Curriculum Vitae

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Education

- Ph.D., Physics, University of California, Santa Cruz, *June 2001*.
- M.S., Physics, University of California, Santa Cruz, *Winter 1996*.
- B.S., Physics, San Francisco State University, *Spring 1993*.

Areas of Expertise

- Signal processing and data analysis
- Computer simulation
- HF radar and radiometer remote sensing
- Error analysis

Experience

June 2002 to date: Assistant Adjunct Professor (Jan 1, 2008 to date), **Assistant Research Engineer** for the last 6 years, Electrical Engineering Dept. University of California at Santa Cruz. Researcher involved with both in situ and remote sensing techniques for the marine environment. Instructor for the CE/EE Senior Capstone Design Project course.
1999-2001: Graduate Research Assistant, University of California at Santa Cruz. Conducted research into accuracy of shore-based HF ocean radar systems.
1997-1999: Graduate Teaching Assistant, University of California at Santa Cruz. Lab instructor for the Physics Dept.
1993-1994: Undergraduate Research Assistant, San Francisco State University. Conducted research designing systems for acoustic measurements of average flows in bays and estuaries.
1992-1993: Undergraduate Research Assistant, San Francisco State University. Conducted research on the development of sub-atomic particle detectors consisting of arrays of superconducting tunnel junctions.

Research Interests

Focus in the area of remote sensing has included both high frequency (HF) radar and microwave methods. The bulk of my experience is in HF ocean radar systems. These systems provide near real-time measurements of the ocean circulation within the top one or two meters of the ocean surface, on a 1-3 km resolution grid, with a range over the ocean surface of about 70 km with up to 200 km depending on operating frequency. Over recent years there has been a rapid growth in the acceptance and availability of HF surface current measurements. Systems are already in place at numerous locations around the coastal United States as well as many other locations around the world. These systems are now part of operational ocean monitoring projects such as the Coastal Ocean Currents Monitoring Program (COCMP). The ultimate goal of these observing systems is to integrate the measurements into data assimilating ocean circulation models. While the utility of these data products has gained a great level of acceptance over recent years, reliable estimates of the point-by-point uncertainties in the data remain unavailable even though such error values, together with their statistical descriptions, are required for proper assimilation into numerical circulation models. They are also needed for incorporation into the many new operational products that are being created based on continuous maps of ocean surface currents from HF radar networks. While estimates of overall uncertainty levels have been provided through comparisons with in situ measurements, the continuous, two-dimensional near-surface coverage of the radar cannot be duplicated and, therefore systematic errors, such as pointing biases in the current retrieval algorithms, cannot be assessed based solely on comparisons with in situ observations. Simulation-based or radar-to-radar comparison-based error analyses methods are the most appropriate for these error investigations and my research has relied strongly on these methods to obtain results.

A related area of interest is in the development of new data products from HF radar. These products include ship detection wind and wave measurements. As part of this effort I have worked on developing both software and hardware modifications for commercially available radar systems to enhance their performance in these areas.

My research into microwave remote sensing involves passive microwave-based measurement of ocean surface winds. Efforts to this point have focused on development of an inversion algorithm for vector winds from fully polarimetric passive microwave measurements and analysis of Monty-Carlo simulations to understand sources of error. The overall goal of this research is to couple a broadly adaptable, physically-based forward model under development at the University of Michigan, to an optimal inversion algorithm, to increase the understanding of unavoidable sources of error in the vector wind estimates and to evaluate the sensitivity of errors in the measurements on the various environmental and satellite measurement parameters.

Focus in the area of in situ sampling methods has been on the development of an autonomous surface vehicle for wireless-networked adaptive sampling in the marine environment. This research addresses the problem of obtaining measurements required to characterize critical ocean processes that occur at temporal and spatial scales that cannot be effectively sampled with traditional ship-, moored buoy-, or satellite-based approaches. Current oceanographic field programs are fundamentally limited by too few measurements, taken too slowly, and at too great a cost. Traditional studies are particularly limited in their ability to investigate the onset and immediate aftermath of episodic events ranging from earthquakes to toxic spills to ocean circulation features. The overreaching goal of this research is to develop vehicles that function as mobile ocean observing systems and provide broad and adaptive spatial coverage. Efforts over the past two years have resulted in the design, fabrication and testing of a prototype vehicle. This vehicle is designed to carry a suite of sensors including a hyperspectral light sensor, temperature sensor, inertial sensors and navigational electronics. My involvement has been the design and fabrication of the hull and propulsion systems and micro-controller programming and algorithm development.

Selected Publications

Refereed Journal Articles

Laws, K.E., David R. Lyzenga, Donald M. Wiberg and John F. Vesecky, 2006: Characterization of errors in vector wind retrievals from satellite-based polarimetric microwave radiometer measurements, *Geoscience and Remote Sensing Letters*, **Vol. 3, No.1** pp 45-48.

Laws, K.E., D.M. Fernandez and J.D. Paduan, 2000: Simulation Based Evaluations of HF Radar Ocean Current Algorithms, *Journal of Oceanic Engineering*, **Vol. 25, No. 4** pp 481-491.

Vesecky, J. F., C. C. Teague, D. M. Fernandez, J. D. Paduan, J. M. Daida, R. G. Onstott, K. Laws and P. E. Hansen, 1998: HF Radar Observations of Surface Currents on Monterey Bay California, *Backscatter*, **9, 3, 12-21**.

Laws, K.E., W.C. Barber, R.W. Bland, J.W. Carpenter, R.T. Johnson, J.L. Lockhart, J.S. Lee, R.M. Watson, S.E. Labove, C.A. Mears, and B. Ellman, 1993: A Prototype Dark Matter Detector Using a Series Array of Aluminum Superconducting Tunnel Junctions, *IEEE Trans. on Appl. Supercond*. **3, 2076.**

Barber, W.C., R.T. Johnson, J.S. Lee, K.E. Laws, and R.W. Bland, 1993: Measurement of Tunnel Junction Resistance During Formation, *Journal Low Temp. Phys.* **93,599.**

Stricker, D.A., D.D. Bing, R.W. Bland, S.C. Dickson, T.G. Dignan, R.T. Johnson, J.L. Lockhart, K.E. Laws, M.W. Simon, R.M. Watson, 1991: Particle Pulses from Superconducting Aluminum Tunnel Junction Detectors, *IEEE Transactions on Magnetics*, **27,2669**.

Ph.D. Dissertation

Laws, K.E., 2001: Measurements of Near Surface Ocean Currents Using H F Radar, Ph.D. Dissertation, University of California, Santa Cruz, CA.

Publications In Preparation

Laws, K. E., J. M. Paduan, J. F. Vesecky, 2008: Estimation and Assessment of Errors in High-Frequency Radar Ocean Current Measurements. *J. Oceanic & Atmos. Tech.*, Submitted.

Recent Conference and Symposia Publications

Vesecky, J. F., K. E. Laws and J. D. Paduan, 2008: Ship Monitoring with HF Surface Wave Radars:Impact of Frequency and Site Diversity, presented at 2008 Radio Oceanography Workshop, May 6-11, 2008, Boston MA, **Proc. IGARSS 08**, IEEE Press, Piscataway NJ.

Vesecky, J. F., K. D. Laws, C. Bazeghi and S. C. Petersen, 2007 : Prototype Autonomous Mini-buoy for use in a Wireless Networked, Ocean Surface Sensor Array, *The International Geoscience and Remote Sensing Symposium*, July 31-Aug. 4, 2006, Barcelona, *Proc. IGARSS 07*, IEEE Press, Piscataway NJ.

Vesecky, J. F., J. A. Drake, K. E. Laws, F. L. Ludwig, C. C. Teague, J. D. Paduan and D. Sinton, 2007:

Measurements of Eddies in the Ocean Surface Wind Field by a Mix of Single and Multiple-Frequency HF Radars on Monterey Bay California, presented at 2007 *International Geoscience and Remote Sensing Symposium*, July 31-Aug. 4, 2006, Barcelona, Spain, to appear in *Proc. IGARSS 07*, IEEE Press, Piscataway NJ.

Vesecky, J. F., K. D. Laws, C. Bazeghi and S. C. Petersen, 2007:Autonomous Mini-buoy Prototype for a Coordinated, Wireless Networked, Ocean-Surface-Sensor Array, *Proc. Oceans 2007 Europe*, Aberdeen, Scotland.

Vesecky, J. F., J. A. Drake, K. E. Laws, F. L. Ludwig, C. C. Teague, J. D. Paduan and D. Sinton, 2006 :Observing Eddy Features in the Ocean Surface Wind Field by Assimilating HF Radar and Anemometer Measurements in a Wind Model, presented at 2006 *International Geoscience and Remote Sensing Symposium*, July 31-Aug. 4, 2006, Denver CO, *Proc. IGARSS 06*, IEEE Press, Piscataway NJ.

Drake, J. A., F. L. Ludwig, J. F. Vesecky, K. E. Laws, C. C. Teague & D. Sinton, 2006: Synthesis of Real-Time Surface Wind Fields Over Coastal Land and Sea From HF Radar and Surface Anemometer Measurements, *EOS Trans. AGU, 87(36)*, Ocean Sci. Meet. Suppl., Abs. OS23B-06.

Vesecky, J. F., C. Bazeghi, K. D. Laws and S. C. Petersen, 2006: Station/Formation Keeping Prototype Minibuoy for use in a Wireless Networked, Buoy Array, *Eos Trans. AGU, 87*(36), Ocean Sci. Meet. Suppl., Abstract OS45D-27.

Vesecky, J. F. J. A. Drake, K. E. Laws, F. L. Ludwig, C. C. Teague, J. D. Paduan and L. A. Meadows, 2005: Using Multifrequency HF Radar to Estimate Ocean Wind Fields, *Proc. International Geoscience and Remote Sensing Symposium 2005*, IEEE Press, Piscataway NJ.

Vesecky, J. F. J. A. Drake, K. E. Laws, F. L. Ludwig, C. C. Teague and L. A. Meadows , 2005: Ocean Wind Fields from Multifrequency HF Radar: Nonlinear Retrieval and Integration into Coastal Wind Fields, Proc. 8th International Conference on Remote Sensing for Marine and Coastal Environments, Halifax Nova Scotia.

Laws, K. E., J. A. Drake, R. Harris, C. C. Teague and J. F. Vesecky, 2005: HF Radar Systems: A Comparison of Advantages, Limitations and Performance of Different Radar Systems and Data Processing Methods, Proc. 8th International Conference on Remote Sensing for Marine and Coastal Environments, Halifax Nova Scotia.

Vesecky, J. F. J. A. Drake, K. E. Laws, F. L. Ludwig, C. C. Teague, J. D. Paduan and L. A. Meadows, 2005: Wind field Measurements by HF radar & their Integration into Regional Wind Field Estimates, 5th Radio Oceanography Workshop, Costanoa CA.

Vesecky, J. F., K. E. Laws and R. Fay, 2005: Ship Detection and Monitoring Using Multi-frequency HF Radars on Monterey Bay, California, Proc. Dept. of Homeland Security: Working Together Conference, Boston MA, April.

Scholarships and Awards

- Physics and Astronomy Scholarship, SFSU, *January 1991*.