James Campbell Kinsey

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Research Objectives

The development of novel parameter identification and state estimation techniques for nonlinear systems, with a focus on systems related to underwater robotics and oceanography. My research employs the methodology of: *(i)* collaborating with the engineering and oceanographic community to identify relevant state estimation and parameter identification problems; *(ii)* applying my background in systems theory, sensors, and oceanography to develop novel analytical solutions to these problems; and *(iii)* experimentally implementing these methodologies to advance the capabilities of underwater robots or improve our knowledge of oceanographic processes. Projects include the development of *in-situ* calibration techniques for navigation sensor calibration, dynamic model-based nonlinear state estimators for underwater robot navigation, and exploiting advances in underwater vehicle navigation to obtain fine spatial resolution gravity maps.

Education

Ph.D. **Mechanical Engineering, The Johns Hopkins University**, Baltimore, MD USA, 2006
Dissertation Title: *Advances in Precision Navigation of Oceanographic Submersibles*
Adviser: Professor Louis L. Whitcomb

M.S. **Mechanical Engineering, The Johns Hopkins University**, Baltimore, MD USA, 2002

B.E. **Mechanical Engineering, State University of New York at Stony Brook**
Stony Brook, NY USA, 1998

Employment (In electronic versions of this document, click on the blue text to access the URL.)

Woods Hole Oceanographic Institution, Woods Hole, MA USA
Deep Ocean Exploration Institute Postdoctoral Scholar — August 2007 - present
Advisers: Dr. Dana Yoerger (AOPE) and Dr. Maurice Tivey (GG)
Engineer I, Applied Ocean Physics and Engineering — June 1999 - September 1999
Engineering Assistant I, Applied Ocean Physics and Engineering — May 1998 - September 1998
Summer Student Fellow, Applied Ocean Physics and Engineering — June 1997 - September 1997

The Johns Hopkins University, Baltimore, MD USA
Visiting Research Scientist, Department of Mechanical Engineering — July 2007 - present
Postdoctoral Fellow, Department of Mechanical Engineering — July 2006 - July 2007
Graduate Student, Department of Mechanical Engineering — June 1999 - June 2006
On family leave of absence: January 2000 - January 2001

Integrated Coating Solutions, Huntington Beach, CA USA
Automation Consultant — January 2001 - August 2001

Center for Thermal Spray Research, Stony Brook, NY USA
Automation Engineer — June 2000 - January 2001

HD Systems, Inc., Hauppauge, NY USA
Design Engineer — January 1999 - June 1999

Peer Reviewed Journal Publications (In electronic versions of this document, click on the blue text to access the cited reference.)

[J6] D.R. Yoerger and J.C. Kinsey. Deep Ocean Surveying with Autonomous Underwater Vehicles. *Journal of Ocean Technology*. Submitted, under review.

[J5] S.A. Soule, V.L. Ferrini, J.C. Kinsey, D.J. Fornari, C. Sellers, S.M. White, K. Von Damm, S.M. Carbotte. Navigational infrastructure at the East Pacific Rise 9° 50'N area following the 2005-06 eruption: seafloor benchmarks and high-resolution multibeam surveys. *Geochemisty, Geophysics, Geosystems*, 9, Q11T04, November 2008.

[J4] J.C. Kinsey and L.L. Whitcomb. In-situ alignment calibration of attitude and Doppler sensors for precision underwater vehicle navigation: Theory and experiment. *IEEE Journal of Oceanic Engineering*. 32(2):286-299, April 2007.

[J3] J.C. Kinsey and L.L. Whitcomb. Adaptive identification on the group of rigid body rotations and its application to precision underwater vehicle navigation. *IEEE Transactions on Robotics*, 23(1):124-136, February 2007.

[J2] V.L. Ferrini, D.J. Fornari, T.M. Shank, J.C. Kinsey, S.A. Soule, S.M. Carbotte, M.A. Tivey, L.L. Whitcomb, D.R. Yoerger, and J. Howland. Sub-meter bathymetric mapping of the East Pacific Rise crest at 9°50'N linking volcanic and hydrothermal processes. *Geochemisty, Geophysics, Geosystems*, 8, Q01006, January 2007.

[J1] J. C. Kinsey and L. L. Whitcomb. Preliminary field experience with the DVLNAV integrated navigation system for oceanographic submersibles. *Control Engineering Practice*, 12(12):1541-1548, December 2004. Invited Paper.

Peer Reviewed Conference Publications (In electronic versions of this document, click on the blue text to access the cited reference.)

[CR3] J.C. Kinsey and L.L. Whitcomb. Model-Based Nonlinear Observers for Underwater Vehicle Navigation: Theory and Preliminary Experiments. *Proceedings of the 2007 IEEE International Conference on Robotics and Automation*, pages 4251-4256, April 2007, Rome, Italy.

[CR2] J.C. Kinsey and L.L. Whitcomb. Adaptive Identification on the Group of Rigid Body Rotations. *Proceedings of the 2005 IEEE International Conference on Robotics and Automation*, pages 3256-3261, April 2005, Barcelona, Spain.

[CR1] J.C. Kinsey and L.L. Whitcomb. Towards In-Situ Calibration of Gyro and Doppler Navigation Sensors for Precision Underwater Vehicle Navigation. *Proceedings of the 2002 IEEE International Conference on Robotics and Automation*, pages 4016-4023, May 2002, Washington DC.

Additional Conference Publications (In electronic versions of this document, click on the blue text to access the cited reference.)

[CA8] J.C. Kinsey, M.A. Tivey and D.R. Yoerger. Toward High-Spatial Resolution Gravity Surveying of the Mid-Ocean Ridges with Autonomous Underwater Vehicles. *Proceedings of the 2008 IEEE/MTS Oceans Conference*, September 2008, Quebec City, Canada.

[CA7] 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. *Proceedings of the 2008 IEEE/MTS Oceans Conference*, September 2008, Quebec City, Canada.

[CA6] L.L. Whitcomb, M.V. Jakuba, J.C. Kinsey, S.C. Martin, S.E. Webster, J.C. Howland, C. 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. *The Fourteenth Yale Workshop on Adaptive and Learning Systems*. June 2008, New Haven, CT.

[CA5] J.C. Kinsey, R.M. Eustice, and L.L. Whitcomb. A survey of underwater vehicle navigation: Recent advances and new challenges. *In Proceedings of the IFAC Conference of Manoeuvring and Control of Marine Craft*, September 2006, Lisbon, Portugal. Invited paper.

[CA4] J.C. Kinsey, D.A. Smallwood and L.L. Whitcomb. A New Hydrodynamics Test Facility for UUV Dynamics and Control Research. *Proceedings of 2003 IEEE/MTS Oceans Conference*, pages 356-361, September 2003, San Diego, CA.

[CA3] J.C. Kinsey and L.L. Whitcomb. Preliminary Experiments with a Calibration Technique for Gyro and Doppler Navigation Sensors for Precision Underwater Navigation. *Proceedings of the 13th International Symposium on Unmanned Untethered Submersible Technology*, August 2003, Durham, NH.

[CA2] J.C. Kinsey and L.L. Whitcomb. Preliminary Field Experience with the DVLNAV Integrated Navigation System for Manned and Unmanned Submersibles. *Proceedings of the 1st IFAC Workshop on Guidance and Control of Underwater Vehicles*, April 2003. Paper received the IMarEST prize for Best Paper by a Young Author.

[CA1] J.C. Kinsey. Drag Characterization in the Autonomous Benthic Explorer. *Proceedings of 1998 IEEE/MTS Oceans Conference*, pages 1696-1700, September 1998, Nice, France.

Conference Abstracts (In electronic versions of this document, click on the blue text to access the cited reference.)

[AC3] J.C. Kinsey, L.L. Whitcomb, D.R. Yoerger, J.C. Howland, V.L. Ferrini, and Ø. Hegrenæs. New navigation post-processing tools for oceanographic submersibles. *In Eos Trans. AGU, 87(52), Fall Meet. Suppl.*, 2006. Abstract OS33A-1678.

[AC2] L. Whitcomb, J. Kinsey, D. Yoerger, C. Taylor, A. Bowen, B. Walden, and D. Fornari. Navigation upgrades to the National Deep Submergence Facility vehicles D.S.V. Alvin, Jason 2, and the DSL-120A. *In Eos Trans. AGU 84(46), Fall Meet. Suppl.*, 2003. Abstract OS32A-0225.

[AC1] Y. Rzhanov, L. Mayer, D. Fornari, T. Shank, S. Humphris, D. Scheirer, J. Kinsey, and L. Whitcomb. High-resolution photo-mosaicing of the Rosebud hydrothermal vent site and surrounding lava flows, Galapagos Rift 86°W — Techniques and interpretations. *In Eos Trans. AGU 84(46), Fall Meet. Suppl.*, 2003. Abstract OS32A-0231.

Additional Publications (In electronic versions of this document, click on the blue text to access the cited reference.)

[T3] J.C. Kinsey. *Advances in Precision Navigation of Oceanographic Submersibles*. Ph.D. thesis, Johns Hopkins University, Baltimore, MD USA, June 2006.

[T2] J.C. Kinsey and L.L. Whitcomb. *Adaptive Identification on the Group of Special Orthogonal Matrices*. Technical Report, Johns Hopkins University, October 2004.

[T1] L.L. Whitcomb and J.C. Kinsey. *DVLNAV Installation and Configuration Manual*. Technical Report, Johns Hopkins University. April 2003.

Grants

[G2]	Title:	Development of Precision AUV Gravimeter to Enable Near-Bottom Gravity Surveys of Mid-Ocean Ridges
	PI:	D.R. Yoerger (PI), J.C. Kinsey, and M.A. Tivey
	Agency:	Woods Hole Oceanographic Institution
	Dates:	December 1, 2007 to November 30, 2009
	Amount:	$50,000
[G1]	Title:	Improved Navigation Techniques for Deep Oceanographic Submersibles
	PI:	J.C. Kinsey
	Agency:	Edwin Link Foundation
	Dates:	September 1, 2004 to September 1, 2005
	Amount:	$25,000

Field Deployments

[D8] **Juan de Fuca Ridge**, *R/V Thompson*, Summer 2008 — First science cruise for the *Sentry* AUV. Tasks included control and navigation software development, pre-dive engineering checks, and post-processing navigation data for use in high-resolution multi-beam maps of observatory sites.

[D7] **North Atlantic Ocean**, *R/V Oceanus*, April 2008 — *Sentry* AUV engineering cruise. Developed the navigation software used on Sentry. Also contributed to the vehicle control code and systems engineering.

[D6] **South Atlantic Ocean**, *R/V Knorr*, January 2008 — Engineering cruise investigating the use of multiple AUVs, employing acoustic modems for communication and navigation.

[D5] **Pacific Ocean**, *R/V Kilo Moana*, November 2007 — Participated in the engineering trials of *Nereus*, a hybrid ROV/AUV. Developed the navigation system used by *Nereus*.

[D4] **Sea of Crete and Black Sea**, *NRV Alliance*, August 2007 — Served as watch navigator for the *Hercules* ROV during science operations in the Sea of Crete and archaeological excavations in the Black Sea.

[D3] **Juan de Fuca Ridge, Pacific Ocean**, *R/V Atlantis*, July 2002 — Installation and testing of navigation upgrades to the DVLNAV underwater vehicle navigation system developed in collaboration with Louis Whitcomb on *DSV Alvin*.

[D2] **Juan de Fuca Ridge, Pacific Ocean**, *R/V Atlantis*, July 2002 — Deployed DVLNAV, a new underwater vehicle navigation system developed in collaboration with Louis Whitcomb, on the *Jason II* ROV.

[D1] **Bermuda Rise, Atlantic Ocean**, *R/V Atlantis*, June 2001 — Deployed DVLNAV, a new underwater vehicle navigation system developed in collaboration with Louis Whitcomb, on the *DSL120A* robot vehicle and on the *DSV Alvin* inhabited submersible.

Teaching Experience

The Johns Hopkins University, Baltimore, MD

Teaching Assistant — Design and Analysis of Dynamical Systems — Spring 2002

Awarded the 2003 Mechanical Engineering Department Teaching Assistant Award for my work in this class.

Teaching Assistant — Sensors and Actuators — Spring 2001

Awards (In electronic versions of this document, click on the blue text to access the URL.)

- Postdoctoral Scholar , Woods Hole Oceanographic Institution, 2007.
- Link Foundation Oceanographic Engineering Graduate Research Fellowship, 2004-2005.
- IMarEST Prize for Best Paper by Young Author, 1st IFAC Workshop on Guidance and Control of Underwater Vehicles, April 2003.
- 2003 Department of Mechanical Engineering Teaching Assistant Award, The Johns Hopkins University.
- Department Fellow, Department of Mechanical Engineering, Johns Hopkins University, 1999-2000.
- Summer Student Fellow, Woods Hole Oceanographic Institution, Summer 1997.
- Member, Tau Beta Pi and Pi Tau Sigma Honor Societies, inducted 1996.

Additional Information

- **Society Memberships** — American Geophysical Union, Institute of Electrical and Electronics Engineers (Robotics and Automation Society and Ocean Engineering Society)
- **Recent Invited Talks** — European Network on Marine Robotics Navigation Workshop, Killaloe, Ireland; Institute for Archeological Oceanography, University of Rhode Island; Interdisciplinary Science Seminar Series, Loyola College of Maryland; AOP&E Department Seminar, Woods Hole Oceanographic Institution; 2006 New Horizons in Science Briefing;
- **Recent Reviews** — *International Journal of Robust and Nonlinear Control*, *IEEE Transactions on Robotics*, *Journal of Systems and Control Engineering*, *IEEE Transactions on Control Systems Technology*, IEEE Conference on Robotics and Automation, *Oceanography* Magazine, *IEEE Journal of Oceanic Engineering*.