyclone was upgraded to this season's eleventh tropical storm. The storm was

continued on page 7

NOAA Examines Hurricane Impacts on Gulf Fisheries

—By Kirsten Larsen

Following Hurricane Katrina, NOAA scientists immediately began organizing studies to determine the storm's impact on the environment and the valuable commercial fisheries of the northern Gulf of Mexico.

"NOAA is committed to working with other federal agencies and the states to ensure that seafood entering the U.S. market is safe for consumption," said Steven Murawski, chief science advisor for the NOAA Fisheries Service.

"We are looking at four major vectors that may have brought contaminants into the waters impacting our fisheries," Murawski said. These include large-scale oil spills from rigs and processing

continued on page 2

Recycled

NOAA Field Teams, Ships, Aircraft Respond to Storms

—By Jeanne Kouhestani and Ben Sherman

The worst effects of Hurricanes Katrina, Ophelia and Rita brought out the best in NOAA employees who worked in and around the communities and waterways ravaged by the storms to aid in the Gulf region's recovery.

The sense of "One NOAA" has also never been more apparent, as employees reached across organizational boundaries to help each other.

Even before Katrina threatened the U.S. mainland, NOAA Marine and Aviation Operations and NOAA's National Ocean Service teamed up in anticipation of the storms by pre-positioning NOAA assets and personnel for a speedy post-storm mission response.

Before the storms roared onto land, data gathered by the NOAA P-3 hurricane hunters and G-IV surveillance jet played a significant role in helping hurricane forecasters make the right-on-target forecasts that saved thousands of lives.

The NOAA Ship *Gordon Gunter*, based in hard-hit Pascagoula, Miss., remarkably was undamaged, initially serving as a shelter for NOAA's now homeless personnel and a provider of email and satellite phone services for area Navy and Coast Guard personnel.

The NOAA Ship *Oregon II*, also based in Pascagoula, didn't fare so well. A hole punched into its battered hull above the waterline rendered it unseaworthy.

The NOAA port office in Pascagoula where the ships were berthed was demolished, along with much of the fisheries laboratory it was housed with. Several

continued on page 6

Gulf Fisheries

continued from page 1

plants, non-point pollution released from the hundreds of boats sunk in the region's rivers, lakes and bayous, water being pumped from the streets of New Orleans into Lake Pontchartrain and contaminants from shore washed out to sea by the storm surge.

To begin the assessment of water quality and seafood safety in the northern Gulf of Mexico, the NOAA Ship *Nancy Foster* launched on Sept. 13 from the Navy base at Pensacola, Fla., where it had docked.

A team of ten scientists was assembled from NOAA laboratories across the country because scientists from the Gulf area and their equipment and facilities were heavily impacted by the storm. The research team—pulled together less than 80 hours before the ship's departure time—included NOAA oceanographers, toxicologists, microbiologists and a marine mammal/turtle observer.

NOAA personnel from both the Atlantic Oceanographic and Meteorological Laboratory in Miami, Fla., and the Northwest Fisheries Science Center in Seattle, Wash., shipped collection gear and sample-storage materials to scientists on *Nancy Foster*. They also checked 18 crates of supplies with them on their flights to the Gulf.

NOAA scientists aboard the ship sampled the environment from the mouth of the Mississippi River off the Louisiana coast to Mobile Bay, Ala. They collected shrimp, blue crabs, Atlantic croaker and bigeye tuna to be analyzed for the presence of contaminants in muscle tissue and liver bile. They took water samples from the surface and near the bottom of the water column and grabbed samples of sediment from the bottom to compare with baseline level samples of contaminants prior to Katrina.

Both water and animals are being tested for pesticides, petroleum-based compounds and pathogens that may have entered into the food chain from the waters being pumped out of New Orleans. Water samples are also being analyzed for general environmental parameters, including dissolved oxygen, salinity, temperature, nutrients and plankton.

"The oceanographic data and sample analyses will be enormously important to future cruise plans in the area and the growing environmental evaluation effort by federal, state and local agencies," said Shailer Cummings, a research oceanographer from the Atlantic Oceanographic and Meteorological Laboratory, who was chief scientist for the cruise.

Scientists are examining daily satellite imagery to locate potentially harmful algal blooms because of the high concentrations of chlorophyll and freshwater coming out of the Mississippi River and adjacent lakes.

Researchers are also using pre- and post-storm LANDSAT satellite photo-imagery of the flooded areas along the Gulf coast to estimate wetland loss. Wetlands are essential components of the northern Gulf ecosystem, providing nursery habitat for fishery species, and function as a natural barriers against storm surges.

Initial, preliminary results of sampling released in September indicated that croaker, a common groundfish, did not have elevated levels of hydrocarbons, indicating they had not been exposed to petroleum products. Also, the fish and blue crabs sampled were not harboring *E. coli* bacteria at high levels, an indicator of fecal contamination from released sewage.

Results from shrimp and pesticides from the first cruises will be released in mid-October.

Glenn Hyatt/NOAA

Jay Lawrimore.

Jay Lawrimore Is the Employee of the Month

—By John Leslie

October Employee of the Month Jay Lawrimore has been a driving force behind NOAA's improving abilities to track U.S. weather and climate.

As chief of the Climate Monitoring Branch of NOAA's National Climatic Data Center in Asheville, N.C.—the official archives of U.S. weather and climate information—Lawrimore leads a team of nine scientists who meticulously record weather statistics that are reported by the 121 forecast offices of NOAA's National Weather Service.

The Climate Monitoring Branch was created in 1998 during a period when heat records were being shattered around the world. "The administration was naturally interested in better understanding how current global climate conditions compared to the historical record, and how the Earth's climate might be changing," Lawrimore recalled.

Globally, the year 1998 went on to become the hottest year on record for surface temperatures, on the heels of the previous all-time record set just the previous year. Lawrimore said the year was the pinnacle of a warming trend that had been building for 100 to 150 years.

"Because of the many research-quality climate data sets that NCDC scientists developed during the previous decades, the center was in a unique position to monitor global climate conditions on a near real-time basis through the Climate Monitoring Branch," Lawrimore said.

"We were seeing [warming] related changes in the global climate, including the shrinking areas of arctic sea ice and snow cover in the Northern Hemisphere, and a global rise in sea level," Lawrimore said. "While the Climate Monitoring Branch does not focus on the contribution of human factors to these changes, aspects of our monitoring and research indicate that man has had a discernable impact on the Earth's climate."

Before Lawrimore became chief of the Climate Monitoring Branch, the Greenville, S.C., native was a physical scientist in what is now the Climate Analysis Branch at NCDC. For a few years after he graduated from North Carolina State University, Lawrimore was an air quality meteorologist with the North Carolina Division of Air Quality, preparing ground-level ozone forecasts and evaluating emission-control scenarios for ozone reduction.

During the summer and fall of 2004, Lawrimore, an Air Force reservist, spent time in Tikrit, Iraq, as a staff weather officer. In Iraq, Lawrimore was responsible for a team of Air Force weather forecasters who primarily provided support for Army aviation, division command staff and intelligence officers.

continued on page 8

Will VonDauster/NOAA

Gerry Murray.

Gerry Murray Is the Team Member of the Month

—By Jana Goldman

Colorful high-top tennis shoes are October Team Member of the Month Gerry Murray's signature footwear.

"People see them and it makes them smile," he said.

As a contractor with the Systems Research Group since 1994, Murray has been instrumental in the development of the Advanced Weather Interactive Processing System, the principal system for handling NOAA weather forecast information. In the process, he has made a lot of people smile at NOAA's Forecast Systems Laboratory in Boulder, Colo.

Murray was the main developer of the interactive graphic display software, which is the core of the AWIPS workstation. Murray modified the AWIPS software so that it could run on inexpensive but powerful personal computers using the Linux operating system.

"When the idea came up, Gerry enthusiastically supported it at a

continued on page 8

Focus On...

Trained Dolphins Rescued After Katrina

Samia Solangi/IMMS

One of eight trained dolphins swept from an oceanarium into the Gulf of Mexico during Hurricane Katrina approaches a boat of scientists attempting to rescue them.

Samia Solangi/IMMS

NOAA-led scientists located all eight trained dolphins swimming together.

—By Alicia Pimental

Eight trained bottlenose dolphins were rescued from the Gulf of Mexico in September after they were washed from their tank at the Marine Life Oceanarium in Gulfport, Miss., during Hurricane Katrina.

Before the storm hit, the dolphins were moved to a tank in the oceanarium that had survived Hurricane Camille in 1969. But the steel and concrete tank was no match for Katrina's 40-foot storm surge, which destroyed the entire oceanarium when it made landfall Aug. 29. All eight dolphins were swept out of their tank and into the open waters of the Gulf of Mexico.

"The facility had massive damage and there was sharp metal everywhere," said Jeff Foster, a NOAA marine biologist who led the rescue team. "It's unbelievable that the dolphins got through there and into the elements in the Gulf."

When scientists and trainers from the oceanarium realized the dolphins were no longer in their tank, they were afraid the animals were either dead or lost forever.

Then came the moment everyone had hoped for. On Sept. 10, nearly two weeks after the hurricane hit, NOAA scientists spotted the dolphins swimming in a group just off the Gulfport coastline. Trainers were surprised to find all eight of the dolphins together in the gulf since they had not been housed together at the oceanarium.

"They had many lacerations, some a foot long," Foster said. "They were real beat up." Yet, amazingly, none of the animals had sustained life-threatening injuries.

Three times a day, NOAA marine biologists and trainers from the oceanarium motored out to the area where the dolphins had been

continued on page 5

continued from page 4
found. They blew whistles and banged on buckets, sounds the dolphins knew to mean it was feeding time. The dolphins were fed fish stuffed with vitamins and antibiotics to rebuild their strength.

Rescuers decided the best way to rescue the dolphins was to help the animals beach themselves on floating mats so that they could be removed from the water and transported to another tank.

The rescuers faced many challenges. The dolphins were weak from the storm and had to be fed regularly to regain their strength. Also, they had lived in captivity for so long they likely could not defend themselves against predators like sharks. To make matters worse, the choppy waters carried dangerous debris and contaminants.

But on Sept. 15 the rescuers' hard work and determination paid off when the two sickest dolphins were rescued, put on NOAA boats then transported by truck to specially treated swimming pools in local hotels. After two more were rescued, the four animals were moved to special saltwater tanks set up by the U.S. Navy.

Samia Solangi/IMMS

After capturing the cooperative dolphins, rescuers transport them to a hotel swimming pool.

"We were so fortunate to have the Navy, which flew in pools and a team of capable people who assisted," said Blair Mase, equipment director for the rescue operation. "It was a huge asset for us."

The rescue team returned to the location where the dolphins had been rescued, but could not locate the remaining four animals. The boats began searching wider areas for the dolphins, assisted by a helicopter and several other agencies, including the Coast Guard, Florida Fish and Wildlife and a Navy team from San Diego.

Two days after the dolphins went missing, a NOAA Fisheries boat found them near Biloxi, Miss., about 15 miles from where they had first been spotted. "That's a real big swim from Gulfport," Foster said. "When we were about a quarter of a mile away they recognized the sounds of the boat engine and whistles. They were excited to see us. We jumped in the water and rubbed them down."

On Sept. 20, three more dolphins were rescued.

The dolphins are now safe in the Navy tanks. "They're doing great," Mase said. "At this point the screening process begins. We want to make sure they don't have any viruses that can be spread to other dolphins." The dolphins will be held in the tanks for about 30 days and then transported to another aquarium in the U.S., perhaps in Florida. Wherever they end up, the goal is to keep all eight of the dolphins together, just as they were found in the Gulf of Mexico.

Samia Solangi/IMMS

The dolphins are transferred into Navy tanks before being relocated to another aquarium.

Assessments

continued from page 1

first NOAA scientists on the scene after Katrina, working at the Coast Guard command post in Baton Rouge, La.

"When I first came on the scene, I had a large number of mapping requests from the Coast Guard," Henry said. "The maps played a major role in their search and rescue missions, helping them figure out patterns where they could launch air boats. These maps helped them to see the big picture, and they were able to use them for strategic planning purposes.

"This is a situation where the world doesn't look the same. The maps we used before Katrina are useless now," Henry said. "Roads have been destroyed. Bridges are underwater. The only way to figure out what's going on is to create new maps, constantly updating them as we get new information."

Henry and two other scientific support coordinators working at Coast Guard command posts in Alexandria and Mobile, Ala., were supported by OR&R's Hazardous Materials Division in Seattle, Wash.

"I depend on the home team in Seattle to get me the information," Henry said. "In this capacity, I serve as a conduit, feeding the Coast Guard's requests to NOAA and making sure that the Coast Guard receives the requested information. This is a critical part of my job.

"For the first days, the Coast Guard's priority mission was to perform search and rescue," Henry said. "In the following days we were able to start looking more at pollution response efforts."

Assessing and responding to a situation of this magnitude required the support of other NOAA offices.

"People are coming out of their traditional roles to help," Henry said. "People are just asking, 'Where can we help?'

"Normally I work with a team of about two or three people," Henry said. "But for this event we had to bring in other scientific support coordinators, damage assessment specialists, scientists and information management specialists. I'm working with about 10 people now."

The extra personnel also provided round-the-clock service.

"We have people in the impact zone and around the country working seven days a week to support search and rescue efforts and evaluate oil spills," said William Conner, chief of the Hazardous Materials Division.

OR&R used overflight information to prioritize response efforts to oil spills and worked with the Coast Guard, EPA, local governments and industry representatives to identify, assess, prioritize and mitigate nearly 400 reported releases of hazardous materials.

Two of the spills reported involve approximately 3.2 million and 420,000 gallons of oil. Generally the oil in these spills is South Louisiana Crude Oil, a heavy oil that is persistent and difficult to clean up.

"Using modeling and trajectory analyses, we can figure out where the oil is going, where it will stop and how long it will take to get there," said Capt. Ken Barton, OR&R's deputy director.

OR&R systematically reviewed petroleum facilities and other areas where leaks may have occurred. This review also included the assessment and monitoring of approximately 150 sunken or grounded vessels.

"In terms of over-all impact, Katrina is the largest incident the Office of Response and Restoration has ever responded to," said director David Kennedy.

Ships, Aircraft

continued from page 2

ship crew members and local NOAA Fisheries personnel lost their homes, but still returned to work on the ships and at the lab, determined to help in the recovery.

In the heart of the storm-ravaged area, the ships served as a staging ground for other relief efforts as well. Two *Gordon Gunter* engineers drove to the National Data Buoy Center at Stennis Space Center to perform emergency repairs to the generators.

A Public Health Service officer assigned to the NOAA Marine Operations Center in Seattle tracked down critical hepatitis and tetanus vaccines—in short supply nationally—and shipped them to Mobile, Ala. A Health Service officer on *Gordon Gunter* drove 400 miles to pick up and deliver them to the data buoy center, where employees were exposed to raw sewage in the water.

NOAA's Great Lakes Environmental Research Laboratory in Ann Arbor, Mich., loaned a truck to a *Gunter* officer, who loaded it up with supplies and headed to Pascagoula, along with a second laboratory van full of donated supplies.

NOAA's Bell helicopter flew thousands of pounds of supplies to NOAA facilities in the storm-affected region. Later flights helped locate hazards to navigation, oil and chemical spills, a wayward buoy and damaged tide gauges. The NOAA Shrike aircraft searched for stranded marine mammals and turtles along the Gulf Coast.

Once the Katrina damage assessment was complete, two NOAA ships—*Nancy Foster*, quickly outfitted with multi-beam and side-scan sonar by NOAA's Office of Coast Survey, and *Thomas Jefferson*—were dispatched to the

continued on page 7

Ships, Aircraft

continued from page 6

storm-ravaged region to conduct emergency surveys of navigational obstructions.

The day after Katrina's landfall, personnel from the Remote Sensing Division of NOAA's National Geodetic Survey were in the air flying NOAA's Citation jet to photograph what was left of the Gulf region. More than 8,300 aerial images were posted on the NOAA Web site. The search engine Google quickly developed an interface with its geographic software allowing both residents and responders to zoom in to see if their houses were still standing and assess damage. The result was a daily download of nearly 4.5 million photos for nearly three weeks, the greatest number of Web downloads in NOAA history.

A NOAA P-3 aircraft conducted post-Katrina damage assessment flights at 1,000 feet to compare actual damages with hurricane forecasts to help determine forecast accuracy. All too soon, the P-3 flew a post-Rita assessment.

"Our teams worked around the clock to help restore safe navigation channels," said Coast Survey director Capt. Roger Parsons. "The currents of the Mississippi River are so rapid that obstructions that were identified were sometimes washed away before they could be removed, requiring our [teams] to go back and resurvey. However, the river and ports were quickly re-opened by the Coast Guard."

NOAA's work to open shipping lanes did not go unnoticed by the shipping community. "I personally would like to thank the USCG, NOAA, and the [Corps of Engineers] for their swift response in restoring our channel," wrote Capt. Michael A. Morris, presiding officer of the Houston Pilots Association.

Katrina Forecast

continued from page 1

named Katrina on Aug. 24, 13 years after Hurricane Andrew devastated South Florida with 165-mph winds.

Katrina reached hurricane strength before moving ashore in southeast Florida, near North Miami Beach, with 80-mph sustained winds on Aug. 25.

Wind gusts at NOAA's National Hurricane Center in Miami that evening climbed to 87 mph before settling to near calm as Katrina's eye passed directly over the wary forecasters on a track that would take it over the warm and energizing waters of the Gulf of Mexico.

Katrina rapidly intensified over the open gulf, reaching its peak Aug. 28 with top sustained winds of 175 mph. The storm's central pressure, inversely correlated to wind speed, plummeted to 902 millibars—the fifth lowest recorded in the entire Atlantic Basin.

At 10:11 a.m. the same day, 20 hours before Katrina made landfall on the Mississippi-Louisiana coastline, NOAA's Slidell, La., weather forecast office issued a firm statement to people in the hurricane's path that included the following messages:

"Most of the area will be uninhabitable for weeks…At least one half of well constructed homes will have roof and wall failure...Airborne debris will be widespread and may include heavy items such as household appliances and even light vehicles…Persons, pets and livestock exposed to the wind will face certain death if struck. Power outages will last for weeks as most power poles will be down and transformers destroyed. Water shortages will make human suffering incredible by modern standards."

In the final hours before landfall, Katrina's winds slowly decreased.

Katrina slammed into southeast Louisiana on the morning of Aug. 29 as a category 4 hurricane with winds of 140 mph. The Hurricane Center had consistently projected landfall to occur in this area more than two days in advance and had issued a hurricane warning for the area more than 30 hours prior to landfall.

In bracing for the storm's wrath, NOAA facilities in the central Gulf Coast region were evacuated or activated continuity plans to minimize service interruptions as Katrina hit. The Weather Service forecast office in Slidell became a refuge for most staff members and their families.

Farther south at the Hurricane Center, director Max Mayfield led the extensive outreach to the public and the emergency management community with support from the center's hurricane experts and a special team of meteorologists assembled from across NOAA. Mayfield also called the governors of Louisiana and Mississippi and the mayor of New Orleans to ensure their awareness of the situation.

Advances in hurricane research and computer forecast modeling coupled with continuous data from NOAA and U.S. Air Force hurricane hunter aircraft on the atmospheric conditions inside and surrounding Katrina aided Hurricane Center forecasters in producing such accurate track and intensity forecasts with extended lead times.

"The most accurate forecasts are only beneficial when people react by taking the necessary steps to save their lives and property," Mayfield said. "Preparedness remains essential. Knowing the risks, knowing ahead of time where to go and what to bring if evacuating, and heeding orders from local officials empowers individuals, businesses and communities."

Gerry Murray

continued from page 3

time when many were skeptical," wrote Carl Bullock, chief of the laboratory's Modernization Division, in nominating him for team member of the month. "He plunged ahead, working through a host of issues and problems and pioneered the approach others would follow. This included extensive research and tests before settling on compilers that would meet the needs of all groups, a daunting task which took more than a year to complete."

Before the Linux workstations were introduced, warning operations required careful management of finite computer resources. Forecasters were forced to limit the amount of data that could be displayed and manipulated to maintain adequate system performance. The migration to the Linux system solved the problem, resulting in better forecasts being issued in a more timely fashion.

For example, one National Weather Service office issued 51 severe thunderstorm and tornado warnings in a six-hour period in April 2004. The office also prepared numerous statements during that episode, keeping the public well informed on the status of potentially life-threatening weather.

"It is unlikely, if not impossible, that this level of service could have been provided with the slower legacy workstations," Bullock wrote.

"Today, weather forecasting office forecasters all across the country are using the Linux-based AWIPS graphics workstations, at a significant cost savings and productivity increase," Murray said.

While Murray brought experience and knowledge of computers to NOAA, he relied on the scientists in the laboratory to help with meteorological concepts.

"But I was very happy that the lab was open to applying new trends in computer science to atmospheric research," he said.

"During the Oklahoma tornado outbreaks in 1997, when forecasters were using the AWIPS software to issue early warnings that clearly saved lives, I came to appreciate how important it is to develop efficient and reliable software," he said.

After graduating from Northeastern University, Murray worked for the U.S. Department of Transportation, where he developed a computer screen that updates flight traffic patterns.

When he moved to Boulder in 1994, he joined the AWIPS team. In 2002, the Boston native returned to New England.

"I didn't want to go back to Colorado," Murray said. "I applied for two jobs, one at the Forecast Systems Laboratory and the other at a Massachusetts Institute of Technology lab. But I did like the application I was working on in Boulder, and I liked the people."

He got the Forecast Systems Laboratory job and telecommuted, with a few trips back to Colorado.

Murray is now taking a new professional direction. He left the Forecast Systems Laboratory in September and is studying respiratory therapy at Southern Maine Community College.

His mathematical mind, once focused on the intricacies of a human-made machine, will concentrate on understanding how the human machine works.

"I'm very interested in how the human body works and I like the idea that I can help people," Murray said.

And what about those brightly colored high-top sneakers? Would they have some role in helping people?

"They sure do make people smile," he said.

Jay Lawrimore

continued from page 3

Because of the threat of mortar attacks, Lawrimore said he spent most of his time in a compound. "The attacks were largely ineffective because the anti-Iraqi forces were poorly trained and ill-equipped, so there was little need to worry about personal safety. This was a rewarding time," he said, "because I was able to contribute to the effort of restoring the peace, building infrastructure and establishing democracy in the country."

Keeping tabs on the weather and climate makes for a hectic pace at NCDC. "No two days are alike here. The daily deadlines are the one thing that doesn't change," Lawrimore said. "Our customers, whether they are public officials, media, private-sector businesses or the general public, rely on the information we provide. The information we have typically is not available anywhere else, so we feel a special responsibility to meet all of our deadlines."

"Jay's team has a very demanding and nearly impossible operational commitment in monitoring U.S. weather and climate," said NCDC Director Thomas R. Karl. "He never fails to deliver excellent products."

*The **NOAA Report** is a monthly publication for NOAA employees about the NOAA mission from the NOAA Office of Public, Constituent and Intergovernmental Affairs, Washington, D.C.*
Send comments and story ideas to:
Editor, *The NOAA Report*
P.O. Box 3234
Shepherdstown, WV 25443
304-876-3628
Email: dane.konop@noaa.gov
***NOAA Report* Online:** *http://www.publicaffairs.noaa.gov/nr*
Jordan St. John, director, OPCIA
Dane Konop, editor