

Despite Storms, Aquanauts Complete Coral Research

—By Jana Goldman

During one of the busiest hurricane seasons in memory in Florida, scientists working out of NOAA's underwater habitat and laboratory *Aquarius* in Key Largo, Fla., managed to complete most of the coral research planned for the 2004 mission season.

Aquarius, owned by NOAA and operated by the University of North Carolina at Wilmington, allows saturation-diving scientists to live and work underwater for up to 10 days without having to surface.

Despite interruptions by Hurricanes Charley and Ivan, *Aquarius* aquanaut-scientists carried out missions to study the effects of tides and currents on algae, determine the ecological impact of parrotfish and surgeonfish eating seaweed, and test medical and surgical tele-robotics and tele-mentoring technologies that might be used in space. NASA astronauts also completed a mission in *Aquarius* to train to work in extreme environmental conditions.

Two *Aquarius* missions in August
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NOAA's Strategic Plan Is Now Online

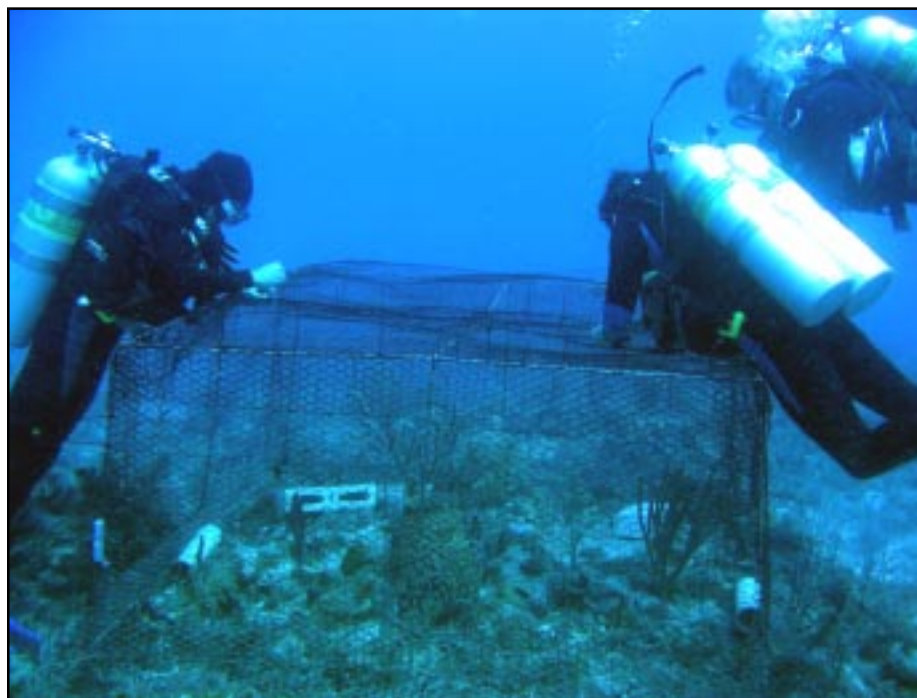
—By Vice Adm. Conrad C. Lautenbacher, Jr., U.S. Navy (Ret.)

The 2005-2010 NOAA Strategic Plan (Sept. 2004) is now available at <http://www.spo.noaa.gov/pdfs/NOAA%20Strategic%20Plan.pdf>.

Many of you throughout the agency contributed to the development of this document, which is intended to guide NOAA during the next several years, and we thank you for your efforts. Only through the hard work and cooperation of employees, partners and stakeholders are we able to achieve meaningful results and deliver the unique and valuable products, information and services that society expects of us. Such achievement begins with planning, and planning begins with a corporate strategic plan.

This plan, which is an update of the 2003-2008 NOAA Strategic Plan, is an important document for NOAA. It provides guidance for defining and developing programs, for tracking our performance and for evaluating our results.

Through good planning we develop good programs, and the NOAA Strategic Plan sets the stage for us to work together to accomplish common objectives. It is through this document that NOAA defines its vision, mission and goals and identifies important cross-cutting priorities necessary to achieve those goals. The goals, objectives and performance measures of NOAA programs, line
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Deron Burkepile/Ga. Tech.

Aquarius aquanauts (left to right) Scott Brady, John Parker and Alex Chequer secure a cage containing parrotfish and surgeonfish to study the effects of the fish feeding on seaweed.



Jim Milbury/NOAA

Kevin Wong of NOAA's Pacific Islands Fisheries Science Center helps launch a prototype autonomous underwater vehicle from Scripps Pier in La Jolla, Calif., while NOAA Southwest Fisheries Science Center researchers in a small boat wait to monitor the AUV's performance.

Subsea Research Robots Debut at NOAA

—By Jim Milbury

Scientists from across the country and as far away as South Africa gathered at NOAA's Southwest Fisheries Science Center in La Jolla, Calif., Nov. 10 to train on an innovative piece of equipment that may transform the way scientists study ocean depths.

The device is an autonomous underwater vehicle, or AUV, a self-propelled, programmable, free-swimming underwater robot that can be customized for many different research purposes.

"This is the next new hammer in oceanography and marine science," said Mark Patterson of Sias Patterson, Inc., an AUV designer and oceanographer at the College of William and Mary. "This technology is going to become increasingly important."

The AUV is not encumbered with a tether or cables, or in need

of a human to tell it what to do once it's launched. A researcher simply programs computers inside the AUV to do the research required and then lets it go. The vehicle will return on its own once the mission is completed.

"They're swimming computers," Patterson said. "Usually there are several computers interacting with each other. One might be driving the vehicle, the other might be logging data, another might be running the specialized payloads like the side-scan sonar."

Several NOAA offices are developing or supporting AUVs that will operate specifically for their particular field of exploration and research.

"It's revolutionary," said David Demer, acoustic engineer and team leader for development of the AUV
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Aquarius

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and September were cancelled because of Charley and Ivan, the first time any missions were scratched since Hurricane Irene threatened the Florida Keys in October 1999.

"We hate to do this, but we want to ensure that no aquanauts are in harm's way when a hurricane or tropical storm is in the area," said Barbara Moore, director of NOAA's National Undersea Research Program in Silver Spring, Md., which oversees *Aquarius* research and operations.

Reminiscent of a large, faded yellow school bus and now encrusted with marine organisms, *Aquarius* is anchored 60 feet below the surface near a coral reef off Key Largo.

Up to six individuals can live and work aboard *Aquarius*, which is equipped with living and working spaces, albeit compact. The 81-ton, 43- by 20- by 16.5-foot chamber includes six bunks, a shower and toilet, instant hot water, a microwave, trash compactor and a refrigerator. Meals and supplies are delivered in water-tight containers to the aquanauts by support divers.

Those below the water are in constant contact with the base station on land on Key Largo via wireless telemetry and are closely monitored and tended to by *Aquarius* support personnel.

Aquarius' underwater operations began in the U.S. Virgin Islands in St. Croix's Salt River Canyon in 1988.

Hurricane Hugo heavily damaged St. Croix in September 1989, forcing the relocation of *Aquarius* to Wilmington. It was refurbished there over 18 months by the National Undersea Research Center at the University of North Carolina at Wilmington, then deployed at
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Marc Pulliam/NOAA

Tim Loomis.

Tim Loomis Is the Team Member of the Month

—By John Leslie

For Tim Loomis, NOAA's December Team Member of the Month, the 2004 hurricane season is one he won't soon forget.

As storm after raging storm barreled toward the southeastern U.S. coastline this past summer, Loomis kept up with the frenetic pace in NOAA's Environmental Visualization Laboratory in Silver Spring, Md., posting high-resolution satellite images of the storms online, which news media used and millions saw around the world.

As head of the visualization program, Loomis, along with his colleague Marc Pulliam, create eye-catching, high-definition animation and graphical images of hurricanes, wildfires and severe weather from the view of NOAA's geostationary and polar-orbiting satellites.

For nearly six years working at the visualization lab, Loomis has seen his share of active hurricane seasons, but "this year was extremely hectic, because the storms just kept coming," he said—as did

the demand to see the latest images. Within minutes of posting a satellite image of one tropical system online, Loomis said, it was the top graphic on CNN.com.

Loomis also said the popularity of the lab's website exploded this summer, logging millions of hits each day.

"Tim is NOAA's secret weapon in helping the agency to carry out its mission," said Gregory Hernandez, webmaster for NOAA.gov, which posts images from the lab onto the site. "Millions of people around the world see his work.

"The enhanced hurricane satellite imagery that he and Marc [Pulliam] produced during the 2004 hurricane season was published by major newspapers, in print and online, as well as [by] broadcast and cable news stations across the U.S. and around the world," Hernandez said.

The 2004 Atlantic hurricane season produced 14 tropical storms and nine hurricanes, six of which strengthened into major hurricanes. One hurricane, Ivan, became a category 5 storm.

Hernandez also said the visualization program's "nightlights" image of North and South Korea, which shows the stark differences between the two nations, has been reproduced by major publications across the world.

Loomis became a NOAA contractor in 1999 after producing a visualization project for then NOAA Administrator James Baker. "He liked what we did and decided to give funding for the new lab," Loomis said. Loomis now works as a contractor for RGII Technologies.

Albert "Skip" Theberge, an information specialist in NOAA's Central Library, was impressed with Loomis' development of a visual display featuring the capabilities of NOAA's Satellites and

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Joanne Potts

Lanetta Gray.

Lanetta Gray Is the Employee of the Month

—By Dane Konop

According to news accounts, the shouts of hundreds of adults and school children who lived near a proposed natural gas pipeline in Westchester County, N.Y., drowned out union members who supported its construction during a public hearing on the project's environmental impact staged by NOAA's Office of General Counsel on Nov. 13, 2002.

December Employee of the Month Lanetta Gray, a paralegal specialist in the Office of General Counsel for Ocean Services in Silver Spring, Md., was managing the hearing.

"I remember an angry mob," which, Gray said, is not all that unusual at coastal zone management consistency hearings. At least in this case, she said, the vocal opponents of the pipeline were "a little more controlled, more considerate."

The NOAA General Counsel chaired the hearing, as one by one

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Focus On...

Preserving NOAA's Heritage

—By David Hall

Treasure can be found in unlikely places. That's what a group of employees from NOAA's Silver Spring, Md., campus learned this fall during a series of field trips to the National Geodetic Survey facility in Corbin, Va., where they helped members of the Instrumentation and Methodologies Branch inventory the dozens of historic scientific instruments that have been stored there over the years.

Among the items awaiting the group's attention was a cosmic ray meter made in the 1930s, a portable World War II-era tide computer and a cone-shaped ceramic survey marker that may have been used in the 1800s by the U.S. Coast Survey's founder and first superintendent, Ferdinand Hassler.

Branch chief Kendall Fancher and his staff knew the historic value of the instruments in their charge at the Corbin facility and had already taken steps to conserve many of them. But they welcomed the assistance of their fellow NOAA employees, who carefully sorted, tagged, logged and photographed the items.

How does one separate historical gems from junk?

"The first challenge is to identify them," said retired NOAA Corps Capt. Albert "Skip" Theberge, a technical information specialist with the NOAA Central Library and a member of the Corbin field trip team.

According to Theberge, historic assets could include instruments, models of ships, aircraft and satel-



David Hall/NOAA
Senior geodesist David R. Doyle uncovers a theodolite that was once used in surveys to measure horizontal and vertical angles.

lites, documents such as books, memos and letters, photographs or even artwork, including etchings, sketches and paintings.

"Any item that engenders a sense of continuity with the past" and that helps "capture a sense of who we are as an agency, where we came from and to some degree where we are going" could be considered an historic asset, Theberge said.

"The classic survey instruments located at the Corbin facility are tangible links with the history of the National Geodetic Survey," said Fancher, who sees the preservation of the historical items in his care as a duty. "I feel these artifacts should be preserved and made available for others so they might reflect upon the great advances in technology and the many accomplishments made by NGS during the last 197 years."

Everyone on the 12-person team was impressed with the craftsmanship that went into making the instruments and their wooden storage cases.

"Many of these instruments were cutting-edge technology upon their
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David Hall/NOAA

National Marine Sanctuary Program senior advisor Cheryl Oliver and National Geodetic Survey senior geodesist David R. Doyle tag and catalogue a leveling instrument, one of many NOAA instruments retired to the National Geodetic Survey storage facility in Corbin, Va.,

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introduction” Fancher said.

“Seeing all of the beautifully crafted old instruments [at Corbin] really makes you think about all the people who have contributed to making NOAA what it is today—the scientists, the inventors, the people who created and used this marvelous equipment,” said NOAA Heritage Project Manager Lynette Joynes.

While efforts to inventory and conserve NOAA’s historic assets are nothing new, employees throughout the agency are responding to the White House’s “Preserve America” initiative, which challenges federal agencies to step up efforts to preserve, protect and promote the historic assets in their care. The upcoming 200th anniversary of the U.S. Coast Survey in 2007 has also renewed interest in NOAA’s history and heritage.

“As the nation’s oldest scientific agency, NOAA has an astounding array of historic items that tell the NOAA story, which is one of innovation, leadership and service,” said Daniel J. Basta, the chair of



David Hall/NOAA

Marine sanctuary program senior advisor Cheryl Oliver (left) and Kelley Elliot, an intern with NOAA’s Office of Ocean Exploration, catalogue historic survey instruments, including an astronomical telescope, currently housed at the National Geodetic Survey storage facility.

the NOAA Preserve America working group. “It’s up to each of us to be good stewards of these resources, which really belong to the American people. They represent the heritage of both NOAA and the nation.”

NOAA recently received the

first-ever award for excellence in federal preservation from the Advisory Council on Historic Preservation, the lead federal agency for the initiative. The council singled out the NOAA Preserve America Web site as a symbol of NOAA’s commitment to the initiative.

The Corbin effort and other NOAA asset preservation success stories will be highlighted Feb. 7-11, 2005, during the first annual NOAA Heritage Week. This annual event will feature restored artifacts, exhibits, films and guest speakers.

“NOAA Heritage Week will not only educate new and long time NOAA employees about their agency’s proud heritage, it will also provide a platform to take the NOAA story to a new generation of Americans,” Basta said.

The award and initiation of NOAA Heritage Week are only the beginning, Basta said. “Good things are happening, but we can and must do more to save our historic treasures and tell the story of NOAA service then, now and in the future.”



David Hall/NOAA

NOAA Central Library technical information specialist Albert “Skip” Theberge (left) and National Geodetic Survey senior geodesist David R. Doyle examine a number of long-retired instruments that were once the cutting edge of survey technology.

Aquarius

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its present location on Conch Reef in the Florida Keys National Marine Sanctuary in 1992.

After a typical 10-day mission, saturation-diving *Aquarius* aquanauts must spend 17 hours in *Aquarius* decompressing before they can return safely to the surface, avoiding the bends.

"We keep our eyes on the weather all of the time," said Otto Rutten, associate director of the Southeastern U.S. and Gulf of Mexico National Undersea Research Center. "If there's any possibility that *Aquarius* will be in the path of a tropical storm or a hurricane, that's when we make the decision to pull the plug on the mission."

It's a disappointing decision, especially for the scientists who have planned missions years in advance.

As Hurricane Charley approached in August, scientist Neils Lindquist of the University of North Carolina at Chapel Hill was a member of the scientific team aboard *Aquarius*. Lindquist and three other scientists were studying the role of sponges in the coral reef ecosystem. The aquanauts were told by the *Aquarius* technicians that the storms could force them to abort their mission.

"We went to sleep thinking we would have at least one more dive and then we'd begin our 17 hours of decompression needed before leaving *Aquarius* for the surface," Lindquist wrote in the journal he posted on the *Aquarius* Web page.

But that hope was thwarted the next morning by reports from the command base on Key Largo that the storm was heading toward the Florida Keys and "that decompression needed to be started sooner rather than later," thereby canceling one last excursion out on the

reef.

Arrangements were made with the command base to collect scientific equipment and personal gear while the aquanauts began the long process of adjusting to conditions on land instead of life in the sea.

Lindquist and his colleagues were luckier than Mark Warner from the University of Delaware and his team. Hurricane Ivan caused the cancellation of their Sept. 13-22 mission, twice interrupting their aquanaut training with mandatory evacuations. Warner's team was to study symbiotic algae that live in the stomach cells of reef-building corals.

"This was an unusual year to have two missions either cancelled or cut short," Moore said. "But the safety of the aquanauts is our major priority."

Although *Aquarius* is anchored to the sea floor 60 feet below the water surface, it can feel effects of the waters above disturbed by hurricane-force winds. During Hurricane Georges in 1998, 28-foot waves were recorded at Conch Reef, where *Aquarius* was moored. One of *Aquarius*' four base plate legs was so severely damaged that it needed to be replaced.

"We would rather bring people up to the surface than have them ride out a storm," Rutten said.

John Parker of the Georgia Institute of Technology was one of the lucky scientists this season. This was Parker's first experience aboard *Aquarius*, which he likens to camping out in the woods, "only your tent is a large metal tube, that forest is now a coral reef, and those squirrels flitting about are now schools of hungry fishes."

Parker was a member of the Nov. 8-17 mission's scientific party investigating how fishes indirectly help corals by removing seaweeds that would normally out-compete the slower growing corals.

However, that mission felt some effects from the weather, especially on day three, Nov. 10, when there were high winds on the surface, something that those below also experienced.

"We mainly feel the surge in our ears as the inside pressure changes slightly with the passing waves. It's kind of weird, sort of like the feeling when a plane takes off. Couple that with the ominous whoosh of the surge sucking air out of the habitat, each time followed by a rushing surge of water spilling into the wet porch, and it feels and sounds like we're in a hurricane, only 50 feet below the surface, surrounded by water," Parker wrote in his online journal.

Parker related what a typical day was like. "The morning dive is the best part of the day. You head out when the sun is still down and see the sunrise on the reef. Most of the creatures (except us) are still sleeping and we've got the run of the place. We look around for big shadows of predators—sharks, groupers, barracuda, snappers—hunting the reef in the early morning. It is a quiet, reflective time on the reef. We pass a sleeping parrotfish under a ledge. The only sounds are our own bubbles from breathing.

"Then, when we near the end of our dive, we pack up our tools, leave them in a secure spot and we head back to *Aquarius* by pulling ourselves along the excursion ropes laid out to mark the route. Along the way, which is about 900 feet, we all look around for various interesting creatures, all the aquanauts stopping and pointing out things to the others. It is in these brief moments that it hits us. We are living in the ocean; what a cool experience."

This year's last mission in *Aquarius* is Navy training for saturation divers from Dec. 6-9 and Dec. 11-14. ☺

AUVs

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for NOAA at the Southwest Fisheries Science Center. "Just as the military is going in the direction of autonomous planes for reconnaissance, I think more and more oceanographic challenges are going to be resolved by AUVs."

Demer first became interested in pursuing AUV technology in the mid-1990's when he found that ships fitted with echo sounders had limitations when surveying marine life that lived on the ocean's surface, sea floor or near the shoreline.

The idea of using an AUV was "frozen" in his head in 2000, he said, while measuring krill abundance from a small open boat in the chilly near-shore waters off the Antarctic peninsula.

"An AUV can position instruments closer to the sea floor for improved measurements and safely allow surveys to be conducted close to the shore or other navigational hazards such as sea ice," Demer said.

The AUV that Demer's group is working with is about the size of a large sea lion and resembles a very small submarine with a long antenna instead of a periscope. Patterson called it "the first AUV on the planet optimized for fisheries oceanography."

Demer is also placing electronic equipment on the AUV that will acoustically and optically characterize fish and may allow for better stock assessments of groundfish and other species. The novelty is that sound echoes from fish will be recorded at the same time their species, sizes and orientations will be measured using a stereo camera.

The concept of a self-powered underwater vehicle is not new. Large AUVs up to 30-feet in length and several feet in diameter were developed by the military during the Cold War in the 1970's. But

what makes today's AUVs so innovative are the advances in computer technology.

"In the early '90s when the personal computer revolution started taking off, processors got faster and smaller and less power hungry," Patterson said. "You could give a swimming robot the smarts that it could actually do full-blown missions."

The Coast Survey, which creates the nautical charts of U.S. coastal waters, has been testing an AUV since last spring.

"We think that there is a very strong possibility that we can improve the efficiency of our survey operations in some areas by using AUVs to augment our traditional ship and launch platforms," said Lt. Ben Evans, a NOAA Corps officer in the Coast Survey Development Laboratory in Seattle, Wash.

In the future, Evans sees multiple AUV's with survey systems onboard being deployed from ships or launches, more efficiently and effectively conducting surveys while freeing humans to do other, more difficult tasks.

NOAA's Office of Oceanic and Atmospheric Research has long supported the use of AUV technology. The office provided funding for instruments for the first underwater robotic vehicle of its kind, called the Autonomous Benthic Explorer, built by the Woods Hole Oceanographic Institution. ABE weighs about 1,200 pounds and is over two meters long. While Demer's and Evan's AUV can dive between 100 and 300 meters, ABE can go as deep as 5,000 meters.

"We've invested in producing a different type of AUV," said Justin Manley, an ocean engineer with the Office of Ocean Exploration. "It's called a glider, which will be able to be deployed by an airplane."

Scientists still face surprises in developing AUV technology, as

Demer's group found when they deployed a prototype of their AUV in the ocean off the fishing vessel *Outer Limits*. On their last deployment of the day, three male sea lions popped up next to the AUV, clearly curious about their mechanical cousin. The sea lions followed the vehicle under water and apparently knocked a rear stabilizer askew, keeping it from surfacing immediately.

Demer's crew quickly found the AUV using an ultrasonic echo locator, then waited patiently while the AUV's onboard artificial intelligence brought it back to the surface for repairs. Patterson summed it up best. "This is a fish that swims on its own." ☺

Strategic Plan

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offices and operating units all must track ultimately to those of the strategic plan. In this manner we ensure efficiency, effectiveness and accountability in all that we do. In this regard, strategic plans for NOAA line offices are now in the final stages of preparation and will be released shortly.

As we enter the second half of this decade, we must use this plan to guide our efforts. NOAA is positioned to take national and international leadership in many areas of vital concern, ranging from climate to ocean resources.

We must continue to work together to break down the "stovepipes" in the agency by seeking ways to cooperate across the various components of NOAA at all levels. Isolation only limits our ability to make full use of all of what NOAA has to offer—and we have much to offer.

I look forward to a successful future for NOAA and those we serve. We have made great progress to date. Let us continue to move forward. ☺

Loomis

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Information that was presented before representatives of the Smithsonian Institution and the NOAA Office of Ocean Exploration.

"This [presentation] had to showcase [NOAA Satellites and Information's] capabilities and products for possible use in the Smithsonian Natural History Museum Ocean Hall," Theberge recalled. "That was a highly stressful two weeks, but Tim produced spectacular visual displays."

Walter Smith, a geophysicist with the NOAA Laboratory for Satellite Altimetry, appreciated Loomis' calm under fire during this year's hurricane season. "Tim was always quick to respond with a 'can-do' attitude and a smile, even if I had to ask him for something while hurricanes were battering the Southeast and the TV stations were battering him [for satellite imagery]."

The Environmental Visualization Program is in the process of moving under the direction of the Satellites and Information's Office of Research and Applications. Director Marie Colton said, "During the long hurricane season, Tim provided the movie loops that were used so much in the press. In spite of being in the EVP, he does this work somewhat 'invisibly,' which is a simple testament to his modesty and work ethic."

Loomis grew up in Calvert County, Md., and upstate New York. After a short period in college, he joined the U.S. Navy and spent eight years working as an avionics technician. He said getting the Team Member of the Month recognition came as a shock. But after a raucous hurricane season, those are the kinds of shocks Loomis said he will gladly take. ☺

Gray

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public officials, representatives of neighborhood organizations and members of the public lined up to air their comments.

In addition to being responsible for the logistics of keeping the hearing running smoothly once it started, it had been Gray's job to find a place that could hold hundreds of participants, coordinate with the parties involved, notify the public and public officials, arrange for a public address system, hire security guards and have the proceedings transcribed by a court reporter.

On this last note, the raucous all-day hearing got off to a bad start.

"It was a lively meeting," said then Assistant General Counsel for Ocean Services Karl Gleaves, who was there. "About an hour and a half into it, the court reporter decided it was too much for her, and she packed up and left."

The hearing could not proceed without a transcript being taken. Gleaves recalled Gray was not rattled by the unexpected turn of events. First, she arranged to use the videotape being recorded by one of the audience members as an *ad hoc* transcript. Then, Gleaves said, "She just got on her cell phone and started making calls. She was great! She's the one person I'd want in the middle of a situation like that—cool and calm."

In less than an hour, a new court reporter arrived on the scene.

In addition to running hearings, Gray also does research for the office's attorneys and manages the law library and all the records for the Office of General Counsel for Ocean Services, which are considerable.

Attorney advisor M.E. Rolle, who works with Gray, said, "She is remarkably proficient. She is very

bright and very personable. And she is simply very good at her job."

"I respect the law," Gray said. "I like the fact that we can use the law to enforce things that are going to make for a better society and to assist folks who are being taken advantage of."

After graduating from high school, Gray worked part-time and went to school at night, sometimes taking three three-hour classes a semester, to earn her associate's degree in paralegal studies from Prince George's (Md.) Community College, all the while raising her daughter as a single mom.

She worked as a secretary in a private law practice and at the National Institutes of Health before coming to NOAA in 1994 as a legal secretary in the NOAA Office of General Counsel for International Law. She also married and had a son, while still continuing her education at night, and is close to receiving a B.S. in legal studies from the University of Maryland.

Gray credits her tenacity to her religious faith and said, "I couldn't have done it without the support of my family." She said she now wants to enjoy life more. "It seems like I have always been going to school. I have two children, and they are my priorities." ☺

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