K A Y L E O N A R D G E M B A

Research and Development Engineer

Marine Physical Laboratory
Scripps Institution of Oceanography
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Citizenship: USA, Germany (dual)

Research interests

Acoustic signal and array processing in the presence of environmental noise

Using transiting surface ships as sources of opportunity for the purpose of array and environmental parameter characterization

Statistical signal processing and passive detection / localization of low-level acoustic sources

Development of adaptive and compressive sensing techniques for source localization and parameter estimation

Education

Doctor of Philosophy, Ocean and Resources Engineering 2014
University of Hawai'i at Mānoa

Thesis title: Characterization of underwater acoustic sources recorded in reverberant environments with application to SCUBA signatures

Dissertation Committee: Eva-Marie Nosal, Bruce Howe, Todd Reed, Brian Bingham, Dilmurat Asimov

M.S. in Chemical Engineering 2009
B.S. in Aerospace Engineering 2008
B.S. in Applied Mathematics 2008
California State University, Long Beach

Honors and Awards

1st Place International Student Challenge Problem in Acoustic Signal Processing 2014, Acoust. Soc. Am.

1st Place Master Category, AIAA Student Research Comp., 2009

Recipient Victoria Hall Scholarship, CSULB, 2009

Outstanding Baccalaureate Graduate, 2008, Aerospace Engineering, CSULB

Outstanding Engineering Student, 2008, Orange County Engineering Council

Professional Membership and Activity

Member of the Acoustical Society of America (ASA)

Member of ASA's Technical Committees on: Signal Processing, Acoustical Oceanography, and Underwater Acoustics

Session Chair (ASA Spring '17, Fall '17, '18, and '19 meeting)

Technical program organizer, Signal Proc. (ASA Fall '17, '18, '19 meeting)

Referee activity: IEEE J. Ocean. Eng., IEEE J. Sel. Topics Signal Process., ELSEVIER Signal Process., J. Acoust. Soc. Am.

Member of Tau Beta Pi and former Chapter President

Selected Seagoing Experience (Scientist at Sea)

MURI 2, Santa Barbara Channel Experiment (SIO, ~Aug 19)

Mid-frequency Noise Experiment 7, Billboard array (SIO, Apr 19)

Mid-frequency Noise Experiment 6, Billboard array (SIO, Aug 18)

Mid-frequency Noise Experiment 5, Billboard array (SIO, Apr 18)

Mid-frequency Noise Experiment 4, Billboard array (SIO, Aug 17)

Seabed Characterization Experiment (SIO, Mar 17)

Mid-frequency Noise Experiment, Billboard array (SIO, Jan 17)

MURI 1, Santa Barbara Channel Experiment (SIO, Aug 16)

Deployment of Pisces IV (HOV) with HURL (UHM, Jun 12)

Oahu Oceanographic & Acoustic Experiments (UHM, Mar 12)

Positions Held

Research and Development Engineer 2018-current
MPL, SIO, UCSD

- Data-driven underwater acoustic research approach with focus on broadband passive detection of low SNR sources and environmental parameter characterization (e.g., water column sound speed perturbations) using sources of opportunity
- Conduct, present, and publish independent research
- Guest Lecturer (e.g., adaptive processing in B. Kuperman's Ocean acoustics class)

Postdoctoral Researcher 2015-2017
MPL, SIO, UCSD

- Data driven research approach includes extensive processing of underwater acoustic experimental and supporting data
- Conduct, present, and publish independent research
- Student supervision during the summer
- Strong knowledge of acoustic propagation modeling and related software packages (e.g., KRAKEN, RAM, BELLHOP, SAGA, OASES)

Acoustic consulting 2013-current

- I help my clients with processing of acoustic data for a variety of applications (clients include aerospace companies (e.g., SpaceX) and chemical engineering companies)

Lecturer – Mathematics 2014
Kapi'olani Community College, UHM

- Duties included mentoring students and teaching of eight Elementary Algebra I & II classes during one calendar year

Visiting Scholar 2011
Stevens Institute of Technology, NY

- Research focus: maritime domain awareness, emergency response, and maritime system resilience
- Objective: test and assess capabilities of a multi-sensor layered port security infrastructure (sensors include underwater arrays, electro-optics, AIS, high-frequency radar, optical and SAR satellites)

Research Assistant and Scientific Diver 2009-2014
Dep. of Ocean and Resources Engineering, UHM

- Emphasis in signal and image processing using passive acoustics for sound source characterization and detection in reverberant environments
- Successful design and execution of four experiments recording SCUBA and rebreather data
- Tasks included conducting acoustic research within the HEAR laboratory (e.g., calibrating and testing new hardware) and deployments (e.g., AUVs owned by UHM or Liquid Robotics, bottom mounted instrumentation at Kilo Nalu shallow water observatory)
- Organization of educational outreach program (e.g., SOEST open house for high school students)
- Planning and execution of underwater acoustic research (self and in support of others)
- Regularly (weekly) assisted UHM Diving Safety Officer in training new scientific divers

Research Assistant 2008-2009
Department of Mechanical and Aerospace Engineering, CSULB

- Research focused on automated multidisciplinary design optimization methods for multi-hull vessels

Junior System Administrator 2005-2009
Department of Physics, CSULB

- Responsible for four computer labs, super computers, and server room
- Proficient with Linux research computers, network security, database applications, as well as with requirements for and execution of high-end parallel computing infrastructures

Lab Assistant, CALVEIN Rocket Project 2004-2008
Department of Mechanical and Aerospace Engineering, CSULB

- Personal research includes design, manufacturing, and testing of a LOX/propylene ablative engine
- The ablative engine successfully completed two static fire tests in 2008 and 2009 (see www.gemba.org)
- The refitted engine successfully completed a flight test in Feb. 2009 and reached a nominal height of 5000 ft. (first of its kind using propylene as fuel)

Platoon Leader, German Army. Rank: Lieutenant 2000-2003

- Final position: Executive Officer (logistics company)
- Received comprehensive leadership training at the German Officer School (Offizierschule des Heeres)
- Responsible for planning and execution of military exercises (+1000 participants with 100 soldiers under my command)
- Deployed 6 months in Sarajevo (Bosnia and Herzegovina), German Italian Battle Group, 2003

Refereed Publications

[9] **Gemba K L**, Nannuru S, Gerstoft P. (2019) Robust ocean acoustic localization with sparse Bayesian learning. IEEE J. Sel. Topics Signal Process., **13**(1), 49-60. (JSTSP 1st featured article)

[8] Nannuru S, **Gemba K L**, Gerstoft P, Hodgkiss W S, and Mecklenbräuker C F. (2019) Sparse Bayesian learning with multiple dictionaries. Signal Process., **159**, 159-170.

[7] Nannuru S, Koochakzadeh A, **Gemba K L**, Pal P, and Gerstoft P. (2018) Sparse Bayesian learning for DOA estimation using co-prime and nested arrays. J. Acoust. Soc. Am., **144**(5), 2719-2729.

[6] **Gemba K L**, Sarkar J, Cornuelle B, Hodgkiss W S, Kuperman W A. (2018). Estimating relative channel impulse responses from ships of opportunity in a shallow water environment. J. Acoust. Soc. Am., **144**(3), 1231-1244.

[5] **Gemba K L**, Nannuru S, Gerstoft P**,** and Hodgkiss W S (2017). Multi-frequency sparse Bayesian learning for robust matched field processing. J. Acoust. Soc. Am., **141**(5), 3411-3420.

[4] **Gemba K L**, Hodgkiss W S and Gerstoft P (2017). Adaptive and compressive matched field processing. J. Acoust. Soc. Am., **141**(1), 92-103.

[3] **Gemba K L**, Nosal E-M and Reed T R (2017). Estimating and removing colorations from the deconvolved impulse response of an underwater acoustic channel. J. Acoust. Soc. Am., **141**(1), EL6-EL10.

[2] **Gemba K L** and Nosal E-M (2016). Source characterization using recordings made in a reverberant underwater channel. Applied Acoustics, **105**(2016), 24-34.

[1] **Gemba K L**, Nosal E-M and Reed T R (2014). Partial dereverberation used to characterize open circuit SCUBA signatures. J. Acoust. Soc. Am., **136**(2), 623-633.

Magazine Publications

[1] B. G. Ferguson, R. L. Culver, and **K. L. Gemba**, "International Student Challenge Problem in Acoustic Signal Processing 2019," *Acoust. Today*, vol. 15, no. 1, pp. 71–73, 2019.

Invited Presentations, Conference Papers

[25] **Gemba K L**, Nannuru S, and Gerstoft P (2019, Jul). Robust source localization with sparse Bayesian learning. Underwater Acoustics International Conference and Exhibition, Crete, Greece. **Invited Presentation**

[24] **Gemba K L**, Paralta H V,Sarkar J, Cornuelle B, Hodgkiss W S, and Kuperman W A (2019, Jul). Using ships of opportunity to estimate sound speed perturbations by the tomographic method. Underwater Acoustics International Conference and Exhibition, Crete, Greece. **Invited Presentation**

[23] **Gemba K L**, Sarkar J, Cornuelle B, Hodgkiss W S, and Kuperman W A (2018, Nov). Using ships of opportunity for array element localization and relative channel impulse response estimation. J. Acoust. Soc. Am. 144 (5). **Invited Presentation**

[22] **Gemba K L**, Nannuru S, and Gerstoft P (2018, Nov). Multi-frequency sparse Bayesian learning for matched field processing in non-stationary noise. J. Acoust. Soc. Am. 144 (5). **Invited Presentation**

[21] Gerstoft P, **Gemba K L**, and Nannuru S (2018, Nov). DOA Estimation in Heteroscedastic Noise. J. Acoust. Soc. Am. 144 (5). **Invited Presentation**

[20] **Gemba K L** (2018, June). Using noise. Ambient Noise workshop, NRL **Invited Presentation**

[19] Durofchalk N C, **Gemba K L**, Sarkar J, and Sabra K G (2017, Jun). Extracting tomographic arrival time information from ships of opportunity in the Santa Barbara channel using blind deconvolution. J. Acoust. Soc. Am. 142 (6). **Invited Presentation**

[18] **Gemba K L**, Sarkar J, Cornuelle B, Durofchalk N C, Sabra K G, Hodgkiss W S, and Kuperman W A (2017, Jun). Differential arrival time accuracy using ships of opportunity. J. Acoust. Soc. Am. 142 (6). **Invited Presentation**

[17] Sarkar J, Cornuelle B, **Gemba K L**, Kuperman W A, Hodgkiss W S, Sabra K G, Tippmann J, and Verlinden C (2017, Dec). Active vs. passive moving source tomography: comparing results from the Santa Barbara Channel Experiment (SBCEx16) on sources of opportunity. J. Acoust. Soc. Am. 142 (6). **Invited Presentation**

[16] Nannuru S, **Gemba K L** and Gerstoft P (2017, Nov). Sparse Bayesian learning with multiple dictionaries, presented at IEEE GlobalSIP.

[15] **Gemba K L**, Nannuru S, Hodgkiss W S and Gerstoft P (2017, Jun). Multi-frequency sparse Bayesian learning for matched field processing. J. Acoust. Soc. Am. 141 (6). **Invited Presentation**

[14] **Gemba K L**, Sarkar J, Tippmann J D, Hodgkiss W S, Cornuelle B D, Kuperman W A, and Sabra K G (2017, Jun). Channel impulse response arrival uncertainty using source of opportunity for tomography. J. Acoust. Soc. Am. 141 (6).

[13] Kuperman W A, Cornuelle B, **Gemba K L**, Hodgkiss W S, Sarkar J, Tippmann J D, Verlinden C M, and Sabra K (2017, Jun). A tomography experiment using ships as sources of opportunity. J. Acoust. Soc. Am. 141 (6).

[12] Nannuru S, Gerstoft P, **Gemba K L** (2017, Mar). Sparse Bayesian learning with uncertain sensing matrix, IEEE ICASSP 2017.

[11] **Gemba K L**, S Nannuru, E Richards, Hodgkiss W S and Gerstoft P (2016, Nov). Robust multi-frequency sparse Bayesian learning: data results. J. Acoust. Soc. Am. 140 (5). **Invited Presentation**

[10] **Gemba K L**, S Nannuru, Hodgkiss W S and Gerstoft P (2016, Nov). Towards underwater channel impulse response estimation using sources of opportunity. J. Acoust. Soc. Am. 140 (5).

[9] S Nannuru, **Gemba K L**, Hodgkiss W S and Gerstoft P (2016, Nov). Robust multi-frequency sparse Bayesian learning: theory and simulations. J. Acoust. Soc. Am. 140 (5).

[8] **Gemba K L**, Hodgkiss W S and Gerstoft P (2016, May). Multiple snapshot and multiple frequency compressive matched field processing. J. Acoust. Soc. Am. 140 (5), 2082. **Invited Presentation**

[7] **Gemba K L**, Hodgkiss W S and Gerstoft P (2015, Nov). Single and multiple snapshot compressive matched field processing. J. Acoust. Soc. Am. 138 (3), 1928.

[6] **Gemba K L** and Nosal E-M (2014, June). Estimating source spectra from recordings made in a reverberant underwater channel. Paper presented at Underwater Acoustics International Conference and Exhibition, Rhodes, Greece.

[5] **Gemba K L** and Nosal E-M (2013). Source signature characterization and detection of open-circuit SCUBA regulators. J. Acoust. Soc. Am. 133, 3526.

[4] **Gemba K L**, Hlousek Z T and Papp Z (2013). Algebraic Solution of the Harmonic Oscillator With Minimal Length Uncertainty Relations, arXiv:0712.2078.

[3] **Gemba K L** and Nosal E-M (2011). Results from a prototype tetrahedral array for tracking sound sources in shallow water. J. Acoust. Soc. Am. 129 , 2675.

[2] Verma D and **Gemba K L** (2009). Flight Testing of a Prototype LOX/propylene Upper Stage Engine. AIAA Paper presented at the AIAA Region VI Student Conference, Long Beach, CA 2009.

[1] **Gemba K L**, Verma D and Besnard E (2008). Development and Testing of a Prototype LOX/propylene Upper Stage Engine. AIAA Paper presented at the 44th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit, Hartford, CT, July 2008.