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TWO YEARS AGO, HEINZ ENDOWMENTS OFFICIALS CHALLENGED THE PITTSBURGH VOYAGER PROGRAM TO UPDATE ITS FLEET OF FLOATING CLASSROOMS WITH A BOAT THAT USES CUTTING-EDGE, ENVIRONMENTAL TECHNOLOGY. THE NEW "GREEN" *EXPLORER* HAS MET THAT CHALLENGE AND EXPANDED THE PROGRAM'S MISSION, REFLECTED IN ITS NEW NAME: RIVERQUEST. BY MICHELLE PILECKI

# ROCKIN' THE BOAT

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elcome to the bottom of the food chain — and the sounds of science.

“Eee—uuuu! I got a rotifer that’s eating,” yells Nathan Ballentine, watching the digestive process under his microscope. “Cool!”

Some of his sixth-grade classmates from Colfax Upper Elementary School in the Pittsburgh suburb of Springdale leave their microscopes to jostle for a peek at Nathan’s zooplankton — a microscopic organism that feeds on algae and serves as food for tiny fish. They affirm Nathan’s assessment with an enthusiastic “That’s really cool!” Meanwhile, Nathan is checking a chart of common river plankton to identify his particular critter as “Brachionus.”

“Notice how the spinning hair — that’s called cilia — brings the food to its mouth,” explains Jennifer Robertson, an instructor in the Environmental Science on the Three Rivers program.

Earlier, the students had skimmed the Ohio River’s surface with a specialized conical net to collect their sample of microscopic beings. They would later switch from biology to chemistry and analyze the river water itself, donning safety glasses as they measured oxygen content, pH level (acidity) and turbidity (cloudiness).

Mixing chemicals and watching for precipitates and color changes requires more concentration. The sixth-graders are quietly methodical — which also helps them avoid being disturbed by the constant vibration under their feet.

These students are not in school. Their science classrooms and labs for the day are on board the aptly named *Discovery*, one of a three-boat fleet on which Pittsburghers can learn about their rivers while floating on the waterways. At the end of the session, Colfax’s young scientists gather with similar student groups to discuss their findings and to decide whether they have evidence to support their initial hypothesis: Pittsburgh’s rivers are healthy, but there’s room for improvement.





o time or inclination to doze off in this science class: Sixth-grade students from Colfax Upper Elementary School near Pittsburgh delve into studying tiny organisms and river water through the RiverQuest program. Above left, Joe Wysocki performs water quality tests. Rachael Carlberg and Destance Freeman, above right, pull on a rope attached to a dredging device called a "petite ponar" that's used to scoop up mud filled with microscopic and macroscopic invertebrates. Studying those organisms and others, such as the mayfly on the opposite page, helps determine the health of the river. Below, Charlie Guy studies plankton under a microscope as James Murray looks on. In the background, Nathan Ballentine peers over his classmates' shoulders while Justin Fetes uses another microscope for his observations.



That also could serve as a prognosis for what had been known as Pittsburgh Voyager, an education program once near extinction. But now, with support from The Heinz Endowments, state officials and the foundation community, it is healthier than ever and has a heightened dedication to environmental education and sustainability, epitomized by its new name, RiverQuest, and its new boat, *Explorer*.

Anchored on the principles of hands-on education, the rechristened RiverQuest program has taken more than 55,000 students through its river-science curriculum and thousands more visitors through informal “science-adventure” tours since 1995. The *Explorer*, a state-of-the-art, 150-passenger boat with an advanced propulsion system and “green” building design, brings not just more spacious classrooms and handicapped accessibility, but also another teaching tool. The environmentally sensitive building materials, novel biodiesel hybrid engine, alternative sources of energy and various 100-plus innovative systems “can be used as teaching materials,” notes Gerry Balbier, the Endowments’ senior Education Program officer and an early supporter.

The new 90-by-25-foot flagship vessel also is expected to steer RiverQuest into a future of fiscal and environmental sustainability, says Caren Glotfelty, director of the foundation’s Environment Program, which had staff heavily involved with this project. The boat will serve, Glotfelty adds, as “a poster child for new diesel propulsion systems” in the marine industry, which currently contributes as much as 30 percent of the diesel particulates in Pittsburgh’s air. *Explorer* uses only half as much energy as other boats its size and emits far fewer greenhouse gases and particulates that can threaten human health as well as the environment.

Eyed as a model for both “green marine” and river education, RiverQuest is growing beyond Pittsburgh and, possibly, even the tri-state area, says Karl Thomas, the organization’s executive director. “The new name is more portable, more appealing to the partners we’re building outside of Pittsburgh,” he says. “The boat can be an engine of economic development, a new platform for technological demonstration.”

There’s a lot riding on *Explorer*.



The project has grown in scope, mission and, not surprisingly, time and cost. Its construction involved five design contractors, dozens of contributing companies and foundations, 14 months of building time, \$2 million more than first envisioned and many, many challenges.

One of the biggest of these came from the Endowments. In 2004, program officials knew a new boat was needed and approached the foundation with a design for a \$1.6 million vessel. The Endowments responded with a challenge and \$1 million in lead funding.

“[Endowments President] Maxwell King said, ‘Do something that’s never been done before,’” recalls Howard “Chip” Berger, president of RiverQuest’s board of directors and one of the original founders.

“Heinz wanted something more cutting-edge than a conventional propulsion system with ‘green’ cabinetry,” Thomas adds. “Every system had to be recalculated from the original bid specs.”

Major Challenge No. 2 was that nobody really knew what a “green” boat was. There were — and still are — no official standards. Peter Niederberger, RiverQuest’s director of strategic planning, coordinated the project with a marine designer and shipbuilders based in Florida, and a “green team” of local professionals well versed in the LEED — Leadership in Energy and Environmental Design — standards of the U.S. Green Building Council, a coalition of builders, architects, government agencies and nonprofit groups. The boating people knew nothing about green standards; the “green” experts knew nothing about boats.

Creating “green marine” means “everything is ‘take a look and make it better,’” says naval architect Andy Lebet of DeJong and Lebet Inc. in Jacksonville, Fla. That included using paints and coatings with fewer volatile organic compounds, which are carcinogenic.

It also meant researching other construction materials, a task that fell to Pittsburgh green consultant Gary Moshier. “For example, [Freeport Shipbuilding will] ask if it’s okay to use a certain type of tape,” he explains. “I contact the manufacturer and pick apart the process of the product.” If he couldn’t find

**R**iverQuest's new flag ship, the 90-by-25-foot *Explorer*, is an impressive vessel with state-of-the-art design. Shown on the opposite page are the mast, above left; the ship's helm, above center; and the boat's two levels above right, that can accommodate 150 passengers. Program officials expect *Explorer* to serve more than 10,000 students a year while providing a practical model for sustainable boating technology worldwide. The "RiverQuest" and "Explorer" names, along with the Web site address, were digitally added to the photographs, which were taken before the words were placed on the boat as shown.

a totally green product that met marine specifications, he found the "least harmful" substitute.

In designing the interior, architect Scott Fitzgerald of the downtown Pittsburgh office of Perkins Eastman chose eco-friendly materials such as Woodstalk, a particle board made of wheat chaff; Trespa tiles of recycled plastic; and Shaw carpet of recycled nylon yarns. None of them "off gas," meaning that they don't emit carcinogenic compounds.

Fitzgerald couldn't use drywall because of Coast Guard concerns about mold buildup, but he could make recommendations about improving the "mechanicals," such as the heating, ventilation and air-conditioning system. He suggested the lightweight DuctSox, canvas ductwork — also used in the city's David L. Lawrence Convention Center — that provides a decorative touch and is easy to launder. Marine designers already have a good handle on efficient plumbing, but *Explorer* goes a step further with waterless urinals and low-flush toilets that use river water.

More difficult to translate from architectural to marine use were the windows. A typical boat window is a single pane, which allows heat to leak out. *Explorer* has energy-efficient windows, and the Lebet firm worked with the extra weight created by the double-paned insulated glass. But the big problem was fit, says RiverQuest's Niederberger, displaying the 11 pages of 473 tasks involved with the windows alone. Marine windows have to be perfectly flush and the flanges perfectly aligned, he explains.

"On a building, things are straight and square," adds John Bond, a Navy veteran

and long-time marine designer. "There's nothing particularly straight and square on a boat, especially on a steel boat, which flexes."

But the main factor that extended the project's time, cost and innovation was the radically new hybrid diesel-electric propulsion system, which can run for about an hour on electricity from battery banks that are then recharged by a diesel-powered generator.

This means that there is no dedicated diesel engine working to turn a propeller shaft, which enables *Explorer* to have more operational flexibility and lower toxic emissions, explains Tom Risley, vice president and manager of marine and industrial operations for Alion Science and Technology Corp., a national defense contractor. The onboard generator runs on biodiesel fuel, which is 80 percent diesel and 20 percent vegetable oil — the so-called "French fry oil."

Those batteries also could be recharged by other sources of energy, and Risley notes that the propulsion system can be retrofitted with new technologies as they become available: perhaps a fuel cell that uses hydrogen, proton exchange membrane or solid oxide. Another possibility is to add renewable-energy generators at the boats' land-side staging area now under construction. RiverQuest recently received a state Energy Harvest Grant, which will help cover the cost of outfitting

*Explorer's* roof and the land-side facility with solar panels that could be used to recharge the boat's batteries. Thomas says funding will be sought in the future for wind turbines and a demonstration mini-hydroelectric system "so we can generate our own power and sell any excess back to the grid."







Photography by Kathryn Romen

# EXPLORER SPECS

## Dimensions

Length Overall: 90' 6"  
Length on Deck: 89' 0"  
Beam (molded): 26' 0"  
Depth (molded hull): 10' 0"  
Draft, Full Load: 5' 6"  
Draft, Mean Normal: 5' 0"

## Operating

Maximum Air Draft: 40' above baseline  
Gross Tonnage: Less than 100

## Passengers and Crew

Passengers: 150  
Crew: 20

## Certifications

Route: Protected Waters  
U.S. Coast Guard  
Classification: Subchapter T

## Capacities

Fuel Storage Capacity: 2,000 Gallons  
Potable Water Capacity: 1,800 Gallons  
Black Water Capacity: 1,400 Gallons  
Dirty Lube Oil Capacity: 200 Gallons

## Materials

Hull: 100% recycled steel  
Railing system: Anodized aluminum  
Custom cabinetry: Wheatboard

## Major Systems

Propulsion System:  
ELFA™, Siemens Hybrid Marine  
Marine Paint System: Sherwin-Williams  
Window System: TRACO® NX-200

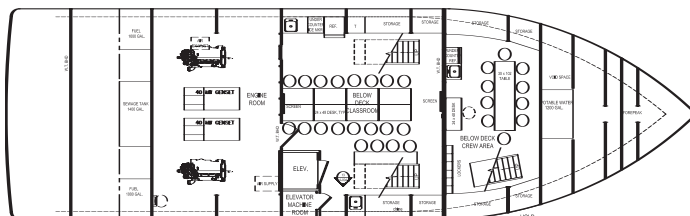
The *Explorer's* lightweight canvas ventilation ducts are part of the DuctSox system and have holes that enable air to be distributed evenly through the boat.



The ship's hull is made of 100 percent recycled steel and has exterior coatings with low "volatile organic compounds."



Cabinets are made from wheat board, one of the renewable materials used for the boat that was new to builders and the industry.





Custom-made, energy-efficient windows replace marine windows – for the same price.



*Explorer's* environmentally friendly air conditioning compressor has a smaller than usual size for a boat.

Highly efficient light systems include fiber optic illuminators like this one, which can deliver 50-watt power to eight lights.



Waterless urinals provide water efficiency without discharging wastewater.

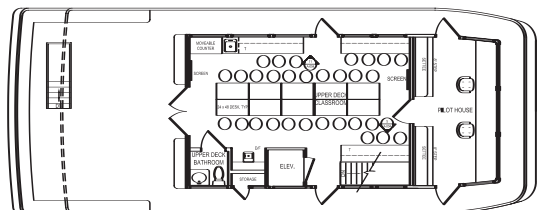
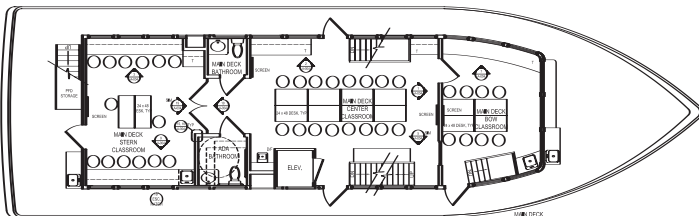


Carpet aboard *Explorer* is made from environmentally acceptable materials.



At the heart of *Explorer's* unique design is the hybrid diesel-electric propulsion system, which includes a variable-speed, diesel-powered generator, (shown left); battery banks housed in enclosures ventilated by explosion-proof fans, (center); and propulsion motors powered by electricity from the battery banks, (right).

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OUTBOARD PROFILE PORT





RiverQuest Executive Director Karl Thomas holds up a placard with the organization's new name, which was announced in September. In the background is Howard "Chip" Berger, president of RiverQuest's board of directors. Shown to the right is a jar of biodiesel fuel, which is 80 percent diesel and 20 percent vegetable oil.



The ultra-efficient propulsion system, built by Siemens Automation and Drives Group, is so innovative that Risley calls it “bleeding-edge technology.” A key factor in the date for *Explorer’s* arrival in Pittsburgh getting pushed back from spring to summer to December was that the U.S. Coast Guard and other regulatory bodies were not familiar with any of these new materials and mechanisms, Risley explains. So they had to spend more time examining everything to make sure it worked correctly.

The now—\$3.4 million boat, with its \$1 million propulsion system, sets a new standard in both marine and green technologies. “In terms of this design for this purpose, there may not be another one like this in the world,” says the Endowments’ Balbier. “Not many people realize that the Pittsburgh region has more than 27,000 boats on the rivers. We believe that this boat’s propulsion systems will have a major impact on the national boating industry as a model for what can be accomplished in reducing pollution and increasing efficiency.”

In giving his own explanation of the delays, Balbier compares building *Explorer* to the experience of a homeowner who has gone through a construction project and finds out that it takes longer and costs more than expected. Endowments’ support continued because staff members believed in the project — and the program.

The Endowments was among the first funders of the original Pittsburgh *Voyager* in 1993, well before it welcomed its first student group — seventh-graders from the South Fayette Township School District on April 25, 1995 — and has contributed a total of \$2.1 million from its Education and Environment programs. Balbier, who admits an emotional connection to what was his first grant as a program officer, has been working with the organization since its grassroots beginning.

“It’s such a Pittsburgh story,” recalls RiverQuest board chairman Berger. A group of parents met in 1991 to discuss their concern about students lagging in math and science. Participants included Navy veterans and folks who had seen river-education programs elsewhere, and the idea of Pittsburgh’s own floating classroom/laboratory was launched. The Pittsburgh Foundation was the first to help, Berger recalls, and the Endowments soon

stepped in with both money and expertise.

With state funding support, a committee wrote the program’s curriculum on environmental science. Board member and Navy vet Dick Martin talked to the U.S. Navy Community Service Program and the Federal Surplus Bureau about donating a boat — then two boats, each able to accommodate 30 students. The vessels, renamed *Voyager* and *Discovery*, had been built in 1958 as yard patrol boats for training midshipmen and junior officers.

In 1994, the Navy took the ships to New Orleans via the Panama Canal. *Voyager* was towed up the Mississippi and Ohio rivers to undergo 18 months of repairs and renovations at the U.S. Army Corps of Engineers’ Neville Island facility near Pittsburgh. *Discovery*, after similar work in the Crescent City, came to Pittsburgh in 1996 under its own power via the Tennessee Tombigbee Waterway and the Ohio River. The 80-foot, 70-ton vessels were joined in 1999 by a 44-foot houseboat renamed *Scout* that could cruise shallower waters upriver and offer community-based educational activities outside of Pittsburgh. The smaller boat also hosts shorter, informal programs that are largely designed for youngsters, but also interest many adults.

As the selection of science-adventure tours expanded, the formal environmental science program was upgraded. Changes included the addition of “Boats, Bridges and Water,” which applies math and physics, among other disciplines, to the environment exploration. Teachers are invited to a two-day training session and get a “trunkload of materials” to take back to their schools so they can prepare their students, explains education director Jeff Jordan. The river trek by the Colfax sixth-graders, for example, was the culmination of six weeks of preparation, says teacher Cathy Restauri.

Connecting concern for the environment with science and mathematics attracts the Endowments’ involvement through both its Education and Environment programs, says Balbier. “It’s an opportunity for us to get Pittsburghers back on the rivers, and not just on party boats and ferries to the sports facilities. The program also helps create a sense of ownership and connection to the rivers and promotes good stewardship.”

Pittsburgh *Voyager* was doing well by the Endowments’ benchmarks throughout the 1990s: an active board; an excellent



executive director, who was Beth O’Toole at that time; and a fee income growing nicely from 10 to 30 percent.

But the old wooden boats needed expensive maintenance, and costs spiked with dry-docking. A one-time hit could be from \$50,000 to \$100,000.

Disaster was looming early in the new century, RiverQuest chairman Berger recalls. “We had a great curriculum, but we weren’t growing and costs kept going up. We realized we had to keep innovating or get absorbed by some other entity to survive.” A new and bigger boat suited to river water — which the wooden boats are not — would not only lower maintenance costs but also, by accommodating three times as many students per trip, raise the fee-income stream back to healthy levels.

*Explorer*, with its stylishly marine blue-and-green interior, soon-to-come large video screens and improved computer access, also can moonlight for charters as a corporate meeting room and other functions. Thomas says RiverQuest’s business plan projects an increase of fee income from its current 20 percent to 50 percent in the next three years. “We’re rethinking the organization with the new boat coming. A lot of us see the boat as a new vehicle for change.”

A number of those changes are still in the planning stage, but they focus on many partnerships — strengthening old ones and building new ones, not only in southwestern Pennsylvania but also throughout the United States and internationally.

Thomas will travel to Brussels in late November to represent the Pittsburgh non-government organization, or NGO, community at the Worldwide Convening of the Alcoa Foundation’s Conservation & Sustainability Fellowship Program on multi-disciplinary research. In the spring, he will go to Catalina Island, where he will be working to build a relationship with oceanographer Jean-Michel Cousteau and his Ocean Futures Society. The international environmental organization is looking to add a river-based program to its Ambassadors of the Environment program for young people, says Thomas. Planned as a multi-day “souped-up summer camp” that includes touring and

studying the Allegheny River, the new collaboration between RiverQuest and the Cousteau group could start as early as next summer. Longer trips on *Explorer* to other

cities, even down the Mississippi or “Tennessee Tom” to the Gulf of Mexico, are possibilities.

RiverQuest also is working with Thomas’ alma mater, Carnegie Mellon University, and its new venture studying local rivers called Water Quality in Urban Environmental Systems. The partnership will “develop the cyber-infrastructure necessary for the new boat to collect and transmit real-time water quality data... for research, education and ultimately, to inform policy decisions in the region,” says Water-QUEST co-director Jeanne M. VanBriesen, an associate civil and environmental engineering professor and a Paul and Norene Christiano Faculty Fellow. Instruments attached to *Explorer* will enable the team to examine water quality changes in response to specific events such as a storm or spill.

And one of RiverQuest’s oldest partnerships is expanding to bring even more of the public on board. The program’s boats have long been docked at the Carnegie Science Center, which now may include *Explorer* river tours among its offerings to visitors as both organizations grow, says director Jo Haas. “Part of the science center’s long-range plan is a major river-based center, collaborating with other educational, advocacy and research groups with interest in the environment.”

RiverQuest will continue to partner with those groups, which include the Riverlife Task Force; the Green Building Alliance; the Rachel Carson Institute; and Friends of the Riverfront, where Thomas served as interim director before coming to RiverQuest. The organization also will maintain and build on relationships with Pittsburgh History & Landmarks Foundation and local chambers of commerce, tourism bureaus and economic development agencies, he says.

It’s an interconnectedness that’s reflected in the way Thomas refers not to “rivers,” but always simply “the river” and, similarly, “the ocean.”

“I see one ocean, one river,” the southern California native and former Navy officer explains. “When you’re out on the water, wherever you are, you’re connected to that piece of water, which is connected to all the water on the planet.” *h*