

SARAH E. WEBSTER

CONTACT INFORMATION

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RESEARCH INTERESTS

Navigation of underwater vehicles; decentralized estimation; distributed sensor networks; scalable navigation algorithms for multiple robotic vehicles.

EDUCATION

Johns Hopkins University

M.S. Mechanical Engineering

2004-2007

Ph.D. Mechanical Engineering

2007-2010

Thesis: *Decentralized Single-Beacon Acoustic Navigation: Combined Communication and Navigation for Underwater Vehicles*

Baltimore, MD

Advisor: Professor Louis L. Whitcomb, Johns Hopkins University

Co-Advisor: Professor Ryan M. Eustice, University of Michigan

Massachusetts Institute of Technology

1995-2000

B.S. Mechanical Engineering

Cambridge, MA

Sea Education Association

1997

SEA Semester Class W-150

Woods Hole, MA

Semester-long oceanographic science and sail training program.

EMPLOYMENT / ACADEMIC EXPERIENCE

Applied Physics Laboratory, University of Washington

Seattle, WA

Research Associate – Ocean Physics Department

October 2012–present

- Designing, testing, and implementing navigation algorithms for the Seaglider autonomous underwater vehicle for work in the marginal ice zone of the Arctic.

Consortium for Ocean Leadership

Washington, DC

Systems Engineer – Ocean Observatories Initiative

March 2011–August 2012

- Working on systems engineering team to support design, construction, and operation of the Ocean Observatories Initiative system of systems.
- Supporting development of data processing and managing across the system.
- Developing Reliability, Maintainability, and Availability Model to capture expected availability of near real-time data flow from 767 sensors located throughout the world's oceans.

Woods Hole Oceanographic Institution (WHOI)

Woods Hole, MA

Guest Investigator

2011-present

Guest Student

2007-2010

Johns Hopkins University

Baltimore, MD

Visiting Scientist

2011-2012

Postdoctoral Scholar

2010-2011

Mechanical Engineering Department

Advisor: Professor Louis L. Whitcomb

Woods Hole Oceanographic Institution (WHOI)**Woods Hole, MA****Engineer II****2003–2004****Engineer I****2000–2003**

- Designed tools and developed methods and tools to enable the excavation of a late 5th-early 6th c. AD Roman shipwreck with a remotely operated vehicle.
- Performed modeling and design work for several underwater vehicles and shipboard support for the remotely operated vehicle (ROV) *Jason*.

TEACHING AND SUPERVISORY EXPERIENCE**Instructor****January 2011****The Kalman Filter**

- Designed and co-taught a three-week, 400-level, 1-unit course on the history, derivation and implementation of the Kalman filter. Classwork included both lectures and computer labs where students learned to implement the Kalman filter and the extended Kalman filter in Matlab.
- Responsibilities included co-teaching three two-hour lectures/lab sessions per week and creating and grading homework problems and computer lab projects.

Teaching Assistant**Fall 2008****Introduction to Robotics**

- Graduate-level introduction to robotics with emphasis on the mathematical tools for kinematics and dynamics, including forward and inverse kinematics, trajectory generation, position sensing and actuation, and manipulator control.
- Responsibilities included teaching one-hour weekly recitation section, weekly office hours, grading.

Teaching Assistant**Spring 2006****Robot Sensors and Actuators**

- Upper-level undergraduate laboratory introduction to modeling and use of actuators and sensors in mechatronic design, including electric motors, solenoids, micro-actuators, position sensors, and proximity sensors.
- Responsibilities included teaching weekly three-hour lab, guest lectures, grading.

Coordinator and Group Leader**2004–2009****Ready Set Design! Engineering Program**

- Helped create a program to introduce Baltimore-city middle school girls to engineering in hands-on, collaborative, non-competitive half-day seminars.
- Organized the program and worked with the girls in small groups.
- Approximately 3–4 seminars per year.

Supervisor of Undergraduate Employee**Summer 2009**

- Worked with and helped oversee lab-based activities of undergraduate lab assistant.

HONORS AND AWARDS

- Link Foundation Doctoral Research Fellowship in Ocean Engineering and Instrumentation, 2008–2009
- IEEE Robotics and Automation Society (RAS) 2008 Fellowship for Women in Robotics and Automation—Honorable Mention.
- Mechanical Engineering Department 2008 Student Award for the Mechanical Engineering Graduate Association
- Johns Hopkins Diversity Leadership Council's 2006 Diversity Recognition Award for Ready, Set, Design!
- American Society of Mechanical Engineers Johns Hopkins Chapter 2006 Award for Ready, Set, Design!
- National Science Foundation Graduate Research Fellowship, 2005–2008
- Johns Hopkins University Dean's Fellowship, 2004–2009
- Johns Hopkins University Mechanical Engineering Department Fellowship, 2004–2005
- Member, Tau Beta Pi, Engineering Honors Society, inducted 1997

OCEANOGRAPHIC CRUISE PARTICIPATION

Challenger Deep, Mariana Trench, May 2009

R/V *Kilo Moana*, Chief Scientist Mr. Andy Bowen, Woods Hole Oceanographic Institution

- Deep-water (11km) engineering cruise to test hybrid remotely operated vehicle *Nereus*.
- Sailed as lead engineer of the vehicle's acoustic communications system.

Southern Mid-Atlantic Ridge, January 2008

R/V *Knorr*, Chief Scientist Dr. Hanumant Singh, Woods Hole Oceanographic Institution

- Hydrothermal vent search and survey using AUVs *Jaguar* and *Puma*.
- Sailed as lead engineer of the vehicle's acoustic communications system.

Pacific Ocean off Hawaii, November 2007

R/V *Kilo Moana*, Chief Scientist Mr. Andy Bowen, Woods Hole Oceanographic Institution

- Engineering cruise to test the new hybrid remotely operated vehicle *Nereus*.
- Sailed as lead engineer of the vehicle's acoustic communications system.

Mediterranean Sea, August 2003

R/V *Knorr*, Chief Scientist Dr. Robert Ballard, Institute for Exploration

- Underwater archaeological survey and excavation using IFE's ROV *Hercules*.
- Sailed as excavation tool designer/operator and member of the vehicle operations team.

Black Sea, July 2003

R/V *Knorr*, Chief Scientist Dr. Robert Ballard, Institute for Exploration

- Underwater archaeological survey and excavation using IFE's ROV *Hercules*.
- Sailed as excavation tool designer/operator and member of the vehicle operations team.

Juan de Fuca, April 2001

R/V *Thomas Thompson*, Chief Scientist Dr. Lisa Levin, Scripps Institution

- Geological survey of hydrothermal vent area using Eastern Oceanics' vehicle.
- Sailed as Chief Navigator.

Juan de Fuca, October 2000

R/V *Thomas Thompson*, Chief Scientist Dr. Lisa Levin, Scripps Institution

- Geological survey of hydrothermal vent area using ROV *Jason*.
- Sailed as member of Deep Submergence Operations Group.

Juan de Fuca, September 2000

R/V *Thomas Thompson*, Chief Scientist Dr. Paul Johnson, University of Washington

- Geological survey of hydrothermal vent area using ROV *Jason*.
- Sailed as member of Deep Submergence Operations Group.

Black Sea, July 1999

Orkuz II, Yildiz Kardesler (Turkish vessels), Chief Scientist Dr. Robert Ballard, Institute for Exploration

- Sonar and ROV survey for ancient shipwrecks.
- Sailed as Assistant Scientist and Assistant Shipboard Operations Manager.

Black Sea, June 1998

Orkuz II (Turkish vessel), Chief Scientist Dr. David Mindell, Massachusetts Institute of Technology

- Sonar survey for ancient shipwrecks.
- Sailed as sonar operations team member.

Sargasso Sea, March 1997

R/V *Westward*, Captain Terry Hayward, Chief Scientist Dr. Chuck Lea, Sea Education Association

- Sailed as student in oceanographic and sailing training program.

JOURNAL PAPERS

- S. E. Webster**, J. M. Walls, L. L. Whitcomb, and R. M. Eustice, *Decentralized extended information filter for single-beacon cooperative acoustic navigation*, IEEE Transactions on Robotics. (Submitted, In Review).
- S. E. Webster**, R. M. Eustice, H. Singh, and L. L. Whitcomb, *Advances in single-beacon one-way-travel-time acoustic navigation for underwater vehicles*, International Journal Robotics Research, 31(8):935-950, July 2012.
- A. D. Bowen, D. R. Yoerger, C. Taylor, R. McCabe, J. Howland, D. Gomez-Ibanez, J. C. Kinsey, M. Heintz, G. McDonald, D. B. Peters, B. Fletcher, C. Young, J. Buescher, L. L. Whitcomb, S. C. Martin, **S. E. Webster**, and M. V. Jakuba, *The Nereus hybrid underwater robotic vehicle*, Underwater Technology: The International Journal of the Society for Underwater Technology, 28(3):79–89, 2009.

BOOK CHAPTERS

- S. E. Webster**, *Archaeological Oceanography*. Princeton, NJ: Princeton Press, 2008, *The development of excavation technology for remotely operated vehicles*, pp. 41–64.

REFEREED CONFERENCES PAPERS

- S. E. Webster**, L. L. Whitcomb, and R. M. Eustice, *Preliminary results in decentralized estimation for single-beacon acoustic underwater navigation*, in Proc. Robotics: Science and Systems Conf., Zaragoza, Spain, June 2010.
- S. E. Webster**, R. M. Eustice, H. Singh, and L. L. Whitcomb, *Preliminary deep water results in single-beacon one-way-travel-time acoustic navigation for underwater vehicles*, in Proc. IEEE/RSJ Intl. Conf. Intelligent Robots and Systems, St Louis, MO, Oct 2009, pp.2053–2060.

NON-REFEREED CONFERENCE PAPERS

- S. E. Webster**, L. L. Whitcomb, and R. M. Eustice, *Advances in decentralized single-beacon acoustic navigation for underwater vehicles: Theory and Simulation*, in Proc. IEEE/OES AUV2010 Conf., Monterey, CA, Aug 2010.
- L. L. Whitcomb, M. V. Jakuba, J. C. Kinsey, S. C. Martin, **S. E. Webster**, J. C. Howland, C. L. Taylor, D. Gomez-Ibanez, and D. R. Yoerger, *Navigation and control of the Nereus hybrid underwater vehicle for global ocean science to 10,903 m depth: Preliminary results*, in Proc. IEEE Int. Conf. Robot. Auto., Anchorage, Alaska, May 2010, pp.594–600.
- S. E. Webster**, R. M. Eustice, C. Murphy, H. Singh, and L. L. Whitcomb, *Toward a platform-independent acoustic communications and navigation system for underwater vehicles*, in Proc. IEEE/MTS OCEANS Conf. Exhib., Biloxi, MS, Oct 2009, pp.1–7.
- S. Singh, **S. E. Webster**, L. Freitag, L. L. Whitcomb, K. Ball, J. Bailey, and C. Taylor, *Acoustic communication performance in sea trials of the Nereus vehicle to 11,000 m depth*, in Proc. IEEE/MTS OCEANS Conf. Exhib., Biloxi, MS, Oct 2009, pp.1–6.
- A. D. Bowen, D. R. Yoerger, C. Taylor, R. McCabe, J. Howland, D. Gomez-Ibanez, J. C. Kinsey, M. Heintz, G. McDonald, D. Peters, J. Bailey, T. Shank, L. L. Whitcomb, S. C. Martin, **S. E. Webster**, M. V. Jakuba, C. Young, J. Buescher, B. Fletcher, P. Fryer, and S. Hulme, *Field trials of the Nereus hybrid underwater robotic vehicle in the Challenger Deep of the Mariana Trench*, in Proc. IEEE/MTS OCEANS Conf. Exhib., Biloxi, MS, Oct 2009, pp.1–10.

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- A. D. Bowen, D. R. Yoerger, C. Taylor, R. McCabe, J. Howland, D. Gomez-Ibanez, J. C. Kinsey, M. Heintz, G. McDonald, D. Peters, B. Fletcher, J. Buescher, L. L. Whitcomb, S. C. Martin, **S. E. Webster**, M. V. Jakuba, *The Nereus hybrid underwater robotic vehicle for global ocean science operations to 11,000m depth*, in Proc. IEEE/MTS OCEANS Conf. Exhib., Quebec, Sept 2008, pp.1–10.
- L. L. Whitcomb, M. V. Jakuba, J. C. Kinsey, S. C. Martin, **S. E. Webster**, J. C. Howland, C. L. Taylor, D. Gomez-Ibanez, and D. R. Yoerger, *Navigation and control of the Nereus hybrid underwater vehicle for global ocean science to 11,000m depth: Preliminary results*, in Proc. 14th Yale Workshop on Adaptive and Learning Systems, Yale University, June 2008.
- A. D. Bowen, D. R. Yoerger, C. Taylor, R. McCabe, J. Howland, D. Gomez-Ibanez, J. C. Kinsey, M. Heintz, G. McDonald, D. B. Peters, B. Fletcher, C. Young, J. Buescher, L. L. Whitcomb, S. C. Martin, **S. E. Webster**, and M. V. Jakuba, *The Nereus hybrid underwater robotic vehicle for global ocean science operations to 11,000m depth*, in Proc. IEEE/MTS OCEANS Conf. Exhib., Quebec, Sept 2008.
- S. E. Webster** and A. D. Bowen, *Feasibility analysis of an 11,000 m vehicle with a fiber optic microcable link to the surface*, in Proc. IEEE/MTS OCEANS Conf. Exhib., San Diego, CA, Sept 2003.
- S. E. Webster**, O. Pizarro, and H. Singh, *Photomosaics in underwater archaeology*, *INA Quarterly*, vol. 28, no. 3, pp. 22–26, 2001.

INVITED LECTURES

Decentralized Navigation for Multiple Underwater Vehicles, Apr 2011

Northrop Grumman Undersea Systems, Annapolis, MD

- Invited speaker for the Community of Practice in Communications and Networking

Combined Communication and Navigation of Underwater Vehicles, Feb 2010

National Oceanography Centre, Southampton, UK

- Invited speaker

Combined Communication and Navigation of Underwater Vehicles, Oct 2008

Eaton E. Lattman Graduate Student Community Lecture Series, Johns Hopkins University, Baltimore, MD

- Selected as one of four speakers for inaugural lecture

Combined Communication and Navigation of Underwater Vehicles, May 2008

Center for Oceanographic Research in the Eastern South Pacific (COPAS), University of Concepción, Chile

- Invited speaker

Deep Sea Archaeology: Ancient Ships and Underwater Vehicles, Aug 2007

Olin College, Needham, MA

- Invited as one of two convocation speakers

Combined Communication and Navigation of Underwater Vehicles, June 2007

Johns Hopkins University Applied Physics Lab, Laurel, MD

- Research briefing

Ancient Ships and ROVs: New Technology for Archaeological Excavation, Mar 2006

Johns Hopkins University Applied Physics Lab, Baltimore, MD

- Research briefing

A Deep Sea Archaeology Saga, Act 1: Hercules Meets Elissa, Apr 2003

Deep Water Archaeology Research Group at MIT, Cambridge, MA

- Presented at monthly meeting, joint talk with Todd Gregory, Institute for Exploration

Digging in the Deep: The Technology for Deep Sea Archaeology, Feb 2003

Johns Hopkins University, Mechanical Engineering Department, Baltimore, MD

- Presented at departmental seminar

Digging in the Deep: Developing Excavation Tools for Underwater Vehicles, Apr 2002

Deep Water Archaeology Conference at MIT, Cambridge, MA

- Presented at conference

Remote Excavation in the Deep Sea, Apr 2001

Deep Water Archaeology Research Group at MIT, Cambridge, MA

- Presented at monthly meeting

VOLUNTEER LECTURES

Ready, Set, Design!, 2005–2007

Three half-day engineering workshops per semester for area middle school girls. Sponsored by American Society of Mechanical Engineers, Johns Hopkins University, Baltimore, MD

Deep Sea Archaeology: Ancient Ships and Underwater Vehicles, Apr 2007

Presentation and demonstration for City Springs Middle School, Baltimore, MD

Deep Sea Archaeology: Ancient Ships and Underwater Excavation, Aug 2004

Young Women in Science Program for middle and high school girls, Flying Cloud Institute, Great Barrington, MA

Ancient Ships and ROVs: New Technology for Archaeological Excavation, Mar 2004

Research and Engineering Briefs, Women's Committee Lecture Series, Woods Hole, MA

Black Sea Excavation: Summer 2003, Oct 2003

Presented to visitors from US Navy, Woods Hole, MA

Developing Deep Water Excavation Technology, July 2002

WHOI Summer Student Fellows (Undergraduate) Lecture Series, Woods Hole, MA

Looking for Noah's Flood, Jan 2002

Virginia Episcopal School (High School) Science Club and Westminster Canterbury Retirement Community, Lynchburg, VA

Archaeology and Technology in Deep Water, July 2001

Northeastern University Engineering Research Center High School Teachers' Symposium, Woods Hole, MA

The Deep Submergence Lab: Who We Are, What We Do, Apr 2001

University of Rhode Island Undergraduate Oceanography Class, Woods Hole, MA

Engineering—A Woman's Occupation, Mar 2001

Girl Scout Sunday, Falmouth, MA

PROFESSIONAL AFFILIATIONS

- IEEE Member since 2008
- IEEE Robotics and Automation Society Member since 2008
- IEEE Women in Engineering Member since 2008
- Virginia Forestry Association Member since 2005