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Ryan M. Eustice

Personal

Degrees

Ph.D. Ocean Engineering, Massachusetts Institute of Technology / Woods Hole Oceanographic Institution Joint Program, Cambridge, MA, 2005.
Advisors: Dr. Hanumant Singh (WHOI), Dr. John J. Leonard (MIT)
Dissertation: "Large-Area Visually Augmented Navigation for Autonomous Underwater Vehicles"

B.S. Mechanical Engineering, Honors College, Michigan State University, East Lansing, MI, 1998.
Summa Cum Laude

Positions at University of Michigan

2013– Associate Professor, Department of Naval Architecture & Marine Engineering.

2013– Associate Professor (Courtesy Appt.), Department of Electrical Engineering & Computer Science, CSE Division.

2013– Associate Professor (Courtesy Appt.), Department of Mechanical Engineering.

2006–2013 Assistant Professor, Department of Naval Architecture & Marine Engineering.

2007–2013 Assistant Professor (Courtesy Appt.), Department of Electrical Engineering & Computer Science, CSE Division.

2009–2013 Assistant Professor (Courtesy Appt.), Department of Mechanical Engineering.

Positions at other institutions or organizations

2017– Vice President, Autonomous Driving, Toyota Research Institute.

2016–2017 Co-Director, Autonomous Driving Development, Toyota Research Institute, Ann Arbor, MI.

2014– Adjunct Associate Professor, Department of Mechanical Engineering, Johns Hopkins University, Baltimore, MD.

2005– Guest Investigator, Department of Applied Ocean Physics and Engineering, Woods Hole Oceanographic Institution, Woods Hole, MA.

2006–2014 Adjunct Assistant Professor, Department of Mechanical Engineering, Johns Hopkins University, Baltimore, MD.

2005–2006 Postdoctoral Investigator, Department of Mechanical Engineering, Johns Hopkins University, Baltimore, MD.

1999–2005 Graduate Research Assistant, Department of Applied Ocean Physics and Engineering, Woods Hole Oceanographic Institution, Woods Hole, MA.

1999 Software Consultant, Trilogy Software, Inc., Austin, TX.

1998 Product Development Engineer Intern, Small Car Group, General Motors Corporation, Warren Technical Center, Warren, MI.

1997–1998 Undergraduate Research Assistant, Biomechanics Evaluation Lab, Michigan State University, East Lansing, MI.

1996, 1997 Manufacturing Engineer Intern, Small Car Group, General Motors Corporation, Lansing Craft Center, Lansing, MI.

Honors and Awards

2016 George J. Hueber Jr. Research Excellence Award, College of Engineering, University of Michigan.

2015 DARPA Defense Science Study Group (DSSG) Fellow, Institute for Defense Analyses, Class of 2016–2017. (Fully participated in 2016 calendar year, resigned from 2017 calendar year due to demand of VP role at TRI)

2014 TRW Automotive Endowed Research Award, College of Engineering, University of Michigan.

2014 Best Student Paper Award (R. Wolcott), IEEE/RSJ International Conference on Intelligent Robots and Systems: "Visual localization within LIDAR maps for automated urban driving" by R. Wolcott and R. Eustice.

2014 Finalist (one of four), KUKA Service Robotics Best Paper Award, IEEE International Conference on Robotics and Automation: "Toward long-term, automated ship hull inspection with visual SLAM, explicit surface optimization, and generic graph-sparsification" by P. Ozog and R. Eustice.

2010 Ruth and Paul Fye Award for Best Graduate Student Paper between 2005–2010 in Oceanographic Engineering, MIT/WHOI Joint Graduate Program.

2009 NA&ME Departmental Award for Outstanding Accomplishment, University of Michigan.

2008 National Science Foundation CAREER Award (CISE–Robust Intelligence).

2007 Finalist (one of eleven), 2007 DARPA Urban Grand Challenge as member of Team IVS.

2007 Office of Naval Research Young Investigator Award.

2006 King-Sun Fu Memorial Best Transactions on Robotics Paper Award of the IEEE Robotics and Automation Society *(First American to win since 1999)*: "Exactly sparse delayed-state filters for view-based SLAM" by R. Eustice, H. Singh and J. Leonard.

2005 Best Student Paper Award, IEEE International Conference on Robotics & Automation: "Exactly sparse delayed-state filters" by R. Eustice, H. Singh and J. Leonard.

1999 Recipient of National Science & Defense Graduate (NDSEG) Fellowship.

Teaching

New courses introduced at University of Michigan

NA568/EECS568 Mobile Robotics: Methods & Algorithms
Theory and application of probabilistic techniques for autonomous mobile robotics. This course presents and critically examines contemporary algorithms for robot perception (using a variety of modalities), state estimation, mapping, and path planning. Topics include Bayesian filtering; stochastic representations of the environment; motion and sensor models for mobile robots; algorithms for mapping, localization, planning and control in the presence of uncertainty; application to autonomous marine, ground, and air vehicles.
–This course has been adopted as a core course for the Masters of Science and PhD in Robotics degrees.
–Co-developed with Edwin Olson of CSE. Introduced Fall 2008 and taught annually thereafter (except AY2013) by either Olson or Eustice.

ROB550 Robotic Systems Laboratory
Multidisciplinary laboratory course with exposures to sensing, reasoning, and acting for physically-embodied systems. Intro to kinematics, localization and mapping, planning, control, user interfaces. Design, build, integration, and test of mechanical, electrical, and software systems. Projects based on a series of robotic platforms: manipulators, mobile robots, aerial or underwater vehicles.
–This course was designed as a required core course for the Masters of Science and PhD in Robotics degrees.
–Co-developed with Ella Atkins, Edwin Olson, and Shai Revzen. Introduced Fall 2014 and co-taught with Ella Atkins for its first offering.

Courses taught at University of Michigan

Regular Courses

Course #	Course Title	Teaching Role	Term	Enrolled	Q1*	Q2*
NA568/EECS568	Mobile Robotics	Instructor	2016 Winter	50	4.63	4.26
NA320	Marine Hydrodynamics I	Instructor	2015 Fall	28	4.71	4.79
NA568/EECS568	Mobile Robotics	Instructor	2015 Winter	28	4.72	4.61
ROB550	Robotic Systems Lab	Co-Instructor	2014 Fall	38	4.53	4.71
NA340	Marine Dynamics I	Instructor	2013 Winter	38	4.58	4.83
NA320	Marine Hydrodynamics I	Instructor	2012 Fall	42	4.50	4.75
NA340	Marine Dynamics I	Instructor	2012 Winter	36	4.34	4.75
NA320	Marine Hydrodynamics I	Instructor	2011 Fall	34	4.15	4.56
NA340	Marine Dynamics I	Instructor	2011 Winter	37	4.37	4.79
NA568/EECS568	Mobile Robotics	Instructor	2010 Fall	25	4.83	4.90
NA590-454	Mobile Robotics (Pilot)	Instructor	2009 Fall	11	4.88	4.79
NA340	Marine Dynamics I	Instructor	2009 Winter	42	4.17	4.60
NA320	Marine Hydrodynamics I	Instructor	2008 Fall	40	4.15	4.50
NA340	Marine Dynamics I	Instructor	2008 Winter	36	3.68	3.56
NA320	Marine Hydrodynamics I	Instructor	2007 Fall	39	3.83	4.00
NA340	Marine Dynamics I	Instructor	2007 Winter	25	3.79	4.07
NA320	Marine Hydrodynamics I	Instructor	2006 Fall	25	4.17	4.59

*Q1. Overall, this was an excellent course. Q2. Overall, the instructor was an excellent teacher. Scale: 1–5 best.

Independent Study Courses

Course #	Course Title	Term	Student
ENGR456	Mentr-Ldr Mltdis Des (UMA)	2016 Winter	Marisa Witcpalek
ENGR355	Inter Multidisc Des (UMA)	2016 Winter	Marisa Witcpalek
ROB590	Directed Study (Covariance Estimation)	2016 Winter	Vitorio Bichucher
ROB590	Directed Study (Automated Driving Vision)	2016 Winter	Derrick Dominic
ENGR355	Inter Multidisc Des (UMA)	2015 Fall	Marisa Witcpalek
ENGR355	Inter Multidisc Des (UMA)	2015 Winter	Kunjan Singh
ENGR355	Inter Multidisc Des (UMA)	2015 Winter	Marisa Witcpalek
ROB590	Directed Study (Visual Localization)	2015 Winter	Joshua Mangelson
EECS599	Directed Study (Sensor Calibration)	2015 Winter	Steven Parkison
ENGR255	Intro Multidisc Des (UMA)	2014 Fall	Jeremy Lipshaw
ENGR255	Intro Multidisc Des (UMA)	2014 Fall	Kunjan Singh
ENGR255	Intro Multidisc Des (UMA)	2014 Fall	Marisa Witcpalek
ME590	Directed Study (Automated Driving Control)	2014 Sp/Su	Eric Shin
ENGR255	Intro Multidisc Des (UMA)	2014 Winter	Jeremy Lipshaw
NA490	Directed Study (Image Processing)	2013 Fall	Vittorio Bichuch
ENGR456	Mentr-Ldr Mltdis Des (UMA)	2015 Fall	Kujan Singh
ENGR355	Multidisc Engr Des I (UMA)	2015 Fall	Marisa Witcpalek
ME590	Directed Study (NGV)	2015 Sp/Su	Eric Shin
ROB590	Directed Study (ESMF)	2015 Winter	Joshua Mangelson
EECS599	Directed Study (NGV)	2015 Winter	Steven Parkison
ENGR255	Multidis Eng Pro I (UMA)	2014 Fall	Jeremy Lipshaw
ENGR255	Multidis Eng Pro I (UMA)	2014 Fall	Marisa Witcpalek
ENGR355	Multidisc Engr Des I (UMA)	2014 Fall	Kujan Singh
ME590	Directed Study (NGV)	2014 Sp/Su	Eric Shin
EECS599	Directed Study (NGV)	2014 Winter	Hyeon Joo
ENGR255	Multidis Eng Pro I (UMA)	2014 Winter	Jeremy Lipshaw
NA490	Directed Study (ESMF)	2013 Fall	Vittorio Bichucher
NA490	Directed Study (NEEC)	2012 Fall	Tim Jones
ENGR355	Multidisc Engr Des I (NEEC)	2012 Fall	Michelle Howard
EECS499	Adv Directed Study (UMA)	2012 Winter	Anthony Bonkowsk
EECS599	Directed Study (Image Processing)	2012 Winter	Paul Ozog
EECS599	Directed Study (NEEC)	2012 Winter	Ryan Wolcott
ENGR355	Multidisc Engr Des I (NEEC)	2012 Winter	Michelle Howard
ENGR456	Mentr-Ldr Mltdis Des (UMA)	2012 Winter	Adrian Choy
NA490	Directed Study (NEEC)	2012 Winter	Tim Jones
ENGR355	Multidisc Engr Des I (NEEC)	2011 Fall	Michelle Howard
ENGR455	Multidisc Eng Des II (NEEC)	2011 Fall	Nick Fredricks
NA490	Directed Study (NEEC)	2011 Fall	Tim Jones
NA590	Directed Study (AUV Control)	2011 Sp/Su	Mike Daeffler
EECS599	Directed Study (Visual SLAM)	2011 Winter	Paul Ozog
ENGR455	Multidisc Eng Des II (NEEC)	2011 Winter	Kurt Bourbonnais
ENGR455	Multidisc Eng Des II (UMA)	2011 Winter	David Devecsery
ENGR455	Multidisc Eng Des II (NEEC)	2011 Winter	Nick Fredricks
ENGR455	Multidisc Eng Des II (NEEC)	2011 Winter	Eric Rossetti
ENGR455	Multidisc Eng Des II (UMA)	2011 Winter	Devin Witt
ENGR456	Mentr-Ldr Mltdis Des (UMA)	2011 Winter	Kurt Bourbonnais
ENGR456	Mentr-Ldr Mltdis Des (UMA)	2011 Winter	Eric Rossetti
ENGR399	Directed Study (NEEC)	2010 Fall	Eric Rossetti
ENGR455	Multidisc Eng Des II (NEEC)	2010 Fall	Kurt Bourbonnais
ENGR455	Multidisc Eng Des II (UMA)	2010 Fall	Devin Witt
ENGR456	Mentr-Ldr Mltdis Des (UMA)	2010 Fall	Eric Rossetti
ENGR499	Directed Study (UMA)	2010 Winter	Andrew Beck
ENGR599	Directed Study (Image Processing)	2010 Winter	Nick Carlevaris-Bianco
ENGR455	Multidisc Eng Des II (UMA)	2010 Winter	Kurt Bourbonnais
ENGR455	Multidisc Eng Des II (UMA)	2010 Winter	Debra Franklin
ENGR455	Multidisc Eng Des II (UMA)	2010 Winter	Ryan Goodman
ENGR455	Multidisc Eng Des II (UMA)	2010 Winter	Eric Rossetti
ENGR455	Multidisc Eng Des II (UMA)	2010 Winter	Devin Witt
ME590	Directed Study (AUV Navigation)	2010 Winter	Jeff Walls
NA590	Directed Study (AUV Navigation)	2010 Winter	Shashi Singh
EECS599	Directed Study (Ford Lidar)	2009 Fall	Gaurav Pandey
EECS599	Directed Study (Ford Lidar)	2009 Winter	Gaurav Pandey
NA490	Directed Study (UMA)	2008 Winter	Andrew Richardso
NA590	Directed Study (AUV Design)	2008 Winter	Hunter Brown
NA590	Directed Study (AUV Design)	2007 Fall	Nathan Niese
NA590	Directed Study (DARPA Urban Challenge)	2007 Fall	Jayanth Srinivas
NA590	Directed Study (DARPA Urban Challenge)	2007 Winter	Sai Majhi

Ph.D. committees chaired/co-chaired

1. S. M. Chaves, "Belief-space planning for active visual SLAM in underwater environments," Ph.D. dissertation, Department of Mechanical Engineering, University of Michigan, Ann Arbor, MI, USA, July 2016. Chair. (Current position: Senior Engineer at Qualcomm Research)

2. R. W. Wolcott, "Robust localization in 3d prior maps for autonomous driving," Ph.D. dissertation, Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, USA, July 2016. Chair. (Current position: Research Scientist at Toyota Research Institute)

3. P. Ozog, "Advances in simultaneous localization and mapping in confined underwater environments using sonar and optical imaging," Ph.D. dissertation, Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, USA, January 2016. Chair. (Current position: Research Scientist at Toyota Research Institute)

4. J. M. Walls, "Cooperative navigation for low-bandwidth mobile acoustic networks," Ph.D. dissertation, Department of Mechanical Engineering, University of Michigan, Ann Arbor, MI, USA, May 2015. Chair. (Current position: Research Scientist at Toyota Research Institute)

5. N. Carlevaris-Bianco, "Long-term simultaneous localization and mapping in dynamic environments," Ph.D. dissertation, Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, USA, January 2015. Chair. (Current position: Research Engineer at a Stealth Startup)

6. G. Pandey, "An information theoretic framework for camera and lidar sensor data fusion and its applications in autonomous navigation of vehicles," Ph.D. dissertation, Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, USA, January 2014. Chair. (Current position: Assistant Professor at IIT-Kanpur, India)

7. A. Kim, "Active visual SLAM with exploration for autonomous underwater navigation," Ph.D. dissertation, Department of Mechanical Engineering, University of Michigan, Ann Arbor, MI, USA, August 2012. Chair. (Current position: Assistant Professor at KAIST, S. Korea)

8. S. E. Webster, "Decentralized single-beacon acoustic navigation: Combined communication and navigation for underwater vehicles," Ph.D. dissertation, Department of Mechanical Engineering, Johns Hopkins University, Baltimore, MD, USA, June 2010. Co-Chair with Prof. Louis Whitcomb of Johns Hopkins University. (Current position: Research Scientist at University of Washington Applied Physics Laboratory)

Undergraduate major projects directed

Faculty Advisor for UM::Autonomy, 2007–2016

UM::Autonomy is a Wilson Center student robotics team founded in 2007 under the guidance of Prof. Ryan Eustice and Prof. David Singer to compete in the annual AUVSI/ONR Autonomous Surface Vessel competition. Teams must demonstrate littoral area navigation, channel following and autonomous docking using computer vision, multi-sensor fusion techniques, proactive and reactive path planning, and machine learning approaches on an autonomous surface vessel that the students design and build. Student participation on the team is typically 20–30 students per year.

– UMA won 3rd place out of 16 participating teams in the 2015 AUVSI/ONR competition.
– UMA won 1st place out of 19 participating teams in the 2012 AUVSI/ONR competition.
– UMA won 1st place out of 13 participating teams in the 2010 AUVSI/ONR competition.

NEEC: Unmanned Vehicle Systems, 2010–2013

Project-based education in the cross-disciplinary system issues in developing robust autonomy. This Naval Engineering Education Center (NEEC) project educates and trains students in perception, control, estimation, planning, and software development for real-world unmanned autonomous systems. Student participation is typically 10 students per year.

Short courses and workshops taught

1. "Synchronous-Clock Acoustic Navigation for Underwater Vehicles" and "Real-Time Visual SLAM for Autonomous Hull Inspection", Korean Unmanned Underwater Vehicle Workshop, Gyeongju, South Korea, Jun. 2012., 60+ enrollment, Keynote Lecturer.

2. "Visual SLAM in an Underwater Environment for Autonomous Hull and Harbor Inspection" and "3D Lidar and Omnidirectional Camera Registration for 3D Mapping and Localization", VIBOT: European Masters in Computer Vision and Robotics Invited Lecture Series, University of Girona, Spain, May 2011., 50+ enrollment, Invited Lecturer.

3. "Advanced Navigation and Mapping for Underwater Vehicles", NSF and DoE sponsored Pan-American Advanced Studies (PASI) Workshop in Dynamics and Control of Manned and Unmanned Marine Vehicles, Cartegena, Colombia, Jul. 2010., 50+ enrollment, Invited Lecturer.

Outreach directly related to teaching

- "NOAA's Ocean Exploration Zone: Dive into Thunder Bay", April 2009, Immersion Presents Live Webcast, K-12 education outreach in collaboration with NOAA Thunder Bay National Marine Sanctuary, `http://immersionlearning.org`.

- "Remote and Autonomous Vehicles." September 2008, live webcast, K-12 educational outreach in collaboration with NOAA Thunder Bay National Marine Sanctuary and OceansLive.org.

- "An Interview with Ryan Eustice", August 2008, NOAA Ocean Explorer Series: Introducing kids to real scientists, `http://www.immersionlearning.org`.

Research

Past grant and contracts

1. Ford Motor Company, "Next Generation Vehicle, Phase II", $4,680,459. Sep. 2015 – Aug. 2018 (transferred PI to Matt Johnson-Roberson Apr. 2016 due to TRI appointment). PI: Eustice. Co-PI: Edwin Olson of CSE. Eustice's share: $2,340,230. Support 2.5 GSRA, 1.5 Postdoc, 1.5 Research Engineer.

2. U-M Mobility Transformation Center, "SmartCarts", $199,410. Sep. 2015 – Aug. 2016. PI: Edwin Olson of CSE. Co-PI: Eustice. Eustice's share: $0.

3. U-M Mobility Transformation Center, "Cybersecurity Roadmap for Automated Cars", $200,000. May. 2015 – Apr. 2016 (NCE Apr. 2017). PI: André Weimerskirch of UMTRI. Co-PI: Eustice. Eustice's share: $70,000. Support 1 GSRA.

4. American Bureau of Shipping, "Autonomous Underwater Exterior Hull Inspection for Support and Augmentation of UWILD, RRDA and 3D CAD Model Product Services—Addendum1", $158,194. Jan. 2015 – Dec. 2015. PI: Eustice. Co-PI: Matthew Johnson-Roberson of NAME. Eustice's share: $79,097. Support 0.5 GSRA.

5. U-M Mobility Transformation Center, "The driver in the driverless car: Simulating vehicle automation for evaluation of driver behavior and performance", $99,990. May. 2014 – Apr. 2016. PI: Anuj Pradhan of UMTRI. Co-PI: Eustice, John Sullivan of UMTRI, and C. Raymond Bingham of UMTRI. Eustice's share: $2431.

6. Office of Naval Research, "A Real-Time Wave Sensing and Ship Motion Prediction System, Phase II", $4,784,144. Mar. 2014 – Apr. 2016. PI: Robert Beck. Co-PI: Eustice, Okey Nwogu of NAME, David Lyzenga of NAME, Laura Alford of NAME. Eustice's share: $211,062. Support 1 GSRA.

7. Office of Naval Research, N00014-12-1-0092-Addendum1, "Extended Capabilities for the HAUV Ship-Inspection Vehicle", $399,932. Oct. 2013 – Sep. 2015 (NCE Apr. 2016). PI: Eustice. Support 1.5 GSRA.

8. Ford Motor Company, "Instrumentation for Next Generation Vehicle Platform for Active Safety and Driver Assistance Research", $1,567,939. Sep. 2012 – Aug. 2015 (NCE Aug. 2018) (transferred PI to Matt Johnson-Roberson Apr. 2016 due to TRI appointment). PI: Eustice Co-PI: Edwin Olson of CSE. Eustice's share: $783,970.

9. Ford Motor Company, "Next Generation Vehicle Platform for Active Safety and Driver Assistance Research", $3,027,921. Sep. 2012 – Aug. 2015 (NCE Aug. 2018) (transferred PI to Matt Johnson-Roberson Apr. 2016 due to TRI appointment). PI: Eustice Co-PI: Edwin Olson of CSE. Eustice's share: $1,563,958. Support 2.5 GSRA, 1 Postdoc, 1 Research Engineer.

10. National Science Foundation, BCS-0964424, "Ancient Hunters of the Alpena-Amberley Ridge: Archaeological Investigations beneath Lake Huron", $267,196. Jun. 2010 – May 2015. PI: John O'Shea of LSA. Co-PI: Guy Meadows of NAME and Eustice. Eustice's share: $30,000.

11. American Bureau of Shipping, "Autonomous Underwater Exterior Hull Inspection for Support and Augmentation of UWILD, RRDA and 3D CAD Model Product Services", $217,728. Sep. 2013 – Dec. 2014. PI: Eustice. Co-PI: Matthew Johnson-Roberson of NAME. Eustice's share: $136,469. Support 0.5 GSRA, 0.5 Postdoc.

12. NAVSEA Naval Engineering Education Center, N65540-10-C-0003-PoE4, "Cooperative Feature-Based Navigation and Mapping for Unmanned Vehicle Theater Support", $149,993. Oct. 2012 – Sep. 2013. PI: Eustice. Support 1 GSRA.

13. Ford Motor Company, "Visual Localization using Map-Derived Priors", $70,490. May. 2012 – Apr. 2013. PI: Eustice. Support 1 GSRA.

14. Office of Naval Research, N00014-12-1-0092, "Extended Capabilities for the HAUV Ship-Inspection Vehicle", $404,615. Oct. 2011 – Sep. 2013. PI: Eustice. Support 1 GSRA, 1 Postdoc.

15. NAVSEA Naval Engineering Education Center, N65540-10-C-0003-PoE3, "Unmanned Autonomous Vehicle Testbed: A Multi-Agent Testbed for Teaching, Training and Learning", $150,000. Oct. 2011 – Sep. 2012. PI: Eustice. Support 1 GSRA.

16. Ford Motor Company, "Map-derived Navigation and Mapping", $47,302. Sep. 2011 – Jul. 2012. PI: Eustice. Support 1 GSRA.

17. National Science Foundation, ANT-1039951, "MRI: Development of AUV Technologies for Long-Range Under-Ice Transects", $488,335. Oct. 2010 – Sep. 2013. PI: Hanumant Singh (WHOI). Co-PI: Albert Plueddemann (WHOI), Fiammetta Straneo (WHOI), Lee Fritag (WHOI), Sarah Das (WHOI), and Eustice. Eustice's share: $69,999.

18. NAVSEA Naval Engineering Education Center, N65540-10-C-0003-PoE2, "Unmanned Autonomous Vehicle Testbed: A Multi-Agent Testbed for Teaching, Training and Learning", $168,675. Oct. 2010 – Sep. 2011. PI:Eustice. Support 1 GSRA.

19. Ford Motor Company, "Salient image-based features derived from lidar for low-cost automotive visual localization", $47,199. Sep. 2010 – Aug. 2011. PI: Eustice. Support 1 GSRA.

20. NAVSEA Naval Engineering Education Center, N65540-10-C-0003-PoE1, "Unmanned Autonomous Vehicle Testbed: A Multi-Agent Testbed for Teaching, Training and Learning", $93,148. May 2010 – Oct. 2010. PI: Eustice.

21. Office of Naval Research, N00014-07-1-0791-Addendum1, "Hull-Relative Feature-Based Navigation Demonstration with the HAUV", $231,273. Oct. 2009 – Jun. 2012. PI: Eustice. Support 1 GSRA.

22. Ford Motor Company, "Low-Cost Automotive Mapping, Localization, and Perception for Active Safety Applications, Derived from Autonomous Vehicle Studies Employing High-Definition LIDAR", $199,996. Sep. 2008 – Aug. 2011. PI: Eustice. Support 1 GSRA.

23. National Oceanic and Atmospheric Administration, WC133C08SE4089, "Mystery Beneath the Waves: Searching for Historic Shipwrecks Within and Beyond the Boundaries of the Thunder Bay National Marine Sanctuary", $73,800. Sep. 2008 – Sep. 2009. PI: Russ Green (NOAA). Co-PI: Roderick Mather (URI) and Eustice. Eustice's share: $11,000.

24. National Science Foundation, IIS-0746455, "CAREER: Toward Robust Multi-Vehicle Multi-Scalar Underwater Robotic Navigation — A Career Development Plan", $432,455. May 2008 – Apr. 2013. PI: Eustice. Support 1 GSRA.

25. National Science Foundation, BCS-0829324, "Ancient Hunters and the Lake Stanley Causeway: A Pilot Study", $25,000. May 2008 – Jul. 2009. PI: John O'Shea of LSA. Co-PI: Guy Meadows of NAME and Eustice.

26. Defense Advanced Research Projects Agency, 080427Z1, "HURRT - Heterogeneous Unmanned Riverine Reconnaissance Teams", $85,000. Mar. 2008 – Mar. 2009. PI: Guy Meadows of NAME. Co-PI: Eustice, David Lyzenga of NAME, and Christopher Roman (URI). Eustice's share: $6000.

27. Office of Naval Research, N00014-07-1-0791-Addendum1, "Real-Time Feature-based Ship-Hull Inspection with the HAUV", $150,000. Jun. 2007 – Aug. 2010. PI: Eustice. Support 1 GSRA.

28. Office of Naval Research, N00014-07-1-0791, "Real-Time Visually Augmented Navigation for Autonomous Search and Inspection of Ship Hulls and Port Facilities", $460,000. Jun. 2007 – Sep. 2011. PI: Eustice. Support 1 GSRA.

29. U-M CoE Faculty Equipment Initiative (Competitive), "Multi Autonomous Underwater Vehicle Testbed", $108,400. Nov. 2006 – Oct. 2007. PI: Eustice. Co-PI: Guy Meadows of NAME, Jing Sun of NAME, and Anouck Girard of AERO. Eustice's share: $108,400.

30. Ford Motor Company, "High-definition LIDAR Mapping for Active Safety Vehicle Situational Awareness", $286,382. Sep. 2006 – Aug. 2008. PI: Eustice. Support 1 GSRA, 1 Postdoc.

Current grants and contracts

1. Department of Energy (subward via Carnegie Mellon University), "Advanced Imaging, Surveying and Mapping for Nuclearized Underwater Robots", $600,033. Oct. 2016 – Sep. 2019. PI: Matt Johnson-Roberson, Co-I: Eustice (Eustice was original PI but stepped back to a Co-I role due to TRI appointment). Support 1.0 GSRA.

2. Toyota Research Institute, "ARIA: Autonomous Robots Imagining to Act", $undisclosed. May 2016 – Apr. 2019. PI: Eustice. Support 4 GSRA, 2 Postdoc.

3. Office of Naval Research, N00014-16-1-2102, "Advanced Capabilities in Multi-Agent Search for the HAUV Ship-Inspection Vehicle", $712,798. May 2016 – Apr. 2019. PI: Eustice. Support 1.5 GSRA.

Publications and scholarly presentations[1]

Note: Names of current supervised graduate students are underlined, names of former supervised graduate students are double underlined, and names of supervised undergraduates are underlined with an asterisk*.

Full articles in refereed publications

[1]The PDF version of this document has embedded hyperlinks to many of the publications; these are indicated by mousing over them.

1. R. W. Wolcott and R. M. Eustice, "Robust LIDAR localization using multiresolution Gaussian mixture maps for autonomous driving," *International Journal of Robotics Research*, 2017, in Press.

2. E. Galceran, A. G. Cunningham, R. M. Eustice, and E. Olson, "Multipolicy decision-making for autonomous driving via changepoint-based behavior prediction: Theory and experiment," *Autonomous Robots*, 2017, in Press.

3. P. Ozog, M. Johnson-Roberson, and R. M. Eustice, "Mapping underwater ship hulls using a model-assisted bundle adjustment framework," *Robotics and Autonomous Systems, Special Issue on Localization and Mapping in Challenging Environments*, vol. 87, pp. 329–347, 2017.

4. S. M. Chaves, A. Kim, E. Galceran, and R. M. Eustice, "Opportunistic sampling-based active SLAM for underwater visual inspection," *Autonomous Robots*, vol. 40, no. 7, pp. 1245–1265, 2016.

5. P. Ozog, N. Carlevaris-Bianco, A. Kim, and R. M. Eustice, "Long-term mapping techniques for ship hull inspection and surveillance using an autonomous underwater vehicle," *Journal of Field Robotics, Special Issue on Safety, Security and Rescue Robotics*, vol. 33, no. 3, pp. 265–289, 2016.

6. N. Carlevaris-Bianco, A. K. Ushani, and R. M. Eustice, "University of Michigan North Campus long-term vision and lidar dataset," *International Journal of Robotics Research*, vol. 35, no. 9, pp. 1023–1035, 2015.

7. G. Pandey, J. R. McBride, S. Savarese, and R. M. Eustice, "Automatic extrinsic calibration of vision and lidar by maximizing mutual information," *Journal of Field Robotics, Special Issue on Calibration for Field Robotics*, vol. 32, no. 5, pp. 696–722, 2015.

8. S. M. Chaves, R. W. Wolcott, and R. M. Eustice, "NEEC research: Toward GPS-denied landing of unmanned aerial vehicles on ships at sea," *Naval Engineers Journal*, vol. 127, no. 1, pp. 23–35, 2015.

9. A. Kim and R. M. Eustice, "Active visual SLAM for robotic area coverage: Theory and experiment," *International Journal of Robotics Research*, vol. 34, no. 4-5, pp. 457–475, 2015.

10. N. Carlevaris-Bianco, M. Kaess, and R. M. Eustice, "Generic node removal for factor-graph SLAM," *IEEE Transactions on Robotics*, vol. 30, no. 6, pp. 1371–1385, 2014.

11. J. M. Walls and R. M. Eustice, "An origin state method for communication constrained cooperative localization with robustness to packet loss," *International Journal of Robotics Research*, vol. 33, no. 9, pp. 1191–1208, 2014.

12. C. Murphy, J. M. Walls, T. Schneider, R. M. Eustice, M. Stojanovic, and H. Singh, "CAPTURE: A communications architecture for progressive transmission via underwater relays with eavesdropping," *IEEE Journal of Oceanic Engineering*, vol. 39, no. 1, pp. 120–130, 2014.

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Chapters in books

1. S. M. Chaves, E. Galceran, P. Ozog, J. M. Walls, and R. M. Eustice, *Workshop on Sensing and Control for Autonomous Vehicles: Applications to Land, Water and Air Vehicles*. Alesund, Norway: Springer, June 2017, ch. Pose-graph SLAM for underwater navigation, in Press.

2. J. R. McBride, J. C. Ivan, D. S. Rhode, J. D. Rupp, M. Y. Rupp, J. D. Higgins, D. D. Turner, and R. M. Eustice, "A perspective on emerging automotive safety applications, derived from lessons learned through participation in the DARPA grand challenges," in *The DARPA Urban Challenge - Autonomous Vehicles in City Traffic*, ser. Springer Tracts in Advanced Robotics, M. Buehler, K. Iagnemma, and S. Singh, Eds. Springer, November 2009, vol. 56, p. 626.

3. H. Singh, C. Roman, O. Pizarro, B. Foley, R. Eustice, and A. Can, *Archaeological Oceanography*. Princeton, NJ, USA: Princeton University Press, July 2008, ch. High resolution optical imaging for deep water archaeology, pp. 30–40.

Government, university, or industrial reports (non-refereed)

1. R. M. Eustice, "Large-area visually augmented navigation for autonomous underwater vehicles," Ph.D. dissertation, Department of Ocean Engineering, Massachusetts Institute of Technology / Woods Hole Oceanographic Institution Joint Program, Cambridge, MA, USA, June 2005.

Other submitted publications

Non-refereed conference proceedings

1. R. Camilli, A. Mallios, D. Sakellariou, B. Bingham, R. Eustice, and J. Goudreau, "Real-time in-situ chemical and localization sensors integration in human occupied submersible for studying hydrothermal vents," in *Proceedings of the 9th Hellenic Symposium of Oceanography and Fishery*, vol. 1, Patra, Greece, May 2009, pp. 123–127.

2. R. M. Eustice, "Toward real-time visually augmented navigation for autonomous search and inspection of ship hulls and port facilities," in *Intl. Symposium on Technology and the Mine Problem*. Monterey, CA, USA: Mine Warfare Association (MINWARA), May 2008.

3. H. Singh, R. Eustice, C. Roman, and O. Pizarro, "The SeaBED AUV — a platform for high resolution imaging," in *Unmanned Underwater Vehicle Showcase*, Southampton, UK, September 2002.

Invited presentations

1. "Autonomous Cars and the Road Ahead", Michigan Space Grant Consortium Annual Fall Conference, Ann Arbor, Michigan, USA, Oct. 2016. **Keynote Speaker**

2. "UM's Work Toward Autonomous Cars", Institute for Robotics & Intelligent Machines, Georgia Tech, Atlanta, Georgia, USA, Apr. 2016.

3. "UM's Work Toward Autonomous Cars — the Next Generation Vehicle Project", University of Alberta, Edmonton, Alberta, Canada, Feb. 2016.

4. "UM's Work Toward Autonomous Cars — the Next Generation Vehicle Project", University of Toronto, Toronto, Ontario, Canada, Jan. 2016.

5. "University of Michigans Work Toward Autonomous Cars", Duo Security, Ann Arbor, Michigan, USA, Dec. 2015.

6. "The Use of 3D Prior Maps in Automated Driving", Schloss Dagstuhl — Leibniz-Zentrum für Informatik, Saarbrücken, Germany, Nov. 2015.

7. "University of Michigans Work Toward Autonomous Cars", Robotics Institute, Carnegie Mellon University, Pittsburgh, Pennsylvania, USA, Oct. 2015.
`https://www.youtube.com/watch?v=cEtpoeFZxCw`

8. "Persistent Visual SLAM for Autonomous Underwater Hull Inspection and Monitoring", Royal Institute of Technology (KTH), Stockholm, Sweden, Oct. 2015

9. "University of Michigans Work Toward Autonomous Cars", Focus on the Future Automotive Research Conference, Ann Arbor, Michigan, USA, Sep. 2015. **Keynote Speaker**

10. "UM's Work Toward Autonomous Cars — the Next Generation Vehicle Project", UM Transportation Research Institute, Ann Arbor, Michigan, USA, Aug. 2015.

11. "SLAM — A User's Perspective: From Automated Driving to Automated Hull Inspection", Workshop on The Problem of Mobile Sensors, Robotics Science & Systems Conference, Rome, Italy, Jul. 2015.

12. "University of Michigan's Work Toward Autonomous Cars", KAIST, Daejeon, S. Korea, Jul. 2015.

13. "University of Michigan's Work Toward Autonomous Cars", Seoul National University, Seoul, S. Korea, Jul. 2015.

14. "University of Michigan's Work Toward Autonomous Cars", IEEE Intelligent Vehicles Symposium, Seoul, S. Korea, Jul. 2015. **Plenary Speaker**

15. "Persistent Visual SLAM for Autonomous Underwater Hull Inspection and Monitoring", Workshop on Persistent Autonomy for Aquatic Robotics: the Role of Control and Learning in Single and Multi-Robot Systems, IEEE International Conference on Robotics and Automation, Seattle, WA, USA, May 2015.

16. "From Submersibles to Self-Driving Cars", Fanuc Robotics Seminar, Fanuc America Corporation, Rochester Hills, Michigan, USA, Apr. 2015.

17. "Advanced Mobility", Panelist Speaker — SXSW Interactive, Austin, Texas, USA, Mar. 2015.

18. "Toward Persistent SLAM in Challenging Environments", IEEE/RSJ International Conference on Intelligent Robots and Systems, Chicago, Illinois, USA, Oct. 2014. **Keynote Speaker**

19. "Robust and Persistent Visual SLAM for Autonomous Underwater Hull Inspection and Monitoring", Workshop on Robotic Monitoring, Robotics Science & Systems Conference, Berkeley, CA, USA, Jul. 2014.

20. "An Adaptive Active Visual SLAM Framework for Real-Time Area Coverage", Workshop on Autonomous Control, Adaptation, and Learning for Underwater Vehicles, Robotics Science & Systems Conference, Berkeley, CA, USA, Jul. 2014.

21. "Next-Generation Vehicle Project Overview", MS Program in Automotive Engineering, University of Michigan-Dearborn, Dearborn, Michigan, USA, Jun. 2014.

22. "SLAM in the Wild: Robust and Persistent Visual SLAM for Autonomous Underwater Hull Inspection", GRASP Lab Seminar Series, University of Pennsylvania, Philadelphia, Pennsylvania, USA, Feb. 2014.

23. "Real-Time Visual SLAM for Autonomous Hull Inspection using Visual Saliency", Control Seminar Series, University of Michigan, Ann Arbor, Michigan, USA, Mar. 2013.

24. "Real-Time Visual SLAM for Autonomous Hull Inspection using Visual Saliency", Department of Electrical and Computer Engineering, Michigan State University, East Lansing, Michigan, USA, Sep. 2012.

25. "Real-time Visual SLAM for Autonomous Hull Inspection using Visual Saliency", Division of Ocean Systems Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea, Jun. 2012.

26. "Real-time Visual SLAM for Autonomous Hull Inspection" and "Decentralized Synchronous-Clock Acoustic Navigation for Underwater Vehicles", Korean Unmanned Underwater Vehicle Workshop, Gyeongju, South Korea, Jun. 2012. **Keynote Speaker**

27. "Real-time Visual SLAM for Autonomous Hull Inspection", Graduate School of Oceanography, University of Rhode Island, Narragansett, Rhode Island, USA, Mar. 2012.

28. "Visual SLAM for Autonomous Hull Inspection", Workshop on Current Directions in Marine Vehicle Autonomy Research, IEEE/RSJ International Conference on Intelligent Robots and Systems, San Francisco, CA, USA, Sep. 2011.

29. "Enabling Future Driver Assistance and Active Safety Features via 3-D Maps and Advanced Localization Algorithms", Research and Advanced Engineering, Ford Motor Company, Dearborn, Michigan, USA, Aug. 2011.

30. "Visual SLAM in an Underwater Environment for Autonomous Hull and Harbor Inspection" and "3D Lidar and Omndirectional Camera Registration for 3D Mapping and Localization", VIBOT: European Masters in Computer Vision and Robotics, University of Girona, Spain, May 2011. **Keynote Speaker**

31. "Visual SLAM in an Underwater Environment for Autonomous Hull and Harbor Inspection", Midwest Computer Vision Workshop (MCVW), Ann Arbor, Michigan, USA, May 2011.

32. "Pose-graph Visual SLAM for Underwater and Urban Navigation", Laboratory for Computational Sensing and Robotics (LCSR), The Johns Hopkins University, Baltimore, Maryland, USA, Dec. 2010.

33. "Pose-graph Visual SLAM for Underwater and Urban Navigation", Virgina Center for Autonomous Systems (VaCAS), Virgina Tech, Blacksburg, Virginia, USA, Nov. 2010.

34. "Automotive Mapping, Localization, and Perception for Active Safety Applications", Focus on the Future Automotive Research Conference, Ann Arbor, Michigan, USA, Sep. 2010. **Keynote Speaker**

35. "Advanced Navigation and Mapping for Underwater Vehicles", Pan-American Advanced Studies Workshop on Dynamics and Control of Manned and Unmanned Marine Vehicles, Cartegena, Colombia, Jul. 2010.

36. "An Overview of Research Projects and Testbed at the Perceptual Robotics Lab (PeRL)", Australian Centre for Field Robotics, University of Sydney, Sydney, Australia, Nov. 2009.

37. "Micro and Macro Scale Navigation for Autonomous Underwater Vehicles: From Autonomous Hull Inspection to Hydrothermal Vent Search", Department of Aeronautics and Astronautics, Stanford University, Palo Alto, California, USA, Jun. 2009.

38. "Micro and Macro Scale Navigation for Autonomous Underwater Vehicles: From Autonomous Hull Inspection to Hydrothermal Vent Search", Anthony J. Healey Robotics Lecture Series, Naval Postgraduate School, Monterey, California, USA, Jun. 2009.

39. "Micro and Macro Scale Navigation for Autonomous Underwater Vehicles: From Autonomous Hull Inspection to Hydrothermal Vent Search", Monterey Bay Aquarium Research Institute, Moss Landing, California, USA, Jun. 2009.

40. "Monocular Vision-based SLAM for Autonomous Underwater Vehicles: Application to Autonomous Hull Inspection", Workshop on Visual Mapping and Navigation Outdoors, IEEE International Conference on Robotics and Automation, Kobe, Japan, May 2009.

41. "Perception-based Robotic Navigation and Mapping in the Marine Environment", NOAA Thunder Bay National Marine Sanctuary, Alpena, Michigan, USA, Jul. 2008.

42. "Toward New Advances in AUV Navigation: From Micro-scale to Macro-scale", Department of Applied Ocean Physics & Engineering, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA, Feb. 2007.

43. "Toward New Advances in AUV Navigation: From Micro-scale to Macro-scale", Department of Mechanical Engineering, MIT, Cambridge, Massachusetts, USA, Feb. 2007.

44. "Visually Navigating the RMS Titanic with SLAM Information Filters", Control Seminar Series, University of Michigan, Ann Arbor, Michigan, USA, Dec. 2006.

45. "Visually Augmented Navigation", Active Safety Group, Research & Advanced Engineering, Ford Motor Company, Dearborn, Michigan, Aug. 2006.

46. "Visually Navigating the RMS Titanic with SLAM Information Filters", Department of Computer Science, Johns Hopkins University, Baltimore, Maryland, USA, Apr. 2006.

47. "Visually Navigating the RMS Titanic with SLAM Information Filters", Stanford AI Lab, Stanford University, Palo Alto, California, USA, May 2005.

48. "Large-area Visually Augmented Navigation for AUVs", SLAM Workshop, IEEE International Conference on Robotics and Automation, Barcelona, Spain, Apr. 2005.

49. "Large-area Visually Augmented Navigation for AUVs", Department of Naval Architecture & Marine Engineering, University of Michigan, Ann Arbor, Michigan, USA, Mar. 2005.

Technology Transfer and Entrepreneurship

US and international patents awarded (title, number, date issued)

1. Field-based Torque Steering Control, Patent # 9618938, Apr. 11, 2017

Provisional patents and patents pending (title, date submitted)

1. Multipolicy Decision-Making via Changepoint-based Behavioral Prediction and Forward-Simulation-based Evaluation of Between-Vehicle Interactions, Apr. 30, 2015

2. Visual Localization within LIDAR Maps, Jan. 19, 2015

Industry interactions (consulting arrangements, board memberships, etc.)

1. Consultant, SeaRobotics Inc., SBIR Phase 1: "Precision Near Hull Navigation", 70+ hours, Sep. 2011 – Mar. 2012

Outreach Directly Related to Research

1. Co-developer of an autonomous underwater vehicle (AUV) exhibit at the Maritime Heritage Center in collaboration with NOAA Thunder Bay National Marine Sanctuary, Alpena, Michigan.

Other

Media Coverage

1. On Point with Tom Ashbrook, "Detroit Vs. Silicon Valley: The Future Of The Driverless Car", Jul. 21, 2015

2. Washington Post, "Driverless cars: A tremendous innovation with a glaring Achilles' heel", Mar. 16, 2015

3. Wall Street Journal, "Self-Driving Cars Could Cut Down on Accidents, Study Says", Mar. 5, 2015

4. EE Times, "Ford Self-Driving Cars on the Cheap", Jan. 20, 2015

5. U-M Record, "U-M student develops lower-cost self-driving car navigation system", Jan. 14, 2015.

6. Ford Motor Company Press Release and Event, "Ford Reveals Automated Fusion Hybrid Research Vehicle; Teams Up With University of Michigan, State Farm", Dec. 12, 2013.

7. Front page of the U-M Record, "New autonomous robot technology helps identify limpet mines on a ship, saving human lives from doing the dangerous job", Sep. 30, 2013.

8. ABC Channel 10 News, San Diego, CA, "Robotic Device Aims To Protect Navy Ships", originally aired July 31, 2012, 6 o'clock evening news.

Oceanographic Deployments

1. Bluefin HAUV hull inspection mapping of the *USNS Mercy*, San Diego, California, Mar. 2017.

2. Bluefin HAUV hull inspection mapping of the *USNS Curtiss*, San Diego, California, Jul. 2016.

3. Bluefin HAUV hull inspection mapping of the *USNS Curtiss*, San Diego, California, Mar. 2015.

4. Bluefin HAUV hull inspection mapping of the *USCGC Escanaba*, Boston, Massachusetts, Oct. 2014.

5. Bluefin HAUV hull inspection mapping of the *NS Savannah*, Baltimore, Maryland, Aug. 2014.

6. Bluefin HAUV hull inspection mapping of the *USNS Curtiss*, San Diego, California, Mar. 2014.

7. Bluefin HAUV hull inspection mapping of the *USS Saratoga*, Newport, Rhode Island, Aug. 2013.

8. Bluefin HAUV hull inspection mapping of the *USS Saratoga*, Newport, Rhode Island, May. 2013.

9. Bluefin HAUV hull inspection mapping of the *USNS Curtiss*, San Diego, California, Feb. 2013.

10. Bluefin HAUV hull inspection mapping of the *USCGC Seneca*, Boston, Massachusetts, Jul. 2012.

11. Bluefin HAUV hull inspection mapping of the *USCGC Seneca*, Boston, Massachusetts, Feb. 2012.

12. UMich Iver2 AUV optical sonar mapping of the NOAA Thunder Bay National Marine Sanctuary boundary waters off of Alpena, Michigan, Sep. 2011.

13. Multi-AUV cooperative acoustic navigation and communications, UMich Iver2 AUVs joint with WHOI SeaBED, Buzzards Bay, Woods Hole, Massachusetts aboard the *R/V Tioga*, Aug. 2011.

14. Bluefin HAUV hull inspection mapping of the *M/V Terry Bordelon*, Panama City, Florida, Jun. 2011.

15. Bluefin HAUV hull inspection mapping of the *USCGC Seneca*, Boston, Massachusetts; Apr. 2011.

16. Bluefin HAUV hull inspection mapping of the *USNS Curtiss*, San Diego, California, Feb. 2011.

17. Bluefin HAUV hull inspection mapping of the *USCGC Venturous*, Tampa, Florida, Oct. 2010.

18. UMich Iver2 AUV optical and sidescan sonar mapping of the NOAA Thunder Bay National Marine Sanctuary boundary waters off of Alpena, Michigan aboard the *R/V Storm*, Aug. 2010.

19. Bluefin HAUV hull inspection mapping of the *R/V Oceanus*, Woods Hole, Massachusetts, Jan. 2010.

20. Bluefin HAUV hull inspection mapping of the *King Triton*, Boston, Massachusetts, Nov. 2009.

21. UMich Iver2 AUV optical mapping of the Alpena-Amberley Ridge in Lake Huron for mapping ancient landscapes and hunting sites aboard the *R/V Blue Traveler*, Aug. 2009.

22. UMich Iver2 AUV sidescan sonar mapping of the NOAA Thunder Bay National Marine Sanctuary boundary waters off of Alpena, Michigan, Aug. 2008.

23. Bluefin HAUV hull inspection mapping of the *USS Saratoga*, Newport, Rhode Island, May 2008.

24. Multi-AUV southern mid-Atlantic ridge hydrothermal vent cruise aboard the *R/V Knorr*, Jan. 2008.

25. Multi-AUV arctic hydrothermal vent cruise aboard the ice-breaker *R/V Oden*, May/Jun. 2007.

26. SeaBED AUV deep water archaeology off of Santorini, Greece, aboard *R/V Aegaeo*, Jul. 2006.

27. SeaBED AUV deep water archaeology off of Chios, Greece, aboard *R/V Aegaeo*, Jul. 2005.

28. SeaBED AUV coral habitat mapping off of Puerto Rico aboard the *R/V Cape Hatteras*, Jun. 2004.

29. SeaBED AUV investigations of gas blowout structures off of North Carolina on the *R/V Cape Hatteras*, May 2003.

30. SeaBED AUV deep water coral mapping off of US Virgin Islands on *R/V Chapman*, Jun. 2003.

31. SeaBED AUV habitat mapping of the Stellwagen Bank National Marine Sanctuary on the *R/V Oceanus*, Mar. 2003.

32. SeaBED AUV deep water coral mapping off of Bermuda on the *R/V Weatherbird II*, Aug. 2002.

33. SeaBED AUV deep water coral mapping transects off of Puerto Rico, Jun. 2002.

34. DSL120A sonar sled evaluation trials off of Bermuda on the *R/V Atlantis*, Aug. 2001.

35. Odyssey AUV autonomous docking deployments off of Monterey, California as part of the Autonomous Ocean Sampling Network (AOSN) project, Aug. 1999.

Service

Major committee assignments in the Department, College, and/or University

Departmental Committees

- Member, Launch Committee for Prof. Ram Vasudevan, Department of Mechanical Engineering (Jan. 2015–May. 2016)
- Member, Robotics Ph.D. Part I Qualifying Exam Committee (AY 2014–2015)
- Member, Robotics Graduate Program Committee, AY 2014–2016
- Member, Lauro Ojeda's Associate Research Scientist Casebook Committee, Department of Mechanical Engineering, AY 2015–16
- Chair, Ad-hoc Experiential Lab Committee, Department of Naval Architecture & Marine Engineering, AY 2010–11
- Member, Ad-hoc Marine Engineering Committee, Department of Naval Architecture & Marine Engineering, AY 2010–11
- Member, Space Use Policy Committee, Department of Naval Architecture & Marine Engineering, AY 2010–11
- Member, Marine Hydrodynamics Laboratory Electronics Technician Hiring Committee, AY 2010–11
- Member, Lauro Ojeda's Assistant Research Scientist Casebook Committee, Department of Mechanical Engineering, AY 2009–10
- Member, Information & Technology Hiring Committee, Department of Naval Architecture & Marine Engineering, AY 2008–09
- Member, Ph.D. Part-1 Written Qualifying Exam Committees (Hydrodynamics, Controls, Probability & Random Processes), Department of Naval Architecture & Marine Engineering, AY 2006–2013, 2015
- Chair, Ocean Engineering Graduate Program Exploratory Committee, Department of Naval Architecture & Marine Engineering, AY 2006–07

College of Engineering Committees

- Member, Robotics Steering Committee, AY 2013–16
- Member, Robotics Director Search Committee, AY 2014–15
- Member, CoE-UMTRI Joint Search in Transportation Committee, AY 2013–14
- Member, Library Advisory Committee, AY 2012–13
- Member, Responsible Conduct of Research and Scholarship (RCRS) Task Force, AY 2011–12
- Member, MEng in Robotics and Autonomous Vehicles (RAV) council, AY 2010–2013
- Member, Research Advisory Committee, AY 2010–11
- Member, Dean's NA&ME Chair Search Advisory Committee, Member, AY 2011–11
- Member, Dean's NA&ME 5-Year Internal Review Committee, Member, AY 2008-09
- Member, CoE Search Committee for Autonomous Vehicles / Robotics, AY 2007–08
- Member, Scholastic Standing Committee, Member, AY 2007–10

University Committees

- Member, Unmanned Systems Policy Committee, AY 2015–16
- Member, University of Michigan Transportation Research Institute (UMTRI) Internal Review Committee, AY 2014–15
- Member, Mobility Transformation Facility (MTF) Design Committee, AY 2013–14

PhD Committees

1. Member, Dr. Hyun Jeong Cho (Chair: David Munson, Defended: Aug. 2016), "Autofocus and Back-Projection in Synthetic Aperture Radar Imaging", Department of Electrical Engineering & Computer Science: ECE Division, University of Michigan

2. Member, Dr. Moritz Niendorf (Chair: Anouck Girard, Defended: Mar. 2016), "Robustness of Mission Plans for Unmanned Aircraft", Department of Aerospace Engineering, University of Michigan

3. Member, Dr. Yang Liu (Chair: Hong Zhang, Defended: Feb. 2016), "Appearance SLAM in Changing Illumination Environment", Department of Computing Science, University of Alberta

4. Member, Dr. Jong Jin Park (Chair: Ben Kuipers, Defended: Dec. 2015), "Graceful Navigation for Mobile Robots in Dynamic and Uncertain Environments", Department of Mechanical Engineering, University of Michigan

5. Member, Dr. Caihao Weng (Chair: Jing Sun, Defended: Nov. 2015), "Kernel Based Model Parametrization and Adaptation with Applications to Battery Management Systems", Department of Naval Architecture & Marine Engineering, University of Michigan

6. Member, Dr. Johannes Strom (Chair: Edwin Olson, Defended: Apr. 2015), "Online Mapping and Perception Algorithms for Multi-Robot Teams Operating in Urban Environments", Department of Electrical Engineering & Computer Science: CSE Division, University of Michigan

7. Member, Dr. Andrew Richardson (Chair: Edwin Olson, Defended: Apr. 2015), "Learning and Searching Methods for Robust, Real-Time Visual Odometry", Department of Electrical Engineering & Computer Science: CSE Division, University of Michigan

8. Member, Dr. Zhenzhong Jia (Chair: Jing Sun, Defended: Sep. 2014), "Integrated SOFC/GT Systems with Improved Dynamic Capabilities for Mobile Applications", Department of Naval Architecture & Marine Engineering, University of Michigan

9. Member, Dr. Justin Rufa (Chair: Ella Atkins, Defended: Jul. 2014), "Location-Based Sensor Fusion for UAS Urban Navigation", Department of Aerospace Engineering, University of Michigan

10. Member, Dr. John Rebula (Chair: Art Kuo, Defended: Apr. 2014), "Mechanisms of Stability and Energy Expenditure in Human Locomotion", Department of Mechanical Engineering, University of Michigan

11. Member, Dr. Ying-Ze Bao (Chair: Silvio Savarese, Defended: Nov 2013), "Geometric and Semantic Scene Understanding", Department of Electrical Engineering & Computer Science: ECE Division, University of Michigan

12. Reader, Dr. John Vial (Chair: Tim Bailey, Defended: Aug. 2013), "Conservative Sparsification for Efficient Approximate Estimation", Australian Centre for Field Robotics, University of Sydney

13. Member, Dr. Wongun Choi (Chair: Silvio Savarese, Defended: May 2013), "Understanding Complex Human Behaviour in Images and Videos", Department of Electrical Engineering & Computer Science: ECE Division, University of Michigan

14. Member, Dr. Dhananjay Anand (Chair: Dawn Tilbury, Defended: Apr. 2013), "Semantic Networks for Hybrid Processes", Department of Mechanical Engineering, University of Michigan

15. Member, Dr. Jong-Hwa Yoon (Chair: Huei Peng, Defended: Dec. 2012), "Robust and Cost-effective Vehicle Sideslip Estimation by using GPS", Department of Mechanical Engineering, University of Michigan

16. Member, Dr. Changsun Ahn (Chair: Huei Peng, Defended: Dec. 2010), "Driver Models to Emulate Human Anomalous Behaviors Leading to Vehicle Lateral and Longitudinal Accidents", Department of Mechanical Engineering, University of Michigan

17. Member, Dr. Erik Talvitie (Chair: Satinder Singh (Baveja), Defended: Jun. 2010), "Simple Partial Models for Complex Dynamical Systems", Department of Electrical Engineering & Computer Science: CSE Division, University of Michigan

18. Member, Dr. Hsin-Hsiang Yang (Chair: Huei Peng, Defended: Apr. 2010), "Driver Models to Emulate Human Anomalous Behaviors Leading to Vehicle Lateral and Longitudinal Accidents", Department of Mechanical Engineering, University of Michigan

19. Reader, Dr. Matthew Johnson-Roberson (Co-Chairs: Stefan Williams and Oscar Pizarro, Defended: Nov. 2009), "Large-Scale Multi-sensor 3D Reconstructions and Visualizations of Unstructured Underwater Environments", Australian Centre for Field Robotics, University of Sydney

20. Member, Dr. Britton Wolfe (Chair: Satinder Singh (Baveja), Defended: Jun. 2009), "Modeling Dynamical Systems with Structured Predictive State Representations", Department of Electrical Engineering & Computer Science: CSE Division, University of Michigan

21. Member, Dr. Yanhui Xie (Chair: Jing Sun, Defended: Jan. 2009), "Modeling, Analysis and Control of DC Hybrid Power Systems", Department of Naval Architecture & Marine Engineering, University of Michigan

22. Member, Dr. James Bretl (Co-Chairs: Robert Beck and Guy Meadows, Defended: Jan. 2009), "A Time Domain Model for Wave Induced Motions Coupled to Energy Extraction", Department of Naval Architecture & Marine Engineering, University of Michigan

Service to government or professional organizations

Editorial Activities

- Associate Editor, IEEE Robotics and Automation Letters (2015–2016)
  (stepped down early to join TRI)
- Associate Editor, IEEE Transactions on Robotics (2012–2016)
- Associate Editor, IEEE Journal of Oceanic Engineering (2010–2015)
- Associate Editor (Area Chair), Robotics: Science and Systems Conference (2012, 2013)
- Associate Editor, IEEE International Conference on Robotics and Automation (2010, 2011, 2012, 2013)
- Associate Editor, IEEE International Conference on Intelligent Robots and Systems (2011, 2012)

Panel Reviews

- NASA Endurance ASTEP Antarctica Project Review Panel, Member (2008)
- NSF panel review: CISE–Robust Intelligence, Member (2007, 2009, 2011)

Conference Appointments

- Workshop/Tutorial Committee, 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems
- Local Arrangements Chair (with Edwin Olson), 2016 Robotics: Science and Systems (RSS) Conference at University of Michigan
- Best Paper Award Committee, IEEE International Conference on Robotics and Automation (2015)
- Program Committee, Robotics: Science and Systems (RSS) (2005–2011, 2015)
- Program Committee, Association for the Advancement of Artificial Intelligence (AAAI) Conference, (2011, 2012)
- Program Committee, Workshop on Algorithmic Foundations of Robotics (WAFR), (2012)
- Program Committee, RSS 2008 Workshop: Inside Data Association, (2008)
- Program Committee, IFAC Conference on Manoeuvring and Control of Marine Craft (MCMC), (2012)
- Program Committee, IFAC Workshop on Navigation, Guidance and Control of Underwater Vehicles (NGCUV), (2012)
- Session Chair, IEEE International Conference on Robotics & Automation (ICRA), (2011, 2014, 2015)
- Session Chair, IEEE International Conference on Robotics & Automation (ICRA), (2011, 2014)
- Session Chair, IEEE International Conference on Intelligent Robots & Systems (IROS), (2009, 2011, 2013, 2014)
- Session Chair, IEEE/OES AUV2008 Conference on Polar AUVs, (2008)
- Session Chair, Autonomous Underwater Vehicles for Scientific Applications (AUVSA) Conference, (2006)
- Session Chair, IEEE/MTS OCEANS Conference & Exhibition, (2005)

Proposal Reviews

- Reviewer, Swiss National Science Foundation, (2015)
- Reviewer, Netherlands Technology Foundation STW, (2015)
- Reviewer, NSF Division of Ocean Sciences, (2008, 2009, 2010, 2011, 2012, 2013)
- Reviewer, Strategic Environmental Research and Development Program (SERDP), (2007, 2008, 2015)

PROFESSIONAL MEMBERSHIP

- Member, American Society for Engineering Education (ASEE), (2007–Present)
- Senior Member, Institute of Electrical and Electronics Engineers (IEEE), (2010–Present)
- Member, Institute of Electrical and Electronics Engineers (IEEE), (2005–2010)
- Student Member, Institute of Electrical and Electronics Engineers (IEEE), (2000–2005)
- Member, IEEE Oceanic Engineering Society (OES), (2000–Present)
- Member, IEEE Robotics and Automation Society (RAS), (2004–Present)
- Member, Society of Naval Architects and Marine Engineers (SNAME), (2006–Present)

Contribution to diversity and climate

- University of Michigan Spring Commencement Marshal, (2006, 2007, 2015, 2016, 2017)
- Rackham Graduate School Commencement Marshal, (2014, 2015, 2016, 2017)

Outreach that is not part of research or teaching, or entrepreneurship

- Presentation to American Society of Mechanical Engineering Student Chapter Meeting, "From Marine Robotics to Self-Driving Cars", University of Michigan, Ann Arbor, Michigan, USA, Mar. 2015.
- Presentation to American Society of Civil Engineering Student Chapter Meeting, "From Marine Robotics to Self-Driving Cars", University of Michigan, Ann Arbor, Michigan, USA, Jan. 2015.
- Presentation to U-M Society of Physics Students Speaker Series, "Robotic Perception for Autonomous Navigation: From Autonomous Hull Inspection to Self-Driving Cars", University of Michigan, Ann Arbor, Michigan, USA, Oct. 2013.
- Presentation to SNAME Quarterdeck Student Chapter, "An Overview of Robotic Navigation and Mapping at PeRL", Ann Arbor, Michigan, Mar. 2011
- Presentation to Michigan Student Artificial Intelligence Lab, "An Overview of Robotic Navigation and Mapping at PeRL", Ann Arbor, Michigan, Nov. 2009
- Presentation to St. Johns Rotary Club, "Robotic Perception for Autonomous Vehicles", St. Johns, Michigan, Sep. 2009