

Fieldwork

USGS Researchers Collaborate with National Park Service Archeologists to Better Predict the Life Expectancy of the USS Arizona

By Curt Storlazzi

The USS *Arizona* was one of seven active battleships attacked and damaged by Japanese aircraft on the morning of December 7, 1941, in the first act of World War II against the United States in the Pacific. Six of the battleships were raised to fight again, but the USS *Arizona* continues to rest in 13 m of water on the fine gray silt of O'ahu's Pearl Harbor in Hawai'i. In 1980, the National Park Service (NPS) inherited the USS *Arizona* Memorial and manages the site. As many visitors (more than 1,000 per day) have noticed, black fuel oil leaks from the hull at a rate of about a quart per day, causing a shimmer of colors on the surface waters. Over the past 6 decades, the hull has undergone substantial deterioration in the harbor's corrosive environment; bulkheads have collapsed, and many of the ship's overheads are corroded and weakened. More than half a million gallons of fuel oil still trapped in the fractured hull poses a serious environmental risk, with the potential for much of the oil being released into the harbor when the *Arizona*'s fuel bunkers finally give way. This threat led to a major initiative started in 2000 by the NPS to document the condition of the USS *Arizona* in order to answer some basic questions: What is happening to the wreck? How long will it remain intact?

Since 2000, archeologists from the NPS' Submerged Resources Center (SRC) have



↑ **Mike Field** (left) and **Curt Storlazzi** on the dock of the USS *Arizona* Memorial after deployment of an instrument package. Photograph by **Matt Russell** (NPS).



↑ **Matt Russell** (NPS-SRC, left), **Mike Field** (center) and **Marshall Owens** (NPS, Memorial Curator, right) on the dock of the USS *Arizona* Memorial, discussing the second deployment dive. Photograph by **Curt Storlazzi**.



⇔ Underwater photograph of a drop of No. 6 fuel oil leaking from the starboard midships of the USS *Arizona*. The drop is about 2 cm across. Collapse of the deteriorating fuel bunkers could cause a catastrophic release of this oil into Pearl Harbor. Photograph by **Curt Storlazzi**.

conducted several surveys of the USS *Arizona*. In addition, engineers from the University of Nebraska have conducted detailed studies of the corrosion rate of the hull's metal and the present structural integrity of the ship. In fall 2002, **Mike Field** (USGS, Santa Cruz, CA) was asked by NPS-SRC archeologists **Larry Murphy** and **Matt Russell** for advice on deploying oceanographic instruments on the *Arizona* to make measurements of the seawater environment around the ship. **Mike** brought in **Curt Storlazzi** (USGS, Santa Cruz, CA) to design an experi-

ment setup, instrument mounts, sampling routines, and deployment and recovery protocols for **Marshall Owens**, the USS *Arizona* Memorial's curator.

In early November, **Kevin O'Toole** and **Walt Olson** of the USGS' Marine Facility in Redwood City, CA, built the mounts for a wave/tide/current-meter package and a sepa-

(USS *Arizona* continued on page 2)

Correction for November issue:

The URL for the "Discovery for Recovery" Web site was inadvertently omitted from the mailed edition of the November 2002 *Sound Waves*. The URL is <http://www.werc.usgs.gov/pinsat/>

It should have been the last line of the article "Scientists Track Pintail-Duck Migration to Learn More About the Species' Population Decline." We apologize for the omission.

—Editor

Sound Waves

Editor

Helen Gibbons
Menlo Park, California
Telephone: (650) 329-5042
E-mail: hgibbons@usgs.gov
Fax: (650) 329-5198

Print Layout Editors

Susan Mayfield, Sara Boore
Menlo Park, California
Telephone: (650) 329-5066
E-mail: smayfiel@usgs.gov; sboore@usgs.gov
Fax: (650) 329-5051

Web Layout Editor

Trent Faust
St. Petersburg, Florida
Telephone: (727) 803-8747 Ext. 3043
E-mail: tfaust@usgs.gov
Fax: (727) 803-2030

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Submission Guidelines

Deadline: The deadline for news items and publication lists for the February issue of *Sound Waves* is Thursday, January 16.

Publications: When new publications or products are released, please notify the editor with a full reference and a bulleted summary or description.

Images: Please submit all images at publication size (column, 2-column, or page width). Resolution of 200 to 300 dpi (dots per inch) is best. Adobe Illustrator© files or EPS files work well with vector files (such as graphs or diagrams). TIFF and JPEG files work well with raster files (photographs or rasterized vector files).

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Fieldwork, continued

(USS Arizona continued from page 1)

rate multisensor to measure temperature, salinity, dissolved oxygen, pH, and reduction potential. On November 19 and 20, **Mike** and **Curt** worked with NPS archeologists and Memorial staff to build and program the instrument packages, and they trained NPS staff in instrument-recovery-and-deployment protocols. **Mike** and **Curt** then worked with **Matt** and **Marshall** to install the wave/tide/current-meter package over the course of two scuba dives. The package was deployed in 13 m of water on the harbor's muddy bottom, 30 m seaward of the *Arizona's* forward port quarter, in water visibility that dropped from 3 m to less than a few centimeters as the sea-floor mud was stirred up during deployment. The multisensor is being installed on the *Arizona's* deck by NPS personnel in December.

After the successful deployment of the wave/tide/current-meter package, **Matt** and **Marshall** gave an hour-long underwater reconnaissance tour of the *USS Arizona* to **Mike** and **Curt**. They were shown bomb damage, artifacts, exposed intact teak deck, and the number-one turret with its three 14-inch guns. Interestingly, the turret was thought to have been removed by the Navy during salvage operations in 1942 but was

USGS Participates in Sediment-Transport Cruise in the Adriatic Sea

By Chris Sherwood

Several U.S. Geological Survey (USGS) scientists and technicians participated in a major deployment cruise for the PASTA (Po and Apennine Sediment Transport and Accumulation) study. PASTA is a component of EuroSTRATAFORM, a research program using selected areas of the European continental margin to explore the fate of sediment particles from their sources in rivers to their deposition on shallow deltas, on the continental shelf, and in deep-sea basins.

Chris Sherwood, Joanne Ferreira, Dave Rubin, Jonathan Borden, and Hank Chezar traveled to Italy in October, and after spending long days prepping gear at the *(Sediment-Transport Cruise continued on page 3)*



Underwater photograph of the hole in the forward deck between turrets numbers one and two, created by the Japanese aerial bomb that ignited the forward powder magazine and sank the USS Arizona. Photograph by Mike Field.

found intact on the hull by NPS archeologists in 1983.

Every 2 months for 1 year, the NPS staff will send the instrument data to **Curt**, who will analyze the data to gain a better understanding of the harbor's environment and what controls it. This information, in turn, will be used to more accurately predict the life expectancy of the *USS Arizona's* hull and fuel bunkers. USGS researchers, along with NPS staff, hope to establish a cooperative program to continue this scientific effort on behalf of one of the Nation's most hallowed grounds and a potent symbol of our history. ❁



Joanne Ferreira, Modesto Brañas Area (bosun on the research vessel Garcia del Cid), and Chris Sherwood deploy the GEOPROBE tripod.

(Sediment-Transport Cruise continued from page 2)

well-equipped marine facility at Istituto de Geologia Marina (and long dinners in the restaurants of Bologna), they deployed tripods and moorings in the Adriatic Sea. The deployment cruise went almost exactly as planned, which is remarkable, considering that North American scientists were working in Italian waters on a Spanish ship. The officers and crew of the research vessel *Garcia del Cid*, from the Instituto de Ciències del Mar (ICM) in Barcelona, proved outstanding mariners, and all the coring, mooring, tripod, and water-column work went perfectly. The USGS gear had been prepared at the USGS' Marine Facility (MARFAC) in Redwood City, CA, by **Dave Hogg**, **Dave Gonzales**, **Kevin O'Toole**, and **Hal Williams** and at the USGS' Marine Operations Facility (MOF) in Woods Hole, MA, by **Marinna Martini** and **Andree Ramsey**. It arrived in Italy and breezed through customs in perfect condition.

USGS scientists teamed up with Canadian scientists **Paul Hill** and **Tim Milligan** to deploy two tripods at the sand-mud transition zone (about 10-m water depth) off the Chienti River near Ancona. **Dave** and **Hank** will collect daily images of bottom-sediment texture with their newly developed micro-video camera from a tripod that will also provide sonar images of bedforms, video photographs of bottom features, high-resolution photographs of particles in the bottom boundary layer, and acoustic-doppler profiles of currents in the overlying waters. A nearby tripod, prepped by **Chris**, **Paul**, and **Joanne**, will measure waves, currents, turbulence, and suspended sediment near the bottom with acoustic technology, as well as turbidity, temperature, and salinity. The tripods are protected by three guard buoys, provided by the Woods Hole Oceanographic Institution (WHOI) and the University of Washington, that support near-surface instruments to measure temperature, salinity, and turbidity. The USGS also deployed a GEOPROBE tripod at 20-m water depth, which will measure near-bottom flow and sediment transport. USGS emeritus scientist **Dave Cacchione** (Menlo Park, CA) collaborated with **Pere Puig** (ICM, Barcelona) to



In this rare image of **Dave Rubin** at sea, he is seen putting cable ties on the 10-m flow tripod.



Hank Chezar puts the finishing touches on the "Big Top," a veritable three-ring circus of bottom-sediment instrumentation.

deploy an instrumented mooring off the Pescara River to measure internal waves.

The USGS deployments are part of a larger measurement program with seven tripods, two trawl-resistant bottom mounts, an instrumented subsurface mooring, and a dozen guard buoys, some with instruments. The array extends from the Po River to the Gargano Peninsula and will remain in the water until May 2003. A February refurbishing cruise and the May recovery cruise will take place on the *Seaward Johnson II*, from Harbor Branch Oceanographic Institute. Extensive coring, bottom sampling, and hydrographic surveys are being conducted. If all goes as planned, the PASTA study will provide one of the most comprehensive data sets ever for process studies of sediment transport and deposition in a coastal environment.

This winter, the Adriatic Sea is the site of an unprecedented number of major and complementary studies, in addition to the PASTA study:

- the Naval Research Laboratory, in conjunction with the North Atlantic Treaty Organisation (NATO)'s Supreme Allied Commander, Atlantic (SACLANT) Undersea Research Centre (La Spezia, Italy), is conducting several studies, including an Adriatic circulation experiment;
- Croatian scientists are mounting an East

- Adriatic circulation experiment;
- the Italian Ministry for the Environment and Territory is launching ADRICOSM, a pilot project to develop an integrated coastal-management system for the Adriatic Sea;
- the Office of Naval Research (ONR) is funding a large-scale physical-oceanographic research program with the acronym DOLCE VITA; and
- the European Union is funding a pilot Mediterranean forecasting system.

Rich Signell, on loan to NATO/SACLANT from the USGS' Woods Hole Field Center, has been instrumental in helping to coordinate all of these programs.

EuroSTRATAFORM, which is funded by the Office of Naval Research, expands process studies of continental-margin sediment transport and formation of sedimentary strata to geographic regions in the Adriatic Sea and the Gulf du Lyons and to continental-slope regions off Spain and Norway. The October-November cruise was a collaborative effort, with

- North American participants from the USGS, WHOI, the University of Washington, Dalhousie University, and the Bedford Institute of Oceanography;
- Italian participants from the Istituto Geologia Marina (Bologna) and the Istituto Biologia Marina (Venice), both divisions of the Consiglio Nazionale delle Ricerche; and
- Spanish participants from the Instituto de Ciències del Mar (Barcelona).✻



Paul Hill, **Dave Rubin**, **Joanne Ferreira**, and **Modesto Brañas Area** deploy the "Big Top" off the Apennine coast.

Sea-Floor Mapping Goes Inland, to Bear Lake in Utah and Idaho

By Steve Colman

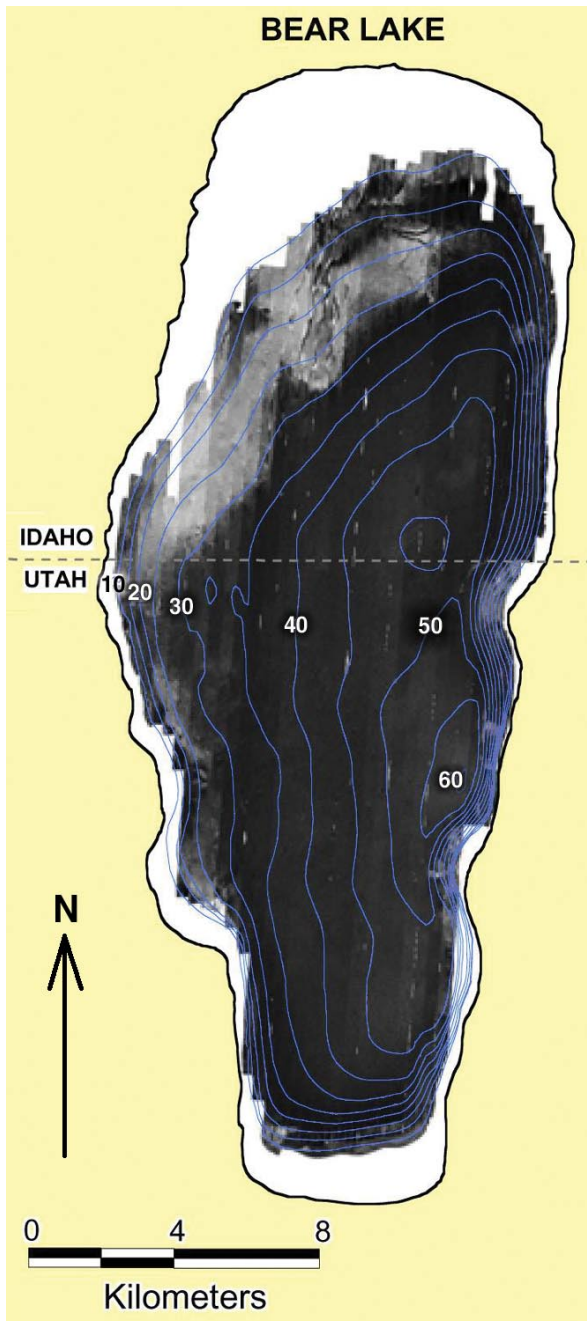
A team of researchers from the U.S. Geological Survey (USGS)'s Coastal and Marine Geology Program (CMGP) used sea-floor-mapping technology to map the floor of Bear Lake (Utah and Idaho) in September. Bear Lake is a medium-size (11 by 34 km) lake that occupies an active half-graben at the boundary between the

Basin and Range Province and the Colorado Plateau. The lake is important as a recreational resource, a fisheries habitat, and a source of water for irrigation and power generation.

Since 1996, **Steve Colman** (USGS, Woods Hole, MA) has been working with scientists from the USGS' Earth Sur-

face Dynamics Program in Denver, CO, to study the sediment of Bear Lake as a record of past climate and limnology. The primary scientific goals of this most recent survey were to look for evidence of sublacustrine spring discharge and to image possible fault scarps that cut the lake floor. Secondary objectives were to produce a sidescan-sonar mosaic and an updated bathymetric map of the lake. The sidescan-sonar mosaic has potential applications ranging from interpreting sedimentary environments to mapping fish habitats.

In addition to **Colman**, other members of the survey team were **Dave Nichols** and **Jane Denny** (USGS, Woods Hole, MA), **Dana Wiese** (USGS, St. Petersburg, FL), and volunteer **Richard Goldberg** (Coastal Carolina University). The research vessel *Raphael* was hauled from Woods Hole to Bear Lake to serve as the data-collection platform. Geophysical systems included a sidescan-sonar (Edgetech DF-1000) system, a Chirp subbottom (Edgetech 424) profiler, and an interferometric swath-bathymetry (Submetrix 2000) system. For the most part, the weather and equipment cooperated, and the results were a high-quality data set. Preliminary interpretation of the data has revealed new insights into the sedimentary environments of the lake, ranging from hemipelagic marl in deep water to debris-flow sand on the fronts of fan deltas. Major fault scarps on the lake floor were clearly imaged, although small-scale fault disturbances visible in subbottom data were obscured in the sidescan-sonar data. Many other features related to such things as spring discharge and the distribution of aquatic snail shells were also observed. ❁



Sidescan-sonar mosaic and new bathymetry for Bear Lake generated from September 2002 operations.



The research vessel *Raphael* heading out onto Bear Lake from the State Park Marina in Garden City, UT, in September 2002. Lake level is about 5 m below the lake datum, exposing much of the marina breakwater.

Lidar Mapping of Vegetation at Assateague Island National Seashore—a First Look

By Amar Nayegandhi

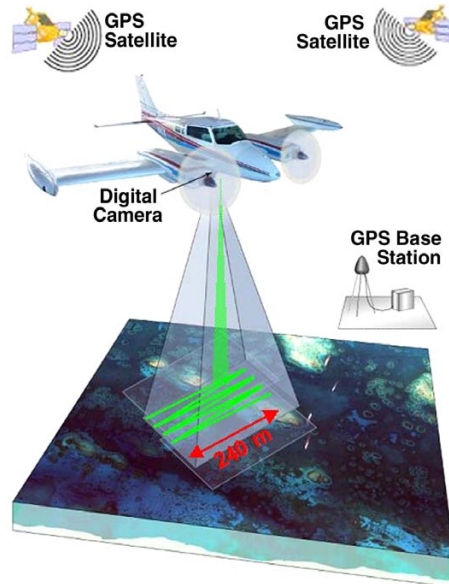
Barrier islands, such as those in Assateague Island National Seashore (in Maryland), are dynamic, responsive entities that are important and fascinating in terms of their intertwined geologic and ecologic processes. As part of its resource-management program, the National Park Service (NPS) at Assateague Island requires accurate and detailed topographic maps to study beach dynamics and vegetation communities at periodic intervals.

The use of a “first reflection” airborne lidar (light detection and ranging) instrument was initiated in 1995 for beach mapping at Assateague Island. In its simplest form, a lidar sends a short pulse of light energy from a laser to a target. The time it takes for each pulse to complete a round trip to and from the target is converted into a direct measure of the elevation of the target. A first-reflection lidar measures the distance to the leading edge of the first laser reflection, typically the first non-air surface the outgoing light pulse encounters, such as the surface of a sandy beach or the tops of the trees in a forest.

A new research project at the U.S. Geological Survey (USGS) is now assessing the capability of a “multiple reflection” lidar instrument to study plant communities and extract “bald earth” elevations in moderately dense vegetated areas. A multiple-reflection lidar records the full “waveform” of the returned signal. When such a lidar is flown over a vegetated area, the unique shape of the waveform can reveal where—in the space between the ground and the treetops—the foliage, trunk, and branches are concentrated. Depending on the density of vegetation, some of the laser light will penetrate to the ground, and the reflected waveform will provide a measure of the ground elevation as well.

In September, a team of researchers led by USGS scientist **John Brock** (St. Petersburg, FL) departed for a 5-day field effort at Assateague Island, MD, to assess and validate the performance of a new lidar instrument, the National Aeronautics and Space Administration (NASA)’s Experimental Advanced Airborne Research Lidar (EAARL). (See “NASA EAARL Lidar Test at Wallops Flight Facility,” *Sound Waves*, April 2001.)

Wayne Wright (NASA) developed the EAARL instrument, which was flown on a



The NASA Experimental Advanced Airborne Research Lidar (EAARL) collected georectified digital aerial photographs and high-resolution lidar data over Assateague Island. The instrument uses a green laser and a raster scanning mechanism to acquire lidar data. Researchers set up a GPS base station to precisely locate the position of the aircraft and the data it collected.

Cessna 310 by pilot **Virgil Rabine** and copilot **Wayne**. The purpose of this mission was to acquire lidar data and digital camera photography over the sandy beach and various vegetated communities at Assateague Island. **Amar Nayegandhi** (USGS) and **Mark Duffy** (NPS) operated a survey-grade global-positioning-system (GPS) base station in a parking lot at Assateague Island National Seashore. EAARL flights were conducted from Salisbury, MD, over 2 days to acquire 7 gigabytes (GB) of lidar data. **Amar** also assisted in real-time programming and aircraft data processing at Salisbury.

To test and validate the lidar instrument, **John Brock**, **Tom Smith**, **Melanie Harris** (all USGS), **Helen Hamilton**, **Mark Sturm**, and **Mike O’Connell** (all NPS) braved the mosquito-infested grasslands and forests of Assateague Island to conduct field observations coincident with the lidar overflights. Six 10-m-radius plots covering various plant communities were surveyed, and the diameter at breast height (DBH) and locations of all stems within each plot were measured.



Melanie Harris conducts field observations.



Tom Smith looks over a camera with a “fish-eye” lens that was used to acquire hemispherical canopy photographs from beneath a canopy looking upward.

A handheld laser rangefinder was used to determine the height of each stem in the plot, and a “fish-eye”-lens camera, provided by **Tom**, was used to acquire hemispherical canopy photographs from beneath a canopy looking upward. The NPS crew, with their in-depth local knowledge, were instrumental in identifying plant species and accessing hard-to-reach spots in the park.

This trip served as an initial assessment of the NASA EAARL instrument to characterize vegetation communities across Assateague Island National Seashore. Data acquired from the aircraft and the on-the-ground measurements are being used to develop methods to extract “bald earth” topography and enable the estimation of vegetation-canopy metrics based on temporally resolved airborne lidar waveforms. ☼

Field-Testing the New USGS Portable Auger Drilling System (PADS) in Louisiana and South Carolina

By Chris Reich

After a year of planning and building, the U.S. Geological Survey (USGS)'s new Portable Auger Drilling System (PADS) was put into the field to test its capability in collecting continuous sediment cores. The coring system consists of a 3-inch-diameter steel barrel with plastic liner that is fixed inside a 3 1/4-inch-diameter hollow stem auger (6-inch outer diameter). The system is entirely hydraulic and is driven by a 31-horsepower gasoline engine. The superstructure is constructed of reinforced heavy-duty aluminum and is dismantled and placed in a 12-ft-long cargo trailer for transport. The system can be placed on an aluminum barge for work in shallow water or transported with the assistance of an all-terrain vehicle (ATV) to hard-to-reach environments.

The inaugural trip for the PADS was to Cocodrie and Port Fourchon, LA, over September 16-23. **Phil McCarty** and **Mike Brown** (University of New Orleans) assisted **Jack Kindinger** (principal investigator), **Jim Flocks**, **Chris Reich**, **Nick Ferina**, and **Chandra Dreher** (all of USGS) in testing the coring capability of the system. In Cocodrie, the first day was spent working out some of the kinks. On the second day, the PADS reached a depth of 50 ft and obtained near-continuous cores of typical deltaic sediment. The system was moved to Port Fourchon, where only 1 day of coring was conducted before having to pack up and leave because of the approach of Hurricane Isidore. All work in Louisiana was conducted from an aluminum barge in 2- to 3-ft water depth.

From October 8 to 17, **Chris Reich**, **Nick Ferina**, and **Jason Greenwood** (USGS) conducted drilling with the PADS at North Island, SC, a heavily wooded sand spit approximately 10 mi long by 1 mi wide, bordered by Winyah Bay to the west and the Atlantic Ocean to the east. We worked in cooperation with **Eric Wright** (assistant professor of marine science at Coastal Carolina University, Conway, SC) and were assisted in the field by **Eric**, **Scott Harris** (also an assistant professor at Coastal Carolina University), and five undergraduate students. Because the only access to North Island is by

boat, the PADS and a four-wheel ATV were transported to the island on an aluminum barge that was driven partly up onto the beach, where the equipment and ATV were unloaded.

Site 1 was located along the axis of the island. A depth of approximately 40 ft was reached with the auger; however, no core was recovered, owing to running or flowing sands, which tend to plague most other drilling systems, as well as the PADS. Running sands occur when drilling reaches the water table and

Portable Auger System (PADS) set up on North Island, SC. The power supply, which consists of a 31-horsepower gasoline engine and a 15-gallon hydraulic reservoir, is in the red frame toward the back half of the large aluminum frame.



Auger system set up on an aluminum platform at Cocodrie, LA.

*The only way to get drilling equipment and ATV to North Island, SC, was by barge. Here, **Jason Greenwood** is driving the ATV onto the barge. The PADS has been dismantled and is lying on the beach in the background.*



Fieldwork, continued

(Auger Drilling System continued from page 6)

fluidized sand flows upward into the core barrel. Standard core catchers located at the base of the inner barrel cannot retain these sands. The water table was less than 5 ft deep at site 1. Because we were unable to take a core, we decided to drill to bedrock (approximately 40 ft down) and sample the sediment on the auger flights as they were withdrawn from the ground. This plan worked well. Sediment texture ranged from green-gray fine sand at the top of the

hole to light-cream-colored lime mud with coarse quartz grains at the base. The lime mud is probably a residual product from weathering of the limestone bedrock.

Site 2 on North Island was on the foredune set. It took 1 day to break down the PADS at site 1 and move it over a series of large dunes with the ATV to site 2. Drilling at site 2 proved to be more difficult because the auger pipe stopped at a depth of approximately 25 ft for unknown reasons. Again, running sands

kept us from obtaining any sediment cores. The auger pipe was eventually retrieved, and the PADS was dismantled and hauled back across the island to be loaded on the barge for the long boat ride back to the dock.

Overall, this system has a strong potential for work in many environments. The problem with running sands is being addressed, and solutions will be tried and tested. At present, at least five potential projects have a need for the PADS. ❁

Research

Diamondback Terrapin Still Vulnerable to Human Activities

By Jeff Lovich

The salt marshes and barrier islands of South Carolina appear to be tranquil and idyllic to most people who visit those enchanted shores. Gently waving palmetto trees and stately live oaks grace a landscape punctuated by wind-sculpted maritime forests and seemingly endless expanses of cordgrass and tidal creeks. Here, land and water meet intimately, blurring the distinctions between the two elements in subtle ways that defy the imagination. Beyond this brackish interface are dunes covered in sea oats and sandy beaches, each molded by winds and waves as the land finally gives way to the embrace of the Atlantic Ocean.

This is the home of the diamondback terrapin (*Malaclemys terrapin*). Terrapins are small turtles, with females rarely exceeding 9 inches in length. Males in the same population are always smaller than adult females. The terrapin is the only species of turtle in the United States that routinely occupies brackish-water habitats, occurring in tidal creeks of estuaries along the Atlantic and Gulf coasts from Cape Cod, MA, to Corpus Christi, TX.

Roger Conant, one of America's most famous herpetologists, called terrapins the "most celebrated of American turtles." His comment was based on the fact that terrapins were heavily exploited as a food source for privi-

leged members of society in the 1800s and early 1900s. With increasing demand for terrapins by epicures, prices soared, and a market was born to supply the big eastern cities of Baltimore, Philadelphia, and New York. Thus, the terrapin became one of the most economically important reptiles in the world.

In recognition of the demand for terrapins,

the State of Maryland enacted a law in 1878 providing a closed season and a size limit for the species, but it was almost too late: prices increased with demand, and wild stocks became depleted. In response, the United States Government initiated studies of captive propagation. The terrapin fad finally died out around the time of Prohibition, and

populations recovered from the several decades of exploitation. Human activities, however, are once again causing declines in terrapin populations, as shown by various studies, including a long-term population study by myself and others in South Carolina.

Beneath the apparent calm of the terrapin habitat in South Carolina lies a world in tumult. Each day, water levels fluctuate by almost 6 feet as the creeks flush in and out with the inexorable pull of the tide. This fluctuation causes profound changes in the direction and speed of tidal flow, water temperature, and salinity. Punctuating these daily changes are hurricanes that brush or hit Charleston, SC, on average once every 5 1/2 years. Hurricanes commonly generate large storm surges on top of already-impressive tides. According to one source, a hurricane hit

(Diamondback Terrapin continued on page 8)



Diamondback terrapin (Malaclemys terrapin)—the most celebrated of American turtles. Once popular as a gourmet-food item, terrapin populations were decimated by collectors in the late 19th and early 20th centuries. New threats to the terrapin's survival include habitat destruction, incidental capture and drowning in crab traps, both commercial and recreational, and death of females on roads when they migrate to nesting sites. "Terrapin" is an Algonquian word that means "turtle." Photograph by Jeff Lovich.

Research, continued

(Diamondback Terrapin continued from page 7)

Charleston in 1752, causing a storm surge that nearly covered the entire downtown area. When the wind shifted, the water level fell 5 ft in 10 minutes. Given the relatively long lives of terrapins (possibly as much as 40 years), they are likely to live through several hurricanes in South Carolina.

I had the good fortune to study the daily lives and annual cycles of activity of terrapins at Kiawah Island, SC, from 1983 to the present with my colleague **Whit Gibbons**, a professor of ecology and senior research ecologist at the University of Georgia's Savannah River Ecology Laboratory. What we discovered was amazing. Despite their small size, terrapins are powerful swimmers. Females are capable of making round-trip nesting journeys of more than 5 km from the salt marsh to beach dunes. Yet most terrapins are remarkable homebodies, inhabiting not only the same creek from year to year, but commonly the same small reach of water. Of 442 individuals that were recaptured 1 year or more after their initial capture, only 25 had changed locations from one tidal creek to another. This site fidelity appeared to be unchanged even after such major hurricanes as Hurricane Hugo in 1989, packing 140-mile/hour winds.

On the whole, the ability of terrapins to stay in the same tidal creek despite daily tidal fluctuations and storms is but one reflection of the remarkable resiliency of the salt-marsh ecosystem. Palmettos and cordgrass bend and flex in all but the most severe of hurricanes, and tidal meanders

give way to waves and tides in ways that ultimately preserve the characteristics of this dynamic landscape. Severe storms are all part of the cycle of life in the salt-marsh ecosystem, much like fires in forest systems. Only recently have scientists come to appreciate the value of natural disturbances in maintaining the health of ecosystems.

Today, the terrapin faces new threats, including death by drowning in blue-crab (*Cal-*

linectes sapidus) traps, habitat degradation (past and present), and negative interactions associated with human recreational activities. One study suggested that heavy beach use may reduce nesting by terrapins, and noted increased rates of propeller injury on nesting females as boat use increased in the study area. As a result of human impacts, terrapin populations are declining in some areas, with significant local declines documented in Flor-

(Diamondback Terrapin continued on page 9)

The Kiawah River (left) provides a corridor for females leaving the marsh to nest on the dunes visible in the background. The dunes are the birthplace of terrapins; just beyond them lies the Atlantic Ocean, birthplace of hurricanes. Photograph by Jeff Lovich.



Some diamondback terrapins have distinctive markings on their heads and carapaces (upper shells). Facial patterns commonly make a terrapin look as if it has a moustache or is wearing lipstick. Photograph by Jeff Lovich.

Jeff Lovich stands near the Kiawah River during high tide, testing the use of radios on terrapins in field pens. The radios presented a real challenge when used in brackish water or saltwater, because the signals will transmit to the receiver only when the antennas are above water. USGS photograph, taken by an Earthwatch volunteer.



Tim Owens (on left) and Tony Mills of the University of Georgia's Savannah River Ecology Laboratory check nets placed in Terrapin Creek to catch terrapins. The nets commonly caught blue crabs and stingrays, adding to the challenge of working on the project. Photograph by Jeff Lovich.

Research, continued

(Diamondback Terrapin continued from page 8)

ida and some parts of South Carolina.

The site tenacity of this little turtle makes it especially vulnerable to incidental capture in crab traps set in creeks near public-

access points. Limited movement among tidal creeks means that once terrapins are trapped out of one area, a long time will elapse before another population can be-

come established. Without continued protection, the future looks uncertain for the “most celebrated of American turtles.” ❁

Outreach

Dusty Roads Outreach—Gene Shinn Spreads the Word on Impacts of Dust Transported by Transoceanic Winds

By Barbara Lidz

Between September and November, U.S. Geological Survey (USGS) scientist **Gene Shinn** conducted a dust-beating swing across the country. Among **Gene** and his team’s research activities is the study of impacts of African dust transported to North America by transatlantic winds. **Gene’s** talks during his 2-month odyssey focused on those impacts, with titles ranging from “Soil Dust: Big Impact of Tiny Specks” to “Transoceanic Soil-Dust Transport and Medical Implications.” **Gene’s** travels included an invited talk at the American Association of Petroleum Geologists (AAPG)’s Rocky Mountains Section meeting in Laramie, WY, and a luncheon discussion with the board of the Agouron Institute in Pasadena, CA. Agouron focuses on and promotes subjects they feel are not receiving adequate attention.

After a presentation at a USGS session on medical geology at the Geological Society of America (GSA) annual meeting in Denver, **Gene** traveled on to be the Geological Society

of Utah’s luncheon speaker in Salt Lake City. From there, **Gene** traveled directly to Yale University, where he was the weekly speaker in the Department of Forestry for the Curtis and Edith Munson Marine Conservation Lecture Series. Two weeks later, he was at Florida International University. The following week, both **Gene** and **Dale Griffin** spoke to the Florida Keys Technical Advisory Committee in Marathon, FL. The week after that, **Dale** made a dust presentation at the first Sino-U.S. Workshop on Dust Storms and Their Effect on Human Health, held November 25-26 in Raleigh, NC. The meeting was organized and sponsored by the National Aeronautics and Space Administration (NASA), the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA), the National Oceanic and Atmospheric Administration (NOAA), the National Institute of Environmental Health Sciences (NIEHS), and North Carolina State University (NCSU).

Dale and **Gene** also spent the past several

months advising military Homeland Defense personnel on the potential threat of dust as a cover or carrier for bioterrorism activities.

The clear reading from all these travels is that the USGS’ Center for Coastal and Watershed Studies in St. Petersburg, FL, remains the first governmental organization to identify and culture viable bacteria from transatlantic dust. This work by **Dale Griffin** was made possible by funding from NASA’s “Healthy Planet” program. Until **Dale’s** work, the microbiological paradigm was that ultraviolet (UV) radiation would kill microbes during aerial transport. Not!

This USGS research was recently a highlight in National Science Foundation (NSF) Director **Rita Colwell’s** address to the American Society of Microbiology, viewable at URL <http://www.nsf.gov/od/lpa/forum/colwell/rc020519asmlecture.htm>. To view an 8-minute online USGS video on African dust, link to URL http://coastal.er.usgs.gov/african_dust/documentary/. ❁

Woods Hole Field Center Hosts Second Annual Open House in Celebration of Earth Science Week

By Kate Visser

In celebration of Earth Science Week, the U.S. Geological Survey (USGS)’s Woods Hole Field Center hosted its second annual open house, “GeoFest: Earth Adventures,” for kindergarten through eighth-grade students on Saturday, October 26, in the hopes of getting students excited about Earth science. Students, parents, and teachers from the surrounding communities of Falmouth, Bourne, and Mashpee, MA, participated in the festivities. The Carriage House of the

Woods Hole Oceanographic Institution (WHOI) was packed with hands-on exhibits staffed by USGS scientists:

- Two sediment cores from a local cranberry bog and a freshwater marsh, each containing many different layers and relics, allowed kids to examine past depositional environments.
- A coring activity enabled kids to collect their own sediment cores using short, pushup-style corers.
- A scaled-down glacier, layered with

rocks, sand, and clay, helped kids to understand the formation of Cape Cod.

- An interactive display described the formation of Cape Cod and its associated features and noted conservation issues critical to the cape.
- A gas-hydrate exhibit encouraged kids to explore sediment behavior in the natural environment through activities that included making gas-hydrate models, handling montmorillonite of

(Woods Hole GeoFest continued on page 10)

Outreach, continued



Sandy Baldwin helps a GeoFest participant make a paper nautiloid model.

(Woods Hole GeoFest continued from page 9)

different moisture contents, examining a particle-suspension/sedimentation model, and watching a video of gas-hydrate “ice cubes” burning.

- A three-dimensional poster of a submarine canyon helped kids learn how 3D glasses work; they also had the opportunity to make their own three-dimensional drawings.
- Fish habitats were created with different bottom-sediment types and vegetation, and kids were invited to stick their hands into a “mystery box” to discover what type of habitat lay within.
- An exhibit of the different types of beach sand in Falmouth showed kids that the sand types look and feel different, and made them think about why.
- Visitors were invited to inspect a collection of rocks and sand from around the world.

Two geology walks through the WHOI campus and along Trunk River Beach taught participants about the geology and formation of Cape Cod, as a nor’easter battered both the beach and the participants. In preparation for the beach walks, **Bob Oldale** gave interested USGS employees a vivid and detailed lesson about the glacial, deglacial, and present-day history of the area.

GeoFest participants included **Seth Ackerman, Sandy Baldwin, Brian Buczkowski, John Bratton, Sarah Kelsey, Dirk Koopmans, Tammie Middleton, Dave Mason, Joanne Sedlock, Kate Visser, Bill Waite, Glynn Williams,** and



John Bratton and kids delve deep into the glacier model.



Bill Waite encourages kids to investigate the details of a gas-hydrate molecule. ↓



Seth Ackerman helps kids explore different seafloor-habitat types at the Habitat Mapping exhibit.



Dirk Koopmans answers questions about the different layers of the wetland cores.



Kids wash montmorillonite off their hands, thanks to the gas-hydrate group.

Bill Winters. The activities, bountiful information, ask-a-geologist service, and free raffle were enthusiastically received

by all who attended, and everyone walked away from GeoFest excited about geology and science! ❁

Fourth Annual Open House in St. Petersburg, FL, Sets New Records

By Dennis Krohn

The U.S. Geological Survey (USGS)'s Center for Coastal and Watershed Studies (CCWS) in St. Petersburg, FL, hosted its fourth annual open house on October 9 and 10. The event was tied to the American Geologic Institute's Earth Science Week, whose theme this year was "Water Is All Around You." A record number of more than 35 exhibits presented research topics from five USGS offices in Florida, including offices in St. Petersburg, Tampa, Gainesville, Altamonte Springs, and Tallahassee.

Highlighted among the exhibits was **Gene Shinn's** 24-ft-long blimp designed to sample African dust. **Gene** had the USGS visual identifier embossed on the side—as far as we know, the largest USGS visual identifier made to date. Also notable was an exhibit assembled by USGS biologists in St. Petersburg to simulate a marsh environment; it included native marsh plants, aquariums, a kiddie pool full of horseshoe crabs, and a cooling mist that sprayed everything and everyone. The mist was well appreciated, because the temperature on October 9 was 89° at 77-percent relative humidity, for a NOAA Heat Index (apparent temperature) of 109°!



Gene's Shinn's 24-ft-long blimp designed to sample African dust.

We were especially pleased that exhibitors came from afar to help out, including **Jane Eggleston** from Tallahassee, **Trudy Phelps** from Altamonte Springs, and **Larry Harvey** from the Hubbs-SeaWorld Research Institute in Melbourne, FL. The tour guides were real heroes that day, helping to lead a record 871 4th-graders, teachers, and chaperones through the exhibits. The work of the CCWS Marine Operations group, under **Terry Kelley** and **Dave Wegener**, was most commendable; they

set up and took down a record 13 tents to shade exhibitors, and handled other construction and all the last-minute running of electrical cords for outdoor power. CCWS graphic artists **Betsy Boynton** and **Laurinda Frye** made countless posters, signs, manatee bone casts, and more for the event. Fifty new portable exhibit boards built for the "Gulf of Mexico Integrated Science-Tampa Bay Pilot Study 2nd Annual Science Conference," held on September 19 in St. Petersburg, proved crucial in highlighting all the science we had to display.

On the second day, the open house was held for the public, and more than 250 people attended. Feedback forms showed that no one exhibit was the clear favorite, but many exhibits seemed to be favorites for numerous people. This result suggests that the public has a wide range of interests and that the USGS is well served by offering displays illustrating the large variety of science topics studied here. Thanks to one and all who made this event a success! ❁

USGS Participates in Great American Teach-In

By Dennis Krohn

The U.S. Geological Survey (USGS)'s Center for Coastal and Watershed Studies (CCWS) in St. Petersburg, FL, participated in Pinellas County's Great American Teach-In on November 20 for the third year in a row. Parents, business partners, and community members were invited to visit local schools on this day and share information about their jobs, hobbies, and other

experiences. The event is highly promoted in Pinellas County, FL, and the USGS generally has numerous requests from teachers for classroom visits.

Dennis Krohn visited McMullen Booth Elementary School and spoke to three classes about hurricanes and making volcano models. **Jim Flocks** visited Meadowlawn Elementary School and talked to five classes about

rocks and minerals. Volunteer **Kathy Krohn** demonstrated **Ellen Raabe's** "Marshes as Sponges" exhibit at McMullen Booth school. This exhibit, popular at CCWS' recent open house (see article "Fourth Annual Open House in St. Petersburg, FL, Sets New Records," this issue), presents new material that teachers can readily incorporate into their curriculum. ❁

4th-Graders Tour USGS' Center for Coastal and Watershed Studies in St. Petersburg, FL

By Dennis Krohn

The Trinity School for Children in Tampa, FL, visited the U.S. Geological Survey (USGS)'s Center for Coastal and Watershed Studies (CCWS) in St. Petersburg, FL, on the morning of November 7. Fifty-three 4th-graders took part in the tour, which was requested by **Eugene Henry**, on the Hillsborough County staff, and arranged through **Claire Brooks** and **Jamie Andrisio**, fourth-grade teachers at the Trinity School. The school has about 400 students ranging from preschool through eighth grade.

We divided the large group into three subgroups and had three stations for demonstrations. **Chris Reich**, **Noreen Buster**, and **Chuck Holmes** gave 10-minute presentations on coral reefs, analyzing drill cores, and geochronology. **Ilsa Kuffner**, **Karynna Calderon**, and **Dennis Krohn**



led the tours. **Dave Wegener** and **Terry Kelley** helped with parking and shop tours. **Stacy Merriweather**, **Marci Marot**, and **Kate Ciembronowicz** helped with goodie bags. As a special treat, **Rich Young** and **Molly McLaughlin** helped prepare orange drink packaged in 10-ounce scientific

water-sampling containers. As might be expected, the drink containers were the students' favorite memory of the tour, but **Gene Shinn's** famous flushable toilet on top of porous limestone from the Florida Keys was a close second. Thanks are extended to all who participated. ❁

USGS Represented at 90th Anniversary of Girl Scouts

On October 26, the U.S. Geological Survey (USGS)'s Center for Coastal and Watershed Studies in St. Petersburg, FL, participated in "Just Imagine," an event in Tampa, FL, celebrating the 90th anniversary of the Girl Scouts of the USA. The combined effort of three Girl Scout councils from southwestern Florida, the all-day event drew more than 5,000 attendees. To accommodate that many participants, the Girl Scouts had exclusive use of Tampa's Museum of Science and Industry (MOSI) and the University of South Florida (USF)'s Sundome from 8 a.m. to 4 p.m. An experiment for MOSI, it was the first time that the museum had closed its entire facility to the public for a special event.



Megan Frayer led a group of USGS volunteers to staff a booth at MOSI. The USGS shared the MOSI auditorium with some expected exhibitors, such as USF's College of Marine Science and Tampa Bay's Busch Gardens adventure park, and some unexpected exhibitors, such as The Ninety-Nines, an organization started by female pilots

in 1929 to promote women in aviation. Thanks go to **Tracy Enright**, **Kathy Pegram**, and **Iuri Herzfeld**, who helped **Megan** staff the USGS booth. ❁



Entrance to the Museum of Science and Industry (MOSI) in Tampa, FL, showing the Girl Scout banner and theme for the 90th-anniversary celebration.

Tracy Enright helps a prospective geologist identify sand samples.

National Wetlands Research Center Celebrates GIS Day

By Susan Horton

On November 20, the U.S. Geological Survey (USGS)'s National Wetlands Research Center (NWRC) in Lafayette, LA, hosted an open house for the community to celebrate GIS Day and Geography Awareness Week. GIS Day is a grassroots event in which geographic-information-system (GIS) users and vendors open their doors to schools, businesses, and the general public to showcase real-world applications of this important technology. Exhibits, demonstrations, map displays, tours of the NWRC mapping and remote-sensing labs, and special presentations highlighted the many uses of this computer-based tool for mapping and analyzing objects and events.

Presenters included a local high-school teacher, **Vickie Hebert**, talking about how she uses GIS in her classroom to enhance her students' knowledge of the geography of Louisiana, and **Greg Guirard**, writer, photographer, and naturalist, who shared his knowledge of one of the largest riverine swamps in the United States through words and images entitled "A Sense of Place—the Atchafalaya Swamp . . . a Melding of People and Resources."

Visitors were amazed at the various ways in which GIS technology is being used. GIS maps showed

- The path of Hurricane Lili and its impacts on the offshore oil industry in the Gulf of Mexico,
- Vegetation "eatouts" caused by the in-



More than 125 visitors enjoyed GIS Day at NWRC and this Louisiana-shaped cake created by USGS geographer **Helena Schaefer**.



USGS geographer **Helena Schaefer** holds the Sponsor's Choice prize—a quilt that she made depicting the countries of the world—as **Cynthia Feirman** (of Carey Technology) announces the winner.

vasive nutria, a hairy herbivore that is wreaking havoc in Louisiana's coastal wetlands,

- The impact site in Mexico of the meteor that changed the Earth's climate and is believed to be the leading cause of the demise of the dinosaurs,
- A new fiber-optic network developed by a local utility system to improve customer service, and
- How sharks in Louisiana coastal waters are studied.

The finale for GIS Day was the presentation of awards for the "Draw Your World" contest. More than 340 students, from kindergarten through ninth grade, submitted hand-drawn maps of their room, house, classroom, school, neigh-



Home-schooler **Jessica Reed** with her winning "Draw Your World" map.



USGS ecologist **Jim Grace** (on left) and **Troy Barrilleaux** (Louisiana Department of Natural Resources) discuss coastal-wetland restoration projects.

borhood, town, or parish. The winning maps were displayed in the NWRC lobby, and the student winners were presented with globes and atlases.

In addition to the USGS, GIS Day sponsors were Fugro Chance, Inc., the University of Louisiana's NASA Regional Applications Center, C.H. Fenstermaker & Associates, Carey Technology, the Lafayette Parish Assessor, Navigation Electronics, Inc., Gulf Engineers and Consultants, the Lafayette Utilities System, the Louisiana Army National Guard, and the Lafayette Economic Development Authority. ❁

Meetings

Symposium on the Effects of Fishing Activities on Benthic Habitats

By Peter Barnes

Fishery harvest from the ocean floor can disrupt the marine benthos (seabed communities) in many of the same ways farming and logging disrupt ter-

restrial ecosystems. This disruption was the focus of a meeting entitled "Symposium on Effects of Fishing Activities on Benthic Habitats: Link-

ing Geology, Biology, Socioeconomics, and Management," held in Tampa, FL, from November 11 to 15. The

(*Benthic Habitats continued on page 14*)

(Benthic Habitats continued from page 13)

U.S. Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), the American Fisheries Society (AFS), and the Ecological Society of America (ESA) co-sponsored the meeting, which was organized by **Peter Barnes** (USGS, Menlo Park, CA) and **James Thomas** (NOAA, Silver Springs, MD). **Ellen Raabe** (USGS, St. Petersburg, FL) was the local coordinator, and **Page Valentine** (USGS Woods Hole, MA) and **Gary Brewer** (USGS, Kearneysville, WV) served on the program committee. **Lori Hidinger** of ESA, who

was the overall meeting coordinator, deserves the credit for the smooth running of the meeting.

The symposium was an attempt to bridge the gaps in research, technology, and social and economic sciences, while linking research to industry and stakeholder issues, as well as to the needs of resource managers. The symposium was well attended by researchers in academia and government, with strong international representation. A final count of close to 400 participants far exceeded the expected 150 to 200.

Chip Groat, Director of the USGS, and **William Hogarth**, Assistant Administrator of NOAA's National Marine Fisheries Service (NMFS), gave lead presentations on the roles of the USGS and NOAA. Plenary sessions and poster presentations focused on all aspects of fisheries activities and their impacts, benthic-habitat-mapping technology, fish/benthos interactions, and management and socioeconomic factors. The final panel session served as a

forum for a lively discussion on lessons learned, keeping the attention of a full house. More than 50 contributions were received at the symposium for compilation in an AFS publication in 2003.

USGS contributions to the symposium represented benthic-habitat research in the Northeast, Florida, Gulf of Mexico, West Coast, Alaska, and the Great Lakes. (See the program and other information at URL <http://walrus.wr.usgs.gov/bh2002/>.)

On the final day of the meeting, **Ellen**, **Chris Smith** (NOAA), and **James Thomas** (NOAA) led a field trip for 10 participants. The trip included visits to restoration sites operated by NMFS, a fish-processing facility, and Fort De Soto Park, and a tour of the USGS' Center for Coastal and Watershed Studies at St. Petersburg, FL. Many thanks go to **Dennis Krohn**, who led the tour group around the St. Petersburg facility, and to **Noreen Buster**, who received the guests on short notice and explained her laboratory work on sediment cores. The visitors were impressed with the USGS facility even after a long week of conferences and field trips. ❁



Noreen Buster (USGS, St. Petersburg, FL) explains her work on sediment cores to field-trip participants.

Planning Meeting in Woods Hole, MA, on USGS Gas-Hydrates Research

By **Debbie Hutchinson**

Before the dust had a chance to settle from U.S. Geological Survey (USGS) Director **Chip Groat's** visit to the USGS center in Woods Hole, MA, members and others interested in the USGS Gas Hydrates Project came from across the country to gather in Woods Hole and look to the future of USGS gas-hydrates research. This retrospective and prospective exercise was prompted by the retirements last January of two senior leaders in the project, **Bill Dillon** of Woods Hole and **Alan Cooper** of Menlo Park, CA. The meeting, held November 20-22, was convened by **Debbie Hutchinson** and **Tim Collett**, project chiefs for the USGS Gas Hydrates Project. The 27 participants included eight repre-

sentatives from outside the USGS (Minerals Management Service [MMS], the U.S. Department of Energy [DOE], the Naval Research Laboratory [NRL], the National Oceanic and Atmospheric Administration [NOAA], Chevron-Texaco, and the Woods Hole Oceanographic Institution [WHOI]), two representatives from the USGS funding programs (Energy Resources Program and Coastal and Marine Geology Program), two emeritus scientists, 14 project members, and a soon-to-be-hired Mendenhall post-doctoral fellow.

On the first day of the meeting, November 20, the group listened to various participants' perspectives on gas-hydrates research. After a charge to the group (by

Debbie Hutchinson) to focus on how individual USGS pieces fit the big picture of gas-hydrates research, **Dawn Lavoie** and **Frances Pierce** opened the presentations with the goals and realities of USGS program support. The rest of the morning was given to perspectives from various stakeholders and collaborators, such as **Jess Hunt** speaking of MMS' environmental and assessment interests, **Brad Tomer** speaking of DOE's goals and expectations, **Warren Wood** speaking of the NRL's program and its relation to USGS research, **Barbara Moore** discussing NOAA's focus on hydrate mounds and associated biological communities, and **Emrys Jones** speak-

(Gas-Hydrates Research continued on page 15)

(Gas-Hydrates Research continued from page 14)

ing of the Gulf of Mexico Joint Industry Program. **Jean Whelan** and **Alexei Milkov** (both of WHOI) kept all presenters on their toes with penetrating questions and discussion points. The day ended with 14 short USGS presentations in which researchers highlighted key accomplishments and their significance to gas-hydrate science. The outcome of this first day was to bring ev-

eryone to a common level of understanding of each other's work and goals.

The second day of the meeting was for USGS-only participants and consisted of discussions aimed at defining a gas-hydrates-research agenda for the next 5 to 10 years. Many of the discussions focused on building closer links between laboratory and field experiments, and between labora-

tory and modeling experiments. We also discussed the development of conceptual models and the subsequent development of numerical models for understanding both the behavior of gas hydrates in sediment and the dynamic evolution of gas-water-sediment systems. Both **Debbie** and **Tim** have their work cut out for them in developing, reviewing, and implementing a plan. ❁



Participants in the USGS Gas Hydrates Planning Meeting take advantage of the clear fall weather for a group photograph outside of the Carriage House, Woods Hole. From left to right, front row: **Dave Mason** (Woods Hole [WH]), **Bill Winters** (WH), **Keith Kvenvolden** (Menlo Park [MP]), **Myung Lee** (Denver), **Brandon Dugan** (new USGS Mendenhall Fellow, from Penn State), **Emrys Jones** (Chevron/Texaco), **Pat Hart** (MP), **Tim Collett** (Denver), **I-Ming Chou** (Reston, VA), **Warren Wood** (NRL), **Dawn Lavoie** (Reston), **Frances Pierce** (Reston); back row: **Bill Waite** (WH), **Steve Kirby** (MP), **Alexei Milkov** (WHOI), **Dave Scholl** (USGS emeritus), **John Bratton** (WH), **Brad Tomer** (DOE), **Tom Lorenson** (MP), **Dave Twichell** (WH), **Bill Dillon** (USGS emeritus), **Barbara Moore** (NOAA), **Jean Whelan** (WHOI), **Bill Gwilliam** (DOE), and **Jesse Hunt** (MMS). Missing are **Debbie Hutchinson** (WH, the photographer) and **VeeAnn Cross** (WH).

Joint Fact Finding: A New Approach to Balancing Science and Politics in Ecosystem- and Resource-Management Decisions

By **Tonya Clayton**

On October 16-17, several experts of international renown in the fields of consensus-building processes and decision science gathered in St. Pete Beach, FL. Their purpose was to introduce U.S. Geological Survey (USGS) scientists, analysts, and managers to a new view of the role of scientific inquiry in addressing complex ecosystem- and resource-management conflicts. The course, entitled "Joint Fact Finding: A New Approach to Balancing Science and Politics in Ecosystem and Resource Management Decisions," was sponsored by the USGS and presented by the Consensus Building Institute (CBI) of Cambridge, MA.

A central tenet of the course was that conventional scientific practice can lead to adversarial science, commonly alienating the public as well as elected and appointed decisionmakers. Joint fact finding, one phase of a broader consensus-building

approach, was presented as an alternative strategy—one that is more effective in generating constructive and lasting agreements about contentious environmental issues. In this process, stakeholders representing a wide variety of interests work together to:

- Identify and understand the myriad interests and issues at stake;
- Determine, on the basis of financial and technical considerations, whether joint fact finding is appropriate in the given case;
- Plan the joint-fact-finding process, determining, for example, which stakeholders need to be involved, what roles various participants will play, and how severe disparities in participants' expertise will be addressed;
- Define the precise questions to be addressed, as well as the most appropriate methods of analysis;
- Agree on how to use the joint-fact-finding

results, including how to accommodate conflicting data and interpretations; and

- Communicate the results of the joint-fact-finding process to various constituencies and policymakers.

In addition to lectures richly textured with illustrative examples and sprinkled with humor, the fast-moving course (complete with a healthy dose of homework!) also included an exploration of two USGS "real-world" case studies, plus various complex role-playing scenarios. One of the highlights of the course was an address by USGS Director **Chip Groat**, followed by a lively discussion of the USGS' mission and the role of its scientists in bringing policy-relevant research to the joint-fact-finding process.

Lead instructors for the course were **Lawrence Suskind** (CBI, Massachusetts Institute

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of Technology), **Howard Raiffa** (Harvard University), and **Lawrence Dixon** (CBI). USGS cosponsors were **Herman Karl** (Geography Discipline), **Lisa Robbins** (Geology Discipline), and **Christine Turner** (Geology Discipline) with **Richard Zirbes** (Geography Discipline). This undertaking was part of the USGS' Integrated-Science Community-Based Values in Land Use Decision-Making (INCLUDE) activity's ongoing research and mission to explore the role of science and scientists in collaborative problem-solving processes.

Participants included approximately 40 physical and social scientists, analysts, and managers from USGS offices across the country (representing each USGS discipline plus the Director's Office), as well as Lawrence Livermore National Laboratory, the National Oceanic and Atmospheric Administration (NOAA), Collaborative Decisions, Umhverfissrannsóknir ehf of Iceland, the California Coastal Conservancy, Duke University, North Carolina State University, the University of Pittsburgh, the University of Washington, and the National Research Council. Among those associated with USGS coastal science and research were **Chris Barton**, **Tonya Clayton**, **Jack Kindinger**, **George Kish**, **Terri Lee**, and **Lisa Robbins** from the St. Petersburg and Tampa, FL, offices; and **Brad Barr** (NOAA National Marine Sanctuary Program), **Deborah Hutchinson**, and

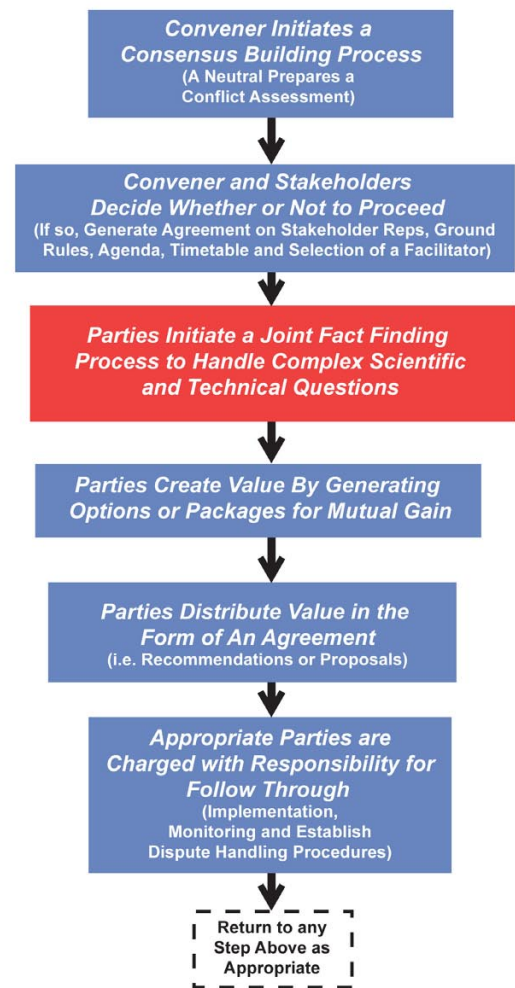
Eric Sundquist from Woods Hole, MA.

For more information, visit these World Wide Web sites:

- The Consensus Building Institute, Inc. (a nonprofit organization), at URL <http://www.cbi-web.org/>, and
- Integrated-Science Community-Based Values in Land Use Decision-Making, U.S. Geological Survey, at URL <http://gam.usgs.gov/DSSandCSP/INCLUDE.shtml>. ☼

The role of joint fact finding in the context of the larger consensus-building process. The steps encompassed by the top two rectangles (initiating a consensus-building process and deciding whether to proceed) determine who is present at the joint-fact-finding table. The joint-fact-finding process itself generates scientific information to be used in the subsequent iterative process of generating options, formulating recommendations, and following through on the agreements reached. Image provided courtesy of the Consensus Building Institute. (Permission to use this copyrighted image for other purposes must be obtained from the Consensus Building Institute.)

THE CONSENSUS BUILDING PROCESS AND THE ROLE OF JOINT FACT FINDING



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Meeting in the UK on Sea-Floor-Mapping Techniques

By Bill Schwab

Jane Denny presented the U.S. Geological Survey (USGS)'s Woods Hole Field Center (WHFC)'s shallow-water-mapping techniques at a 1-day workshop sponsored by the Southern Region of the Hydrographic Society of the United Kingdom (UK). Held in Reading, UK, on November 28, 2002, the workshop was entitled "Multibeam Echosounding—the Total Inshore Solution? Overcoming

the Shallow Water Challenge." It had a diverse audience, among which were academics; hydrographers; representatives of the Royal Navy, the British Geological Survey, the Geological Survey of Ireland, and UK government and private environmental organizations; and various vendors of multibeam echosounders, interferometric sonars, and attitude sensors. Discussions ranged from survey

operations to comparisons between swath-bathymetric systems, and the wide application of these systems. Additionally, the USGS' geologic applications of swath bathymetry were presented at SEA (Group) Ltd. in Beckington, UK, the manufacturer of the Submetrix 2000 Series interferometric sonar used by the WHFC Sea Floor Mapping Group. ☼

Many Visitors to the GHASTLI Laboratory in Woods Hole, MA

By **Debbie Hutchinson**

The U.S. Geological Survey (USGS)'s GHASTLI (Gas Hydrate and Sediment Testing Laboratory Instrument) laboratory in Woods Hole, MA, has been attracting numerous visitors. On November 1, **Shin'ya Nishio** (Institute of Technology, Shimizu Corp., Tokyo), **Eiji Ogisako** (Shimizu Corp.), and **Tatsuya Yokoyama** (Oyo Corp., Saitama, Japan) visited GHASTLI to learn how gas hydrates can be created within sediment in a laboratory setting that mimics natural conditions. They are beginning a program to determine the physical properties of mixtures of gas hydrate and sediment. Their results will be used to model gas-hydrate behavior before and after conducting *in situ* dissociation experiments to recover the trapped methane in deposits offshore Japan.

On November 4, **Devinder Mahajan** (and his son **Monaj**) of Brookhaven National Laboratory visited GHASTLI to discuss laboratory testing of sediment containing natural and synthesized gas hydrates. The USGS and Brookhaven are beginning a joint collaboration on studying how gas hydrate interacts with host sediment on a pore-size scale, using the Brookhaven Synchrotron Microbeam X-ray Computed Microtomography (CMT) complex. Results will be used to construct a simple gas-hydrate-dissociation model for recovering methane from natural sources.

During the Gas Hydrates Planning Meeting on November 20-22, **Barbara Moore** of the National Oceanic and Atmospheric Administration (NOAA)'s

Undersea Research Program (NURP) visited GHASTLI to see the USGS' configuration. **Barbara** oversees gas-hydrate-research grants from NURP to the academic community.

Finally, on November 26, **Chuck Taylor**, who is in charge of the U.S. Department of Energy (DOE)'s gas-hydrate research at the National Energy Technology Laboratory (NETL) in Pittsburgh, PA, visited GHASTLI to discuss collaborating on gas-hydrate/sediment testing. DOE expects to complete construction of a 6-liter chamber for conducting experiments on synthetic gas-hydrate samples. **Chuck** is interested in both interlaboratory calibration experiments and gas-hydrate physical properties. ❁

USGS Scientist on Science-Museum Board in Tampa, FL

By **Dennis Krohn**

Lisa Robbins, Chief Scientist of the U.S. Geological Survey (USGS)'s Center for Coastal and Watershed Studies in St. Petersburg, FL, was recently elected to the Board of Directors for the Museum of Sci-

ence and Industry (MOSI) in Tampa, FL. This science and technology center contains more than 210,000 square feet of exhibits and hands-on displays. Features include a hurricane simulator, a planetarium, and an

IMAX Dome theater. The museum hosts approximately 645,000 visitors per year. **Lisa** will help plan future exhibits, such as one on natural disasters scheduled for completion in 2005. ❁

Two New Scientists Join the Western Region Coastal and Marine Geology Team

The U.S. Geological Survey (USGS)'s Western Region Coastal and Marine Geology team welcomed the addition of two new scientists this fall: **Dan Hanes** in September and **Curt Storlazzi** in October. **Dan** is an oceanographer with extensive experience in coastal sedimentation processes; he has degrees from the University of California, San Diego (B.A.), and the Scripps Institution of Oceanography of the University of California, San Diego (M.S. and Ph.D.), where he worked with **Doug Inman** on the mechanics of flowing granular materials and sediment transport. **Dan** has been in academia since 1983 and a professor in the University of Florida's Coastal and Oceanographic Engineering Program since 1989.

Dan will be working on the Coastal Sediment Transport Modeling and CABRILLO (Southern California Bight Regional Investigations—Life, Land, Ocean) projects. **Dan** is

collaborating with **Guy Gelfenbaum**, **Peter Ruggerio**, and **Chris Sherwood** on issues pertaining to modeling the cross-shore transport of sand and the evolution of the shoreface profile. He is also working with **Dave Rubin** on sediment stratification resulting from sheet-flow processes. **Dan** is stationed at the Pacific Science Center in Santa Cruz, CA.

Curt is an oceanographer with experience in coastal and nearshore processes; he has degrees from the University of Delaware (B.S.) and the University of California, Santa Cruz (Ph.D.), where he worked on studies of El Niño's impacts on central California and sediment distribution and transport along rocky shorelines. **Curt** has more recently worked as a postdoctoral researcher at the USGS with **Mike Field**, studying coral-reef processes in the Hawaiian Islands, and at the University of California, Santa Cruz, where he was the lead oceanographer on the



Curt Storlazzi

Dan Hanes

Partnership for Interdisciplinary Study of Coastal Oceans (PISCO) Project.

Curt will be working on the Coral Reef and Central California Regional Synthesis projects. Initially, he will collaborate with **Mike Field** on investigating sedimentation and oceanographic processes on coral reefs and with **Marlene Noble** on synthesizing our present knowledge of central California's oceanographic regime. **Curt** is stationed at the Pacific Science Center in Santa Cruz, CA. ❁

Two USGS Coastal Scientists Named to Louisiana Coastal-Restoration Advisory Board

By Jeff Williams

The low-relief Mississippi River delta plain of Louisiana is undergoing the highest rates of barrier-island erosion (approximately 10 meters per year) and wetland loss (approximately 75 square kilometers per year) of any State in the Nation and, likely, any region in the world. Much of this erosion has resulted from natural processes, such as storms, subsidence, and sea-level rise and sediment starvation due to delta cycling by the Mississippi River. Increasingly over the past century, however, anthropogenic activities, such as oil and gas development, flood control, and navigation, are exacerbating land loss and increasing the risks of storm damage and flooding to south-central Louisiana, especially to such urban areas as New Orleans. In an effort to stem the rate of erosion and

restore the wetland ecosystem, a Federal-State partnership has produced a \$14-billion program plan that recommends massive barrier-island and wetland restoration and re-engineering of the Mississippi River.

Recognizing the critical need for coastal science to guide the restoration efforts, the Louisiana Department of Natural Resources' Office of Coastal Restoration and Management has recently formed the Louisiana Gulf Shoreline Restoration Advisory Board, composed of nine scientists and engineers. Two of the new science advisors are U.S. Geological Survey (USGS) scientists **Jeff Williams** (Woods Hole, MA) and **Abby Sallenger** (St. Petersburg, FL), who have distinguished careers in coastal research and nearly 40 years combined in studies of geologic framework

and storm effects in Louisiana. As part of the inaugural board meeting on November 20, 2002, in New Orleans, **Williams** and **Sallenger** participated in a workshop on coastal restoration attended by more than 60 people; they spoke, respectively, on the following topics:

- offshore sediment resources, using u-SEABED digital-map technology, for barrier restoration, and
- lidar (light detection and ranging) technology used to map barrier responses to storms, such as recent Tropical Storm Isidore and Hurricane Lilli.

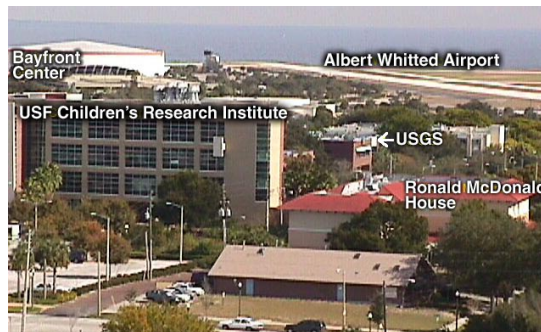
More information on Louisiana coastal restoration is available online at URLs <http://www.coast2050.gov/> and <http://www.lacoast.gov/>. ☼

USGS Employees Tour Neighboring Air Medical Transport Center

By Dennis Krohn

After years of watching the nearby helicopters land and take off, several employees from the U.S. Geological Survey (USGS)'s Center for Coastal and Watershed Studies (CCWS) in St. Petersburg, FL, got a chance to visit the Bayflite Operations Center. **Sandy Coffman**, **Dennis Krohn**, **Karen Morgan**, **Russ Peterson**, and **Dana Wiese** accepted the invitation of neighboring Bayfront Medical Center to take a tour of the facility on December 3. **Dawn Jones** led the tour and discussed the history of the hospital and the role of Bayflite in the region's emergency-room operations. **Pete Silvaggio**, Bayflite's communications supervisor, explained how the center is staffed and

how the BK-117 helicopters are deployed. The center has been operational since 1986 and has become so successful that local responders routinely refer to "Bayfliting" a



View of the USGS' Center for Coastal and Watershed Studies and other St. Petersburg, FL, landmarks from Bayflite's helipad. Tampa Bay is in background.

patient out. Fortunately, one of the helicopters had just landed, and so the group was able to walk out onto the helipad and view the rescue aircraft. **Bill Ratliff**, a paramedic on call, explained the medical procedures used during emergency evacuations. The day was picture perfect, and all enjoyed the view of our own small research facility from Bayflite's perch. For more information on the Bayflite Air Medical Transport, visit URL <http://www.bayflite.com/>. ☼



Bill Ratliff, paramedic for Bayflite, discusses emergency procedures from the back of one of Bayflite's rescue helicopters.

Programmer Guthrie Linck Improves the Marine Realms Information Bank

By Fausto Marincioni

The Marine Realms Information Bank (MRIB), the digital-library component of the U.S. Geological Survey (USGS)'s National Coastal and Marine Geology

Knowledge Bank, took a great leap forward after the arrival last June of its "supremo" programmer, **Guthrie Linck**. A 1999 Brown University graduate in computer sci-

ence, **Guthrie** has completely redesigned the programs composing the backend of the "Information Management System" mod-

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ule for the MRIB. His new design offers significant improvements in terms of both scalability and efficiency, with searches running approximately 75 percent faster than in previous versions. Further increases in speed will soon follow as parallel-pro-

cessing algorithms are implemented, taking advantage of the server's multiple processors. **Guthrie** also created a fiery new Keyword Search option, not available in previous versions of the MRIB. Finally, the "Browse a Map" feature now offers faster

map-generation routines, multiple-map projections, hemispherical views, shaded-relief maps, and more.

If you have not visited the MRIB recently, please take a look at the new features at URL <http://mrrib.usgs.gov/>. ☼

New Webmistress for the Western Region Coastal and Marine Geology Team

On November 4, the Coastal and Marine Geology team (CMG) in the Western Region was pleased to welcome **Laura Zink Torresan** as the new webmistress for the team's Web site (<http://walrus.wr.usgs.gov/>). **Laura** is no stranger to CMG, having been affiliated with the team since 1995.

Laura earned her undergraduate degree in geology from Middlebury College (VT) in 1989 and began her career with the U.S. Geological Survey (USGS) in 1990,

working for the now defunct Sedimentary Processes Branch. In 1995, she began work as a contractor for CMG; soon thereafter, she helped launch the "Access USGS—San Francisco Bay and Delta" Web site at URL <http://sfbay.wr.usgs.gov/>. During the 1997-98 El Niño season, **Laura** helped **Rex Sanders** set up a special El Niño Web server. She has provided GIS and graphic-illustration support for various team projects, with a special emphasis in recent years on Web-page creation and Web-site design.

Welcome, **Laura!** ☼



Laura and son Mario, on the 4th of July 2002.

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Sound Waves
U.S. Geological Survey
345 Middlefield Road, MS 999
Menlo Park, CA 94025

