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### **Architecture Working for the Environment: *The Learning Barge***

The Learning Barge initiative is a unique example of integrating professionals and community partners into the academy in order to create an environmentally conscientious, built project with positive, wide-reaching social and educational implications. This multi-semester, interdisciplinary project to design and build the Learning Barge, a floating, self-sustaining field station, would be impossible to achieve without an innovative structure that unites teaching and practice. Several professionals, including architects, engineers, naval architects, ecologists, teachers and others have contributed their expertise and efforts throughout the process, working closely with students to help them understand the innovations and complexities in professional practice.

Located on the most polluted tributary of the Chesapeake Bay, the Learning Barge will provide interactive K-12 and adult education about how the river ecology and human activities are inextricably linked. Unlike environmental education centers located in pristine "nature," the Barge will traverse an important urban river and major world port. Moving to a different river restoration site every few months, the Learning Barge will teach participants about the tidal estuary ecosystem, wetland and oyster restoration and remediation efforts, as well as sustainable power generation, rainwater harvesting and other green building technologies. The project is been designed to teach through example by harnessing energy from sun and wind, filtering rainwater and gray water in a contained bed wetland, and utilizing recycled materials and "green" technologies.

The University has partnered with The Elizabeth River Project, Chesapeake Bay Foundation, NOAA and three school districts for project and curriculum development and operations. The Use Plan estimates that this semi-nomadic field station will touch the lives of more than 19,000 people each year via school field trips, university research, teacher training, and public workshops and events. By actively engaging students in the Elizabeth's cultural and environmental ecologies, the Learning Barge will encourage environmental stewardship and create a significant national model for education about urban habitat restoration and sustainable architecture. Funded by the Environmental Protection Agency, Virginia Environmental Endowment, and Public Service Fellowship Program, the Learning Barge was awarded the 2006 National Student Collaborative Design Award from the American Institute of Landscape Architects.

The Learning Barge initiative represents the future of architecture towards greater synthesis with environment and ecology—achieved through intertwined phases of research and design, and an integrated way of working across scales: from watershed, to district, to detailed architecture. While demonstrating the didactic value of architecture for public environmental education, the project establishes a proactive model of both service-learning and professional engagement in the academy.

*"If the children are untaught, their ignorance and vices will in future life cost us much dearer in their consequences than it would have done in their correction by a good education." –Thomas Jefferson, 1818*

## **Architecture Working for the Environment: *The Learning Barge***

Architecture is assumed to have the power to radically transform the built environment when architects are committed to "building community" and promoting the public good. Though most architects champion these noble goals, their dedication requires the joint commitment of clients, future inhabitants and governmental agencies. Often architecture students are not adequately informed about the opportunities and complexities of practicing their discipline. New forms of pedagogy, practice, and research are necessary to promote positive change and creative collaboration. The Learning Barge initiative is a unique example of integrating professionals and community partners into the academy in order to create an environmentally conscientious, built project with positive, wide-reaching social and educational implications. This multi-semester, interdisciplinary project to design and build a floating, self-sustaining field station would be impossible to achieve without an innovative structure that unites teaching and practice. Gerald McCarthy, Director of the Virginia Environmental Endowment, described the project as "exactly the kind of scholarship and research that makes beneficial change happen in the real world. Students learn, faculty develop, and communities benefit." While establishing a proactive model of both service-learning and professional engagement in the academy, the project demonstrates the didactic value of architecture to public environmental education.

### **synopsis.**

Located on the most polluted tributary of the Chesapeake Bay, the *Learning Barge* will provide interactive K-12 and adult education about how the river and human activities are inextricably linked. Unlike environmental education centers located in pristine "nature," the Learning Barge will traverse an important urban river and major world port. Moving to a different river restoration site every few months, the *Learning Barge* will teach participants about the tidal estuary ecosystem, wetland and oyster restoration and remediation efforts. The Elizabeth River Project, in partnership with the Chesapeake Bay Foundation, NOAA and three public school districts, will operate the Learning Barge for environmental research, education and public outreach primarily to economically and socially disadvantaged children. The design harnesses energy from sun and wind, filters rainwater and gray water in a contained bed wetland, and utilizes recycled materials and "green" technologies. The Learning Barge has been carefully designed to directly teach visitors about power generation, water collection and filtration utilizing native plants. The project was awarded the 2006 National Student Collaborative Design Award from the American Institute of Landscape Architects.

**service-learning.**

The School of Architecture has embarked upon an ambitious series of service learning projects that rebuild and foster communities, utilize sustainable technologies, and examine how buildings respond and interact with people and the land. Studios research, explore and implement design ideas over the course of multiple semesters, while working with peers in fellow disciplines to prepare for future interactions in the professional world. Students learn directly from professional architects, engineers, ecologists, teachers, contractors, and fabricators in the studio and in the field. The service learning projects completed thus far are a physical manifestation of the School's collective voice of research, design, and experience. School initiatives include community planning and environmental restoration, affordable green modular housing, Gulf Coast rebuilding efforts, and issues of historic preservation and the accessibility needs of an aging population. These projects have resulted from partnerships between students within the Schools of Architecture, Engineering and Applied Sciences, Environmental Science and Education, practicing architects and other professionals, Habitat for Humanity and local affordable housing alliances, and environmental non-profits.

**partner.**

Continuing this program, the Learning Barge was born out of research into the concept of *Sites Out of Mind*—those residual spaces and disenfranchised populations rarely addressed by architects. The Elizabeth River and her shores is such a site. One of the most polluted waterways on the Eastern Seaboard, this tributary of the Chesapeake Bay stitches together the cities of Norfolk, Portsmouth, Chesapeake, and Virginia Beach. The Elizabeth River Project (ERP), a grass-roots environmental non-profit, is attempting to clean and restore the urban tidal estuary. A partnership with the ERP was forged and the Learning Barge was conceived as an educational outreach project that would allow the community to better understand how the river functions as an industrial, social, and ecological unit. This traveling classroom will educate children and adults about the ERP's remediation, wetland and oyster reef restoration, and revitalization efforts while reinforcing the concept that local human settlement and industrial activity has ecological ramifications on the greater Chesapeake Watershed and the Ocean itself.

**learn.**

The Learning Barge will be a river-based observation station and working platform that serves a two-fold program: bringing people to view and help with important remediation and restoration work, and providing the inimitable experience of river occupation to local residents who otherwise would not have the opportunity to better understand the systems and functions of the watershed in which they live. An observation point could not be established on the land since the waterfront property is commercially owned and is heavily protected under the Department of Homeland Security. The river, however, lies within the public domain. The Barge will

move among four designated superfund sites and other areas of ecological and curricular interest, as a highly visible, long-term fixture of the Elizabeth River. As perfectly stated by the ERP, the Barge will evolve and educate, 'one creek at a time'.

### **restore.**

Because the Elizabeth River is technically not a river but a tidal estuary, the problems of waterborne pollutants are amplified. The low flush-rate of the estuary means that toxins do not leave the vicinity until they degrade, which in some cases may take centuries. For this reason the river bottom is highly contaminated. The studio's GIS mapping revealed that the vast majority of contemporary pollutants are smokestack emissions that settle onto the land. Surface water takes contaminants directly back into the estuary, thereby making runoff the largest pollution concern for this watershed that is in one of the largest metropolitan areas in Virginia, with high congestion rates and vast paved area. This is the very reason that the Barge is so incredibly important; people need to know the implications of the way we/they live. It is important to note that neither the ERP nor the Learning Barge team demonize industry, but understand it as a necessary part of a healthy economy and a healthy society in this area. As collective and responsible architects and citizens of the watershed we must ask, how do we enable people to continue to live and thrive within in this industrialized context? The Barge will link natural systems within the local ecology and its integrated engineered systems in order to efficiently function in a sustainable way, and educate visitors in the process.

### **interact.**

Many professionals have donated their expertise and time throughout the three-semester process, working closely with students to help them understand the innovations and complexities in professional practice. For instance, Architect Michael Petrus (Crisman+Petrus Architects) was a weekly participant in the Intention>Fabrication Technology Seminar (Fall 06), which focused on design development and detailing of the classroom envelope. Structural engineer Dennis Moler (Moler & Associates) collaborated on the design of the classroom's steel structure. Naval Architect Eric Matherne (Matherne Marine Design) provided invaluable maritime code and construction advice. He is completing construction documents for the barge hull, which will utilize CAD/CAM fabrication of all components. Students learned about state-of-the-art automated cutting and welding processes while visiting the Norfolk shipyard that will fabricate the hull and steel structure.

### **sustain.**

The Learning Barge is fully off-the-grid and has no singular site; the entire river is our site. The Barge will utilize mechanical, electrical and plumbing systems to replicate the self-cleansing properties of the natural ecology that it educates about and operates on. In a healthy wetland the plants remove contaminants and

make the water habitable for microorganisms that begin the food chain. In order to perform off-the-grid and prevent further damage to local ecology, the Learning Barge will be equipped with several generative and sustaining technologies. MEP systems were developed with Mechanical Engineer Robert Crowell (EEA Consulting Engineers) and Electrical Engineering Professor Paxton Marshall and his students from the School of Engineering and Applied Sciences at the University. A photovoltaic array and wind turbines will produce electricity. A solar hot water array will heat the radiant flooring system. Multiple water-saving and filtration devices will be employed on the Barge. Rainwater will be collected and filtered for hand-washing, composting toilets will eliminate waste while creating soil for plantings, and on-board filtration basins will use native plants to clean graywater. River water will be hand-pumped into a separate set of basins where native wetland plants will purify the captured water for release back into the estuary. Ecologist Ed Morgereth (Biohabitats, Inc.) and NOAA Wetlands Specialist Walter Priest advised students on the fresh and saltwater systems.

#### **recycle.**

As a final effort of sustainable thinking, we minimized the use of new materials and use donated and recycled material from local fabrication facilities and scrap-yards whenever possible. This represents our consideration of the new field of Life-Cycle Analysis (LCA) that the School of Architecture is pursuing in a number of ways in all design departments. All of these design decisions are integrated with the educational program of the Barge. An important agenda for all of the professionals and students involved was to explore the true meaning of 'sustainable'. If the designers of the built environment only seek to lessen the degree of harm thrust upon the planet then the situation will never improve, but only do less damage; this is not sustainable. The Barge will actually leave the river-based sites cleaner than when it arrived.

#### **educate.**

The educational mission of the Barge is its primary focus. The Use Plan estimates that the Learning Barge will touch the lives of more than 19,000 people each year via school field trips, university research activities, teacher training, adult workshops, and public events. This semi-nomadic field station and its curriculum will take advantage of the unique qualities of the particular docking site, as well as the student grade level. The Middle and High School curriculum will address issues relevant to the science portion of the Standards of Learning, such as living systems and life processes, resource management and conservation, energy, habitats, data collection, and weather. Additionally, the Barge will be utilized as a site for students to develop skills in writing, drawing, and mapping. Students will be literally surrounded by the landscape of their curriculum. PhD candidates in the School of Education helped architecture students to envision scenarios for several days of onboard activities, thereby concretizing the range of opportunities afforded by the architecture, season, location and the age of visitors. Funded by a Virginia Environmental Endowment grant secured by the

Architecture Professor directing the project, six teachers and three science coordinators from three public school districts along the Elizabeth River are developing the architecture students' initial curriculum ideas into a specific and realizable curriculum. The Barge will serve as a crucial instrument in creating responsible, future citizens and stewards of the land, by cultivating the education of conservation and recognition of how our actions impact the environments that we occupy.

**fund.**

We have been awarded grants from the Environmental Protection Agency (EPA), Virginia Environmental Endowment, and Public Service Fellowship Program. If additional funds are secured, the prefabricated classroom components will be built this year at the University and transported to the shipyard for installation on the Barge. Any monies awarded will pay for building and educational materials to make the intertwined architecture and educational program a reality.

**inform.**

Students have documented the multi-semester process in order to produce a publication that disseminates the Learning Barge's agenda of public education, sustainable architecture and urbanism to the profession and the general public. The public's understanding of the goals and benefits of "green design" are central to the success of the project as well as the greater prominence of sustainable design in our communities.

**academy + profession.**

The Learning Barge represents the future of architecture towards greater synthesis with environment and ecology. Both the process and design pushes this agenda to show the way; not unlike Verne's Nautilus foretold of now real technologies in a time when they seemed fantastical and beyond belief. The Learning Barge stands as a model for how we as architects and architecture students must approach the tasks before us. The process of building should be actualized through the lenses of researching, imagining, and designing. Additionally, the project demonstrates a synthetic and integrated way of working across scales – from watershed, to district, to detailed architecture that soon will reshape environmental education for the entire Hampton Roads region. This is only possible by creating a new type of unified academic and professional practice that identifies problematic issues, especially in underserved places and with disadvantaged populations, and offers unimagined alternatives.

Our partnerships with professionals, educators and environmental organizations have been inspiring and productive, as noted by the Director of the ERP: "In the fifteen years since the inception of The Elizabeth River Project, no academic professional has provided more useful, more cutting-edge or more committed

interact connect, research, design, sustain, recycle, educate, inspire remediate, restore practice, build

technical support for our restoration efforts. In the last two years, her research has led to powerful results on our urban waterfront.” By actively engaging students in the Elizabeth’s cultural and environmental ecologies, the Learning Barge will encourage environmental stewardship and create a significant national model for education about urban habitat restoration and sustainable architecture.

A convergence of recent societal trends has placed architecture in a powerful position to influence positive change through design insight—an insight that must be fostered in the academy and practiced! Greater public concern for the environment and sustainability creates a favorable situation for design innovation and the architect’s role as advocate. Architects must meet the challenge with creativity and technical expertise. Architects’ skill in creative vision and visual communication position them well in the increasingly image-based media society. To this end, architectural education must promote insight and the practical ability to make visions real. Engaging professionals in the academy is clearly an excellent way to start.