Inside Out

Atlantis

An Underwater Habitat in a Classroom

by Kevin Hardy
with Robert Richards

When I was in middle school, the image of living and working in the sea by the US Navy SeaLab Aquanauts and Cousteau's ConShelf Oceanauts was so compelling that I had to see if I could do a smaller but similar project. Though scaled down, the physics were the same, and the cost was nothing. I started with an old aquarium tank and air pump, a glass jelly jar, and some sprout seeds. It worked, the undersea garden thrived, and I realized this was something I could really do. My interest in ocean engineering was galvanized by their example, and I later went on to work a full career at the Scripps Institution of Oceanography/UCSD. [Editor's Note: see Q&A column to learn more about Kevin Hardy.]

I repeated the underwater terrarium project with my own children when they were in Grade 5. I broke the project into its component pieces, and each became the subject of a class. We put the pieces back together at the end of the school year and built the underwater habitat. With experience came confidence, and we took the next logical step of placing a mouse in a larger habitat below water for five days. The *MouseHouse* was a very engaging project that taught calculated risk, risk management, engineering principles of mechanical and electrical design, physiology, life support systems, and critical back-up systems the students still recall today. We used indoor-outdoor thermometers to measure temperature inside the habitat, in the room, and compared that with water temperature. We placed a microphone inside to listen, had back-up air pumps, even one that ran on batteries that would turn on in the event of a power outage. It was an extraordinary experience for the students, who were totally engaged. No animals were ever harmed, achieving our prime goal. Some of the students grew up to become engineers.

I later revisited the underwater terrarium with my two nieces. We called it *Atlantis*. *Atlantis* places terrestrial plant life in a submerged terrarium for a week's duration. An upside down jelly jar holds the air in and the water out, all-thread legs connect to a metal plate loaded with lead tire weights hidden below the sand, an aquarium air pump pushes fresh air in, while excess air bubbles out through a second straw tube on the opposite side. Students studied whether sprouts grew better with the slightly higher pressure. They also added food colouring to dye the water, seeing how filtering portions of the light spectrum affected the growth of the sprouts. Other science and engineering inquiry-based projects were done. Detailed project notes are included in the course guide "Atlantis: The Lost Island" and "MouseHouse," found online at www.globaloceandesign.com.

I met Bob Richards serendipitously in St. John's, NL, at the recent Oceans 2014 conference. Bob Richards is the Robotics Instructor at Stockbridge High School in Stockbridge, Michigan. In 2012 his Advanced Underwater Robotics class was presented with the epic opportunity to build and operate an ROV to locate and record images of downed

World War II aircraft off Palau. [Editor's Note: read the essay *Expedition to Palau* in this issue.] This year Richards' students will participate in the "MarineLab/PADI Aquanaut Specialty Program" living below the surface of MarineLab's Lagoon in Key Largo, Florida. The students will spend 24 hours undersea working in the MarineLab Undersea Laboratory and the Jules Undersea Lodge.

The conversation led to sharing and developing this lesson plan with Richards in preparation for the students' life below the sea. The students will also bring along their updated ROV and operate it from inside the habitat, using it to explore the reefs around the habitat. The images from the ROV and inside the habitat will be webcast live back to their school and others.

Richards plans to implement the "Atlantis: An Underwater Habitat in a Classroom" curriculum with high school and elementary school students in Stockbridge. His high school students will work with the elementary students to build the Atlantis underwater habitat before heading to the MarineLab Undersea Laboratory in February 2015. In addition to all the great STEM lessons learned while engaged in the project, we hope to make the high school students' robotics telepresence project relevant and understandable for the elementary students.

Other schools interested in participating should contact Bob Richards at richardr@panthernet.net and they can follow along on Facebook at www.facebook.com/StockbridgeRobotics.

(This article is written in loving memory of Capt. Walter Mazzone, Project Manager, US Navy SeaLab Program.)

Kevin Hardy is founder of Global Ocean Design based in San Diego, CA. Robert (Bob) Richards is the Robotics Instructor at Stockbridge High School in Michigan.

Florida International University's Aquarius underwater habitat located in the Florida Keys National Marine Sanctuary.

A young aquanaut peers through the aquarium wall to see her Atlantis undersea habitat.

The Jules Undersea Lodge, a true saturation underwater habitat in Key Largo, FL, will be home to Michigan's Stockbridge High School robotics class.