

Underwater Robotics Applied To STEM Education: A Time-Sensitive Discovery In Marine Archeology



Mark Patterson¹, David Niebuhr², Jennifer Elliott¹

¹Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA (mrp@vims.edu)

²Watermen's Museum, Yorktown, VA (dniebuhr@watermens.org)

Overview

- Put commercial underwater robots into student hands
- Have them gather data over historical shipwrecks
- Teach them real field robotics including operations
- Archeology, history, math, marine science sneak in



Deliverables



Sinking of HMS Charon during Battle of Yorktown

- Driving Seabotix ROV over wreck of the HMS Betsy
- Programming Fetch AUV for autonomous missions
- Gathering environmental data over wrecks
- Lessons on Battle of Yorktown, ROVs and AUVs, Navigation,
 Marine Science of the Chesapeake Bay
- Web resources for others interested in trying our approach



Tending the umbilical to the ROV requires concentration and skill

Approach to our Audience

- Middle to high school students from a demographic crosssection of Hampton Roads
- Pre-field trip exposure to history and technology
- · Hands-on field lessons, with assigned roles within a team
- Impromptu inquiries from Yorktown tourists an unexpected but welcome "value added"
- Presentations to schools, local media, AUVSI Unmanned
 Systems (7,000 attendees 8/12), OCEANS 2012 (2,500 attendees 10/12)
- www.vims.edu/research/units/projects/cornwallis/index.php



ROV image of encrusting organisms on debris field near HMS Betsy

Driving the ROV into the shipwreck area and catching a first exciting glimpse of the past



Students reverse engineer the system diagram of the ROV

NSF Cornwallis Shipwrecks ROV Bottom Currents Date: Operator: Observer: 1. Draw arrow for ROV heading when current is going past camera at right angles 2. Draw current direction arrow 90 degrees to right or left of ROV arrow. (If current is from left to right on camera, then arrow will 90 degrees clockwise around compass rose.) Compass Rose NNW 337.5 NNW 337.5

valuable information for shipwreck monitoring and conservation

Student-collected data on currents over the wreck provide

Impacts and Indicators

- Intense interest in operating robot
- Inquiries about tech careers in marine robotics
- Students problem-solve when things go wrong
- Interest in how sensors really work
- Very positive teacher feedback
- GA Tech will visit with their ROV, and study our approach
- Partnering with National Park Service to reach 500,000 annual visitors to Yorktown
- Formal evaluation spring 2012



Having installed the sonar and GPS, students conduct a pre-launch test of the free-swimming AUV

Challenges

- Visibility, weather, hydroids can cause problems
- Less exciting parts of field robotics (safety observer, umbilical tender) require student focus
- Providing continuity of the experience as it unfolds from week to week
- Teaching field robotics to K12 students at a graduate level

Thanks to the NSF, Friends of the Watermen's Museum, Commonwealth of Virginia Equipment Trust Fund, the National Park Service, Dr. John Broadwater, Stephen Elliott (LT USCG), Dr. Romuald Lipcius, Dr. David Malmquist, Ms. Sara Williams, and our K12 field robotics teams.

