

CURRICULUM VITAE - MARC PERLIN

April 2016

A. PERSONAL

A.1 Marc Perlin

A.2 Degrees:

Ph.D. University of Florida, 1989, Engineering Mechanics

M.C.E. University of Delaware, 1978, Civil Engineering

B.S. Drexel University, 1974, Civil Engineering

A.3 Positions at the University of Michigan:

2011- Director, Marine Hydrodynamics Laboratory

2004- Professor of Ocean Engineering, Department of Naval Architecture & Marine Engineering;
Professor of Mechanical Engineering

2007-2011 Professor of Civil & Environmental Engineering;

2002-2004 Associate Professor of Civil & Environmental Engineering

2002-2004 Associate Professor of Mechanical Engineering

1995-2004 Associate Professor of Ocean Engineering, Department of Naval Architecture & Marine Engineering

1989-1995 Assistant Professor of Ocean Engineering, Department of Naval Architecture & Marine Engineering

A.4 Positions at Other Institutions or Organizations:

Jan 2014- Visiting Professor (Sabbatical), University College Dublin, Dublin, Ireland
June 2014 with Professor Frederic Dias

Jan 2012- Visiting Scholar, State Key Lab – Coastal & Ocean Engineering,
Dec 2016 Dalian University of Technology, Dalian, China. (Annual Renewal).

Jan 2010- HaiTian (Sea-Sky) Scholar, State Key Lab - Coastal & Ocean Engineering,
Dec 2012 Dalian University of Technology, Dalian, China – Renewed.

Jan 2007- Visiting Professor (Sabbatical), Naval Arch & Ocean Engineering, SOTOP,
Jun 2007 University of Ulsan, Ulsan, Republic of Korea

Jan 2007- HaiTian (Sea-Sky) Scholar, State Key Lab - Coastal & Ocean Engineering,

Dec 2009	Dalian University of Technology, Dalian, China
Jan 1997- June 1997	Visiting Professor (Sabbatical), Fluid Mechanics and Heat Transfer, Mechanical Engineering, Faculty of Engineering, Tel Aviv University, Israel
May 1989- July 1989	Post Doctoral Associate, Engineering Mechanics, University of Florida
1987-1989	Graduate Research Assistant, Engineering Science, University of Florida
1983-1987	Directed the Coastal and Oceanographic Engineering Laboratory, University of Florida
1980-1983	Project Engineer, Coastal and Offshore Engineering and Research, Inc
1979-1980	Coastal Engineer, Woodward-Clyde Consultants
1978-1979	Coastal Researcher, Coastal Engineering Research Center, USACE
1976-1977	Research Assistant and Teaching Assistant, University of Delaware
1974-1975	Field Engineer, Raymond International-Soiltech Department

B. PROFESSIONAL OBJECTIVES

B.1 Candidate's statement of professional objectives:

Professional fulfillment includes: conducting research that is interesting, challenging, and timely, and makes a societal contribution as well as a scholarly one; attending conferences and receiving attention and accolades due to the high quality and timeliness of your research; educating students to a level and caliber such that they will be ready for the engineering challenges of this new century; and achieving these objectives without compromise. These objectives and goals are the reasons I joined the professoriate and they remain the focus of my professional career.

B.2 Honors and awards:

Fellow, American Society of Civil Engineers, elected 1998.

Invited Examiner — Tel Aviv University, Ph.D. Thesis, Julia Novak, “Hydrodynamics of Contact of a Microswimmer with a Large Body”, 2016

HaiTian (Sea-Sky) Scholar, State Key Lab - Coastal & Ocean Engineering, Dalian University of Technology, Dalian, China, 2007-209. Renewed for 2010-2012.

Elected Member, Coasts, Oceans, Ports, and Rivers Institute, 2001.

Award for Outstanding Accomplishment, NAME Department, 2005.

Award for Outstanding Accomplishment, NAME Department, 2001.

Invited Examiner — University of New South Wales, Ph.D. Dissertation of Student, Michael Allis, of Professor William Peirson, 2014.

Invited Panelist, Ecole Navales (French Naval Academy), Brest, France, May 2002, May 2003, June 2004.

Research Award, NAME Departmental award for research, 1995, 1997.

Fellow, Cooperative Institute for Limnology and Ecosystem Research (in conjunction with NOAA's Great Lakes Environmental Research Laboratory), 1990-.

Dean's List of Faculty-1996-1997.

Invited Examiner — Tel Aviv University, Ph.D. Thesis, Haiying Jian, “Experimental Measurements and Numerical Simulation of Nonlinear Water-Wave Groups”, 1999.

Phi Kappa Phi, 1988; **Tau Beta Pi**, 1974; **Chi Epsilon**, 1973.

C. TEACHING

C.1 Statement of Contributions to Teaching:

During my twenty-five-year tenure at the University of Michigan, I have contributed to teaching and education in several ways: at the department level; at the college level; and at the national level. Within my department, as evidenced below, I have introduced six new courses, and for the department/college, I have taught *twenty-two* distinct courses. Within the framework of the last course entitled *Drag Reduction Technologies*, I am completing a book (along with Steven Ceccio) for World Scientific publishers. Twenty two courses in 24 years, is a record of which I am proud, and one that has required a significant effort on my part. Among these courses are a cross-listed course that I have taught three times for the Mechanical Engineering Department (ME/AM/NA 627), a cross-listed course that I have taught five times (NA/AOSS/ENSCEN 420), and a course I have taught twice in the Civil & Environmental Engineering Department (CEE 325). As I generally feel that the rigor of the courses we teach has been declining over time, I have challenged continually my classes/students with detailed/rigorous notes and relevant and meaningful homework. I regularly include additional course hours over those scheduled (recitation-type sessions) to provide a forum for questions and discussions as well as for the presentation of solutions to problems/examples. Although I schedule office hours, students are advised to seek help whenever I am in my office. Overall, I feel that the strength of the curriculum in my home department and beyond has benefited from my efforts.

Regarding the teaching of fluid mechanics, in particular, I have made contributions at the *national* level. I have had a National Science Foundation grant to improve the teaching of undergraduate fluid mechanics (with W.W. Schultz, ME), and we proposed a broader NSF proposal that included several universities (Harvard University, Georgia Institute of Technology, Michigan State University, and University of Washington). This research on teaching has been unique in that rarely have engineering faculty from major research universities been involved in such endeavors. Due in part to the first project, the College requested we investigate the likelihood of consolidating its teaching of undergraduate fluid mechanics courses.

C.2 New Courses Introduced at the University of Michigan:

- NA 525 Drag Reduction Technologies (Formerly NA 590), Winter 2012, 9 enrolled. Winter 2013, 15 enrolled, Fall 2015, 12 enrolled.
- NA 492 Marine Engineering Laboratory II
- NA 481 Probabilistic Methods in Marine Systems
- NA 425 Physics of the Oceans
- NA 455 Coastal Dynamics and Sedimentation
- NA 340 Marine Dynamics I (significant revision)
- NA 321 Marine Hydrodynamics II (significant revision)

C.3 Courses Taught at the University of Michigan:

- NA 320 Marine Hydrodynamics I (Basic Fluid Mechanics and Waves)
- NA 321 Marine Hydrodynamics II (Propulsion and flows around bodies)
- CEE 325 Fluid Mechanics (Civil and Environmental Engineering)
- NA 340 Marine Dynamics I (Vibrations and Spectral Analysis)
- NA 381 Probabilistic Methods in Marine Systems
- NA 391 Marine Engineering Laboratory
- NA 420 Environmental Ocean Dynamics (Cross Listed AOSS 420, ENSCI 420)
- NA 425 Physics of the Ocean
- NA 431 Marine Engineering II
- NA 455 Coastal Dynamics and Sedimentation
- NA 481 Probabilistic Methods in Marine Systems (Probability, Statistics, Stochastic Processes, Spectral Analysis)
- NA 490 NEEC Research Topics
- NA 491 Marine Engineering Laboratory I
- NA 492 Marine Engineering Laboratory II
- NA 520 Intermediate Marine Hydrodynamics (Graduate Fluid Mechanics)
- NA 521 Directed Studies and Research in Marine Hydrodynamics (Fluid Mechanics)

NA 522	Experimental Marine Engineering (Laboratory course)
NA 525	Drag Reduction Technologies
ME 590	Research in a Selected Mechanical Engineering Topic (Signal Processing)
ME 590	Research in a Selected Mechanical Engineering Topic (Ice Mechanics)
NA 590	Reading and Seminar (Coastal Engineering; Marine Hydrodynamics)
AM 627	Wave Motion in Fluids (Cross Listed ME 627, NA 627)

C.4 Ph.D. Committees Chaired; M.S. Committees Chaired:

Completed Ph.D. Degrees:

Chao-Lung Ting, Ph.D., Winter 1994. Dissertation entitled “Boundary Conditions in the Vicinity of the Contact Line at a Vertically Oscillating Plate: An Experimental Investigation.”

Huanjay Lin, Ph.D. MEAM Department, Winter 1997. Dissertation entitled “The Vortical Structure of Capillary-Gravity Waves: An Experimental Investigation.”

Lei Jiang, Ph.D. Co-Chair with W.W. Schultz, MEAM. Winter 1997. Dissertation entitled “Nonlinear Gravity-Capillary Water Waves.”

Gary Lapham, Ph.D. Co-Chair with David Dowling, MEAM. 1998. Dissertation entitled “Wave-Surfactant Interaction.”

Ziyuan Liu, Ph.D. Co-Chair with W.W. Schultz, ME. Winter 2001. Dissertation entitled “Film Flow within an Axially Rotating Horizontal Cylinder and Contact Lines on an Oscillating Plate.”

Haiping He, Ph.D. Co-Chair with A. Troesch. Fall 2002. GSRA Support began 1998. Dissertation entitled “Hydrodynamics of Thin Plates.”

Wendy Sanders, Ph.D. Co-Chair with S.L. Ceccio, D.R. Dowling. GSRA support began 2001. Fall 2003. Dissertation entitled “Bubble drag reduction in a flat plate boundary layer at high Reynolds numbers and large scales.”

Xiaoqiang Bian, Ph.D. Co-Chair with W.W. Schultz, GSRA Support began Fall 2001. Fall 2003. Dissertation entitled “Liquid slug motion in an oscillatory capillary tube.”

Jinhyun Cho, Ph.D. Co-Chair with S.L. Ceccio. GSRA support began 2001. Winter 2004. Dissertation entitled “Conceptualization, development, and verification of a bubble void fraction instrument.”

Keary Lay, Ph.D. Candidate. GSRA Support began Jan, 1996. Supported through GSI. Fall 2005. Winter 2006. Dissertation entitled “An experimental and numerical investigation of rimming flow.”

Eric S. Winkel, Ph.D., ME (Co-Chair with SL Ceccio and Dave Dowling). Support began 2003. Fall 2006. Dissertation entitled “High-Reynolds Number Flat Plate Turbulent Boundary Layer Measurements and Skin-Friction Drag Reduction with Gas or Polymer Injection.”

Brian Elbing, Ph.D., ME (Co-Chair with SL Ceccio). Support began 2005. Winter 2009. Dissertation entitled “Skin-Friction Drag Reduction within Turbulent Flows.”

ZhiGang Tian, Ph.D., (Co-Chair with Wooyoung Choi). Support began Fall 2005. Winter 2010. Dissertation entitled “A Study of Two-Dimensional Unsteady Breaking Waves in Finite-Depth Water.”

Yuxiang Ma, Ph.D. (Dalian University of Technology). Consultant. Spring 2010.

Simo Makiharju, Ph.D. (Co-Chair with SL Ceccio). Fall 2011. “The Dynamics of Ventilated Partial Cavities over a Wide Range of Reynolds Numbers and Quantitative 2D X-ray Densitometry for Multiphase Flow.”

Gang Wang, Ph.D. (Dalian University of Technology). Consultant. Fall 2011.

Andrew Wiggins, Ph.D. (Co-Chair with SF Zalek). Winter 2014. “Hydroelastic response of surface-effect ship bow seals: large scale-experiments and post-buckling analysis.”

Fuzuli Agri Akcay, Ph.D. (Co-Chair with DG Karr), Winter 2016, “Prediction, Analysis, and Measurement of Fracture of Ductile Metals”.

Completed MS and MSE Degrees:

Mayank Agarwal, MSE. Graduated Winter, 2002. Co-Chair with W.W. Schultz. GSRA Support began Fall 2000.

Vikas Gaur, MS, Graduated 2002. Co-Chair with A. Atreya, ME.

James Gose, Winter 2012.

Jared DeFoe, Fall 2013.

Active Ph.D. students:

James Gose, Ph.D. candidate. Expected Winter 2016.

Joel Hartenberger, Ph.D. student. Expected Winter 2017.

Dianyong Liu, Ph.D. student (Dalian University of Technology). Expected Winter 2017.

Students supported for some part of an incomplete Ph.D.:

Mary Irene Wise, Ph.D. Student (Passed Parts 1 and 2 of Preliminary Exams), expected date of graduation was 1995. Project entitled “Cross-shore Length Scales of Longshore Bars and Associated Forcing,” SUSPENDED EDUCATION.

Jianhui He, Ph.D. Student (Passed Part 1 of Preliminary Exams), expected 1997. Project entitled “Experiments on Breaking Waves and Incipient Vorticity Generation,” SPECIAL LEAVE.

Post-Doctoral Research Associates

Xiaochun Shen, supported with ONR funds, 2004-2006.

Ghanem Oweis, supported with DARPA funds, 2004-2005.

Kyungjin Lee, supported DARPA funds, 2006.

Keary Lay, supported with ONR funds, 2006-March 2010.

Brian Elbing, supported with ONR funds, 2009-April 2010.

Simo Makiharju, 2012.

Chinese CSC Ph.D. Candidates and Faculty

Prof. Xiaozhou Ma, Dalian University of Technology, Dec 2013 – Nov 2014.

Dianyong Liu, March 2016 – February 2017

Hao Wu, ??? – ???

C.5 Undergraduate and Special Projects Directed:

Simeon Ryan, NA490 on literature review and database for structured surfaces, boundary layer flows, and drag reduction, Fall 2014.

Jonathan Holbert, NA490 on measurements and quantification of the inner boundary layer, Winter 2014.

Jason Bundoff, NA490 on mLCC measurements for the NEEC Prescribed Surfaces, Winter 2014.

Marc Plasseraud, U/G student at the MHL for Prof. Pierre Ferrant, Ecole Centrale Nantes, Fr. Summer 2013.

Weirang Jiang, Joint Institute student, special summer project piezo generation and propulsion. Summer 2011

Carolina Madrid, special summer project, mLCC experiments (with DJ Singer).

NEEC project entitled “Air Layer Drag Reduction for Energy Conservation,” with six undergraduate students including hourly support for part of their efforts and one Ph.D. student.

Two French Naval students from Ecole Navale classified as Visiting Scholars were directed for twelve week projects on blast panels using granular materials. Fall 2005.

Two French Naval students from Ecole Navale classified as Visiting Scholars were directed for eight week projects on bubble ingestion and propulsion. Winter 2004.

Two French Naval students from Ecole Navale classified as Visiting Scholars were directed for eight week projects on Morrison's Equation (with Armin Troesch). Winter 2003.

Two French Naval students from Ecole Navale classified as Visiting Scholars were directed for six week projects on Piezoceramic propulsion. Winter 2002.

Pål Hylland, Student at Norwegian University of Science and Technology and Visiting Scholar NAME/UM, conducting research under my auspice, Sep 97-Mar 98. Report issued.

Visiting NASA SHARP student, Terreka Peterson, Summer 2002.

C.6 Short Courses and Workshops Taught:

"Coastal Sediments-Coastal Processes-Coastal Modeling," sponsored by The American Society of Civil Engineers (during the Coastal Sediments '87 Conference), New Orleans, LA, 1987.

D. RESEARCH

D.1 Candidate's own statement of contributions to research:

Under US Navy leadership/NAVSEA, the NEEC has been continued, and my project was approved (with SL Ceccio) for three years for \$450,984. This is additional research on drag reduction and drag along bio-fouled surfaces.

Presently I am a Co-PI in an ongoing MURI funded by ONR on Superhydrophobic Surfaces for Drag Reduction. This effort includes researchers from UM and MIT, University of Minnesota, Johns Hopkins University, Stanford University, and the University of Texas Dallas. It is a three-year effort with a two-year possible extension funded for \$3.75M. Investigators are primarily from the fluid mechanics and the material sciences areas.

Another recently funded project is part of an American Bureau of Shipping Center at UM. I am funded to conduct Digital Image Correlation analysis (similar to PIV) on large-strain-to-fracture experiments. Funding in its initial year \$54K.

As an original Co-PI/Investigator of the NEEC (Naval Engineering Education Consortium) project, I am involved integrally in that \$50M effort.

An ongoing investigation into the processes of wave breaking has been underway for a MURI through ONR. The umbrella research funding is to continuously remote-sense the sea surface, predict the sea-surface elevation as a function of time and space, and then choose and control a surface ship through the seaway. I am working along with Wooyoung Choi of New Jersey Institute of Technology to experimentally determine the wave breaking threshold and predict/measure the subsequent energy dissipation. This effort has resulted in one published manuscript (*Phys. Fl.*), and one that is nearing submission.

A major ongoing investigation under the auspices of both DARPA and ONR considers gas injection and/or polymer injection in flows about bodies at large scales and high Reynolds number (2×10^8) to reduce friction drag. The results from this research are dual use: at slower

speeds, the viscous drag reduction on the surface of the vessels can result in huge fuel savings; however, our funding agencies are interested primarily with increasing surface and sub-surface vessel speeds for defense purposes (i.e. transporting and deploying troops rapidly, etc.). We have completed several phases of this research, and have one major phase (#9) remaining. We have quantified the persistence or lack of it at high Reynolds number and large scales and with hydrodynamically smooth and rough surface. This research has been conducted in the US Navy's Large Cavitation Tunnel, the largest low turbulence facility of its kind in the world. There have been three PhD students, several Post-Doctoral Research Associates, and other students involved in this research that has now spanned eight years. More than 10 publications in high-quality archival journals have resulted, and fundamental insight into the various processes gleaned. In total the research expenditures are in excess of \$10M.

In addition, I have had several students concentrate on the trijunction at a fluid-fluid-solid interface. It is well known that a non-integrable stress singularity exists at this so-called contact line, and that the boundary conditions there for a continuum description of the fluids interacting with the solid are unknown. We have investigated rectilinear flows, flows in rotating tubes, and most recently flows in horizontally-oscillated tubes (taking advantage of nonlinearity and asymmetric forcing to pump fluids) to try to determine a boundary condition as well as to understand the physics of the region. This problem, even when investigated through a canonical setup, presents a most difficult challenge, and has escaped quantification. Even the proper scaling of this problem remains elusive. Using both a contact-line approach and a disjoining pressure approach, we have had some success. We have submitted an invention disclosure, a first step in the patent application process. Additionally, we are investigating the "snap through" phenomenon that may have significant industrial applications in coating flows. Initiating rotation with a thin liquid puddle on the bottom, upon rpm increase, the fluid suddenly redistributes itself nearly uniformly around the inside of the circular cylinder. Coating of fluorescent fixtures is an industrial application where this technique might be extremely useful.

On the ocean engineering side of research, we completed a fundamental investigation of the fluid dynamics due to thin oscillating disks, and have published these results. This effort was funded by a JIP. This interesting problem is scientifically challenging, and has significant industrial relevance to the offshore oil industry. The vortex rings that may be generated and pair to travel from the structure at various trajectories have been investigated and quantified. This fundamental research considers periodic forcing resulting in aperiodic response due to turbulence and other complications and was very challenging. Few investigations of any such phenomena exist.

Over several years now, I have made fundamental contributions to free surface flows in which capillarity and gravity are both important. These fundamental contributions to the field of short surface waves culminated in a publication entitled "Capillary Effects on Surface Waves" in the most-cited journal in fluid dynamics, *Annual Review of Fluid Mechanics*.

More recently, due to contributions to breaking waves, I have been requested to write another manuscript for *Annual Review of Fluid Mechanics* on "Breaking Waves in Deep and Intermediate Waters," to appear 2013.

D.2 Research Programs Underway:

ONR project with SL Ceccio and AW Troesch entitled "ACV Resistance, Propulsion, and Powering Parameter Setting Study and Technology Assessment", April – Sep 2016. \$246,290.

NEEC project under the auspices of the US Navy, PI, High Resolution Quantification of Turbulent BL Flows along Biofilms and their associated Drag, NAVSEA, (with SL Ceccio) 2016-2018, \$450,984.

ABS on Fracturing Surfaces, Co-PI, Using Digital Image Correlation. Total grant \$86,700.

MURI on Superhydrophobic Surfaces. Co-PI 2012-2017. Total grant \$3.75M.

NEEC (Naval Engineering Education Consortium) project entitled Surface Roughness Effects on Drag, UM PI. 3 years at \$120k per year.

DURIP, Time-Resolved X-Ray Radiography and Computed Tomography System to Investigate Sheet Cavitation and Multiphase Flow, funded by ONR, \$170,000.

Weakly 3D breaking wave experiments with Dalian University of Technology. Initial experiments conducted in Summer and Fall 2013 in their new 3D wave basin.

NEEC (Naval Engineering Education Consortium) project, UM Co-PI/Investigator. Ceccio, Singer and Troesch PIs. \$50M. Perlin first project: 3 years at \$170k per year.

D.3 Grants and Contracts:

1- ONR project with SL Ceccio and AW Troesch entitled “ACV Resistance, Propulsion, and Powering Parameter Setting Study and Technology Assessment”, April – Sep 2016. \$246,290.

2- NEEC project under the auspices of the US Navy, PI, High Resolution Quantification of Turbulent BL Flows along Biofilms and their associated Drag, NAVSEA, 2016-2018, \$450,984.

3- ABS on Fracturing Surfaces, Co-PI, Using Digital Image Correlation. Total grant \$103,000, 2013-2014.

4- ABS on Fracturing Surfaces, Co-PI, Using Digital Image Correlation. Total grant \$147,302.

5- MURI Super Hydrophobic Surfaces, ONR, \$750,000 per year.

6- DURIP ONR, Time-Resolved X-Ray Radiography and Computed Tomography System to Investigate Sheet Cavitation and Multiphase Flow, \$170,000.

7- General Electric via ONR, Investigation of Friction Drag on Super-hydrophobic Surfaces, \$15k.

8- NEEC (Naval Engineering Education Consortium) project, Co-PI, \$50M. Project: Air Layer Drag Reduction, \$170k per year for three years; renewed for another three years at \$150k.

9- Project with S. Zalek and S. Ceccio, “T-Craft SES Bow Seal Experiments,” Ms. Kelly Cooper, ONR, \$2.7M.

- 10- \$137k with SL Ceccio, "Measurement of Skin Friction From a Turbulent Boundary Layer for Various Surfaces and Coatings," Through Ki-Han Kim, ONR.
- 11- \$2M with SL Ceccio and DR Dowling, "Influence of Unsteady Flows on Air Layer Drag Reduction," Through L. Pat Purtell, ONR.
- 12- \$97k with SL Ceccio, "Gas and Polymer Ingestion into a Water-Jet," Through Ki-Han Kim, ONR.
- 13- \$35k with DG Karr on Blast Panel. GAP funding through UM.
- 14- \$20k with University of Ulsan through Hyundai Heavy Industries SOTOP Project entitled "Two-dimensional flows due to high-speed impact on laterally unconfined granular prismatic sections," April 2007 – Sep 2008.
- 15- "Determining the Skin Friction of Hydrophobic Surfaces at High Reynolds Numbers," ONR STTR, in conjunction with Michigan Molecular Institute/Oxazogen Inc. (2007 \$21,000).
- 16- "Large-Scale Air Layer Drag Reduction," ONR, Co-PI with S. Ceccio, D.R. Dowling, two Post-Docs (2006-2007 \$1,005,223).
- 17- "Short-Term Forecasts of Evolving Nonlinear Wave Fields – Physical Experiments," PI, ONR MURI, Optimum Vessel Performance in Evolving Nonlinear Wave Fields, May 2005-2008. (~\$250k, MP portion, \$5M total).
- 18- "Exploration of Micro-Bubble and Air-Layer Drag Reduction," ONR extension to DARPA Friction Drag Reduction Program. Co-PI with S. Ceccio and D.R. Dowling. \$147,000.
- 19- "Assessment of Blast Panel Design," Office of the Vice President for Research, UM, to conduct drop tests to simulate blasts, and evaluate our fluid-structure interaction panel design. Co-PI D.G. Karr. May 2005-April 2006. \$25k.
- 20- "High Reynolds Number Micro-bubble and Polymer Drag Reduction Experiments", DARPA Friction drag-reduction program. Co-PI with S. Ceccio, D.R. Dowling, and M.J. Solomon. One integrated set of results and work effort. \$3,800,000, Sep 2003. Two Ph.D. students and one Post-Doc.
- 21- "Design of a High-Speed Friction Drag Reduction Experiment Using the William B. Morgan Large Cavitation Channel," ONR BAADR program. Co-PI with S. Ceccio, D.R. Dowling, and R.F. Beck. One integrated set of results; work effort and funding split equally. \$2,800,000 for Phases I and II (latter by competition: Awarded to us), includes several subcontractors. One Post-Doc.
- 22- "Microbubble and Polymer Drag Reduction at High Reynolds Numbers and Large Scales," DARPA/ONR Friction drag-reduction program. Co-PI with S. Ceccio and D.R. Dowling. One integrated set of results; work effort and funding divided equally. \$2,718,693, March, 2001. Two Ph.D. students, one MSE student.
- 23- "Workshop on Improving Undergraduate Fluid Mechanics," National Science Foundation, Chemical & Transport Systems and Division for Undergraduate Education, Co-PI W.W. Schultz, ME, and M.K. Smith, GaTech, 1 year, \$90,325 Aug 2000.

- 24- “Using Nonlinearity and Contact Lines to Control Fluid Flow in Microgravity,” National Aeronautics and Space Administration, Program in Microgravity Fluid Physics, May 2000 through Nov 2004, PI with W.W. Schultz, \$270,000. One Ph.D. student and one MSE student funded. Funds and effort equally divided.
- 25- “Hydrodynamics of Thin Plates,” Joint Industry Project (six major Petrochemical Corps), Co-PI with Armin Troesch, 1998 - 1999, \$325,000. One Ph.D. student.
- 26- “A Comprehensive Study for Great Lakes Shorelines,” Great Lakes Protection Fund, Co-PI with G.A. Meadows and T. Ozkan-Haller, 1998 - 2000, (no-cost extension through 2001), \$472,000 (UM, UW, OSU). UM NAME portion: \$200,000. One Ph.D. student.
- 27- “Prediction of the Low Frequency Wave Field on Open Coastal Beaches,” Office of Naval Research, assumed contract of H. Tuba Ozkan-Haller, now at Oregon State University (\$142,309). One Ph.D. student.
- 28- “On the Boundary Conditions at an Oscillating Contact Line,” National Aeronautics and Space Administration, Program in Microgravity Fluid Physics, PI with W.W. Schultz, 1996 - 2000, \$392,000. One Ph.D. student.
- 29- “Wind Addition to Gravity Wave Facility,” Office of Naval Research, University Research Initiative: Program in Ocean Surface Processes and Remote Sensing, PI, 1995 - 1997, \$115,000. One Ph.D. student (partial funding).
- 30- “Short-wave/Surfactant Interactions,” Office of Naval Research, PI, 1993 - 1995, \$51,078. One Post-Doctoral Research Associate and one Ph.D. student (partial funding).
- 31- “Radar Backscatter from Nonlinear Surface Waves,” Office of Naval Research, University Research Initiative: Program in Ocean Surface Processes and Remote Sensing, PI, 3-year to 5-year project, 1992 - 1997, \$596,551. One Ph.D. student.
- 32- “Experiments on Breaking Waves and Incipient Vorticity Generation,” Office of Naval Research, PI, \$180,000, 1993 - 1995. One Ph.D. student (partial funding).
- 33- “Cross-shore Length Scales of Longshore Bars and Associated Forcing,” NOAA Michigan Sea Grant, PI, \$81,102, 1991 -1993. One Ph.D. student.
- 34- “Experiments on the Mechanics of Steep/Near-Breaking Capillary and Gravity-Capillary Waves,” Office of Naval Research, PI, \$224,520, 1990 - 1993. One Ph.D. student.
- 35- “Experiments on Gravity-Capillary Waves,” Office of Naval Research, University Research Initiative, PI, \$10,182, 1990 - 1991.
- 36- “Experiments on Gravity-Capillary Waves,” Office of Naval Research, University Research Initiative, PI, \$14,250, 1989 - 1990.

D.4 New Research Programs Planned

1-ABS project on Jack-Up Platforms with Armin Troesch – on hold by ABS.

2-Proposal on breaking wave criterion via wave maker experiments.

3-Further study on breaking waves – combined numerical and experimental study of weakly three dimensional waves. Research with W. Choi, NJIT, Brian Haus, UMiami.. To NSF.

4-Hydroplastic blast panel research in collaboration with Hassan Mahfuz, FAU, and Idaho National Laboratories. Invited for full proposal (due 6 May 2011) for BAA 11-007.

E. PUBLICATIONS

E.1 Complete Articles in Refereed Publications:

K. Golovin, J.W. Gose, M. Perlin, S.L. Ceccio, and A. Tuteja, “Bio-Inspired Surfaces for Turbulent Drag Reduction,” *Phil Trans of the Royal Soc* Invited Submission, submitted April, 2016.

K. Golovin, J.W. Gose, M. Boban, J.M. Mabry, M. Perlin, S.L. Ceccio and A. Tuteja, “Design of Superhydrophobic Surfaces for Drag Reduction in Turbulent Flow,” resubmitted to *Nature Communications*, 2016.

J.W. Gose, K. Golovin, A. Tuteja, S.L. Ceccio, and M. Perlin, “Experimental Evaluation of Skin Friction along Superhydrophobic Materials in Fully-Developed Channel Flow,” to be submitted to *Physical Review Fluids*, 2016.

1- D. Liu, Y. Ma, G. Dong, and M. Perlin, “Detuning and Energy Dissipation during Nonlinear Wave Focusing in Intermediate and Deep Water,” *Ocean Engr*, Vol. 113, 215-233, 2016.

2- Marc Perlin and Miguel Bustamante, “A Robust Quantitative Comparison Criterion of Two Signals based on the Sobolev Norm of Their Difference,” *Journal of Engr Math*, DOI: 10.1007/s10665-016-9849-7 Mar 2016 (arXiv:1412.6977 [physics.flu-dyn]).

3- M. Perlin, D.R. Dowling, and S.L. Ceccio, “Passive and Active Friction Drag Reduction of Hydrodynamic Flows,” Freeman Scholar Lecture Review, Invited paper, DOI:10.1115/1.4033295, *Journal of Fluids Engr. ASME*, 2016.

4- D. Liu, Y. Ma, G. Dong, and M. Perlin, “An Experimental Study of Weakly Three-Dimensional Non-breaking and Breaking Waves,” DOI: 10.1016/j.euromechflu. 2015.03.007, *Euro J of Mechanics B/Fluids*, April 2015.

5- A.D. Wiggins, S.F. Zalek, M. Perlin S.L. Ceccio, L. Doctors and Etter, R.J., "Development of a Large Scale Surface Effect Ship Bow Seal Testing Platform," Selected as Significant Paper, *SNAME Transactions* 2015 (same as 11 below).

- 6- R.A. Bidkar, L. Leblanc, A.J. Kulkarni, V. Bahadur, S.L. Ceccio, and M. Perlin, "Skin-friction drag reduction in the turbulent regime using random-textured hydrophobic surfaces," Vol. 26 , 085108, *Physics of Fluids*, Aug 2014.
- 7- J.W. Yang, Hyun Park, H.H. Chun, S.L. Ceccio, Marc Perlin, Inwon Lee, "Development and performance at high Reynolds number of a skin-friction reducing marine paint using polymer additives," Vol. 84, 183-193, *Ocean Engineering*, 2014.
- 8- Y. Ma, G.H. Dong, Marc Perlin, X. Ma, "Extreme waves induced by modulational instability on adverse currents," DOI: 10.1063/1.4832715 *Physics of Fluids*, Vol. 25(1) Nov. 2013.
- 9- S. Makiharju, B.R. Elbing, A.D. Wiggins, S. Schinasi, J.-M. Vanden-Broeck, M. Perlin, D.R. Dowling, S.L. Ceccio, "On the scaling of air entrainment from a ventilated partial cavity," *Journal of Fluid Mechanics*, Vol. 732, 47-76, Oct. 2013.
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E.2 Shorter communications, letters, notes, or briefs in refereed publications:

None.

E.3 Refereed Conference or Symposium Presentations:

K. Golovin, J.W. Gose, M. Perlin, S.L. Ceccio, and A. Tuteja, “Three-phase roughness effects on Superhydrophobic surfaces for turbulent drag reduction,” Inter. Conf. Multiphase Flows, Firenze, Italy, May 2016.

J.W. Gose, K. Goloving, A. Tuteja, S.L. Ceccio, and M. Perlin, “Investigation of gas perfusion through porous media with and without super-hydrophobic coatings,” Inter. Conf. Multiphase Flows, Firenze, Italy, May 2016.

ONR Naval Hydrodynamics Symposium, 2016

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1-R.A. Bidkar, L. Leblanc, A.J. Kulkarni, V. Bahadur, S.L. Ceccio, and M. Perlin, “Skin-friction drag reduction in the turbulent regime using random-textured hydrophobic surfaces,” ASME Fluids Engineering Summer meeting 2014, *accepted*, but withdrawn – to journal.

2-S. Mäkiharju M. Perlin, and S.L. Ceccio, “Time Resolved X-ray Densitometry of Cavitating and Ventilated Partial Cavities,” 29th ONR Naval Hydrodynamics Symposium, Aug. 2012. Also published by International Shipbuilding Progress, IOS Press, 2013.

3-S. Mäkiharju, C. Gabillet, M. Perlin, S.L. Ceccio, “Time Resolved Two Dimensional X-Ray Densitometry of Ventilated Partial Cavity,” Proc. 8th Inter. Symposium on Cavitation CAV 2012, Aug. 2012.

- 4-S. Mäkiharju, B. R. Elbing, A. Wiggins, D. R. Dowling, M. Perlin and S. L. Ceccio, "Perturbed Partial Cavity Drag Reduction at High Reynolds Numbers," 28th ONR Naval Hydrodynamics Symposium, 2011.
- 5-Zhigang Tian, Marc Perlin and Wooyoung Choi, "Evolution of Nonlinear Surface Waves Under the Effects of Wave Breaking and Wind Forcing," 28th ONR Naval Hydrodynamics Symposium, 2011.
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- 7-A.D. Wiggins, S.F. Zalek, Marc Perlin, S.L. Ceccio, and L.J. Doctors, "Development of a Large Scale Surface Effect Ship bow Seal Testing Platform," FAST Conference, 2011.
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- 10-S.L. Ceccio, Marc Perlin and B.R. Elbing, "A Cost-Benefit Analysis for Air Layer Drag Reduction," SMOOTH Conference, Istanbul, Turkey, 20-21 May 2010.
- 11-Simo Mäkiharju, B.R. Elbing, A. Wiggins, D.R. Dowling, M. Perlin, and S.L. Ceccio, "Perturbed Partial Cavity Drag Reduction at High Reynolds Numbers," 28th ONR Naval Hydrodynamics Symposium, 2010.
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- 13-Simo Mäkiharju et al., "Ventilated Partial Cavity Flows at High Reynolds Numbers," International Conference on Multi-phase Flows, 2010.
- 14-D.G. Karr, Marc Perlin, B.R. Langhorst, H.S. Chu, "Blast Load Response of Steel Sandwich Panels with Liquid Encasement," 80th SAVIAC Symposium. San Diego, CA 2009.
- 15-R.J. Etter, S.L. Ceccio, D.R. Dowling, and Marc Perlin, "Experiments at High-Reynolds Number in the Large Cavitation Channel," 28th *American Towing Tank Conference*, Ann Arbor, Michigan, 9-10 August 2007.
- 16-B.R. Elbing, E.S. Winkel, M. Perlin, D.R. Dowling, S.L. Ceccio, "Investigation of Drag Reduction Methods by Air Injection beneath a Turbulent Boundary Layer at High-Reynolds-Number," 6th *Inter Conf on Multi-Phase Flows*, Leipzig, Germany, 9-13 July 2007.
- 17-H. He, A.W. Troesch, and M. Perlin, "Hydrodynamics of Damping Plates at Small KC Numbers", *IUTAM Symposium on Fluid-Structure Interaction in Ocean Engineering*, Hamburg, Germany, 23-27 June 2007.

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- 22-E. Winkel, S. Vanapalli, G. Oweis, D.R. Dowling, M. Perlin, M. Solomon, S.L. Ceccio, "Turbulent Boundary Layer Drag Reduction at High Reynolds Numbers Using Injected Polymer Solutions", ISDR, Busan, Korea, 5-9 June 2005.
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- 24-W.C. Sanders, J. Cho, E. Winkel, E. Ivy, R. Etter, D.R. Dowling, M. Perlin, and S.L. Ceccio, "Bubble drag reduction at large scales and high Reynolds numbers," 25th ONR Hydrodynamics Symposium, St. Johns, Canada, Aug 2004.
- 25-E. Winkel, M. Perlin, D.R. Dowling, and S.L. Ceccio, "Saltwater Effects on Microbubbles", U.S.-Japan Workshop on Microbubble Friction Drag Reduction, Maui, Hawaii, Nov 6-8, 2003.
- 26-L. Jiang, M. Perlin, and W.W. Schultz, "Contact Line Dynamics and Damping for Oscillating Free Surface Flows", Coastal Engineering Today, Gainesville, FL, Oct 8-10, 2003.
- 27-M. Perlin, S.L. Ceccio, D.R. Dowling, W.C. Sanders, J. Cho, E. Ivy, and E. Winkel, "Microbubble Drag Reduction at High Reynolds Number and Large Scales", Workshop on Cavitation and Propulsion, Brest, France, May, 2003.
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- 29-W.W. Schultz, M. Perlin, and Z. Liu, "Contact Line Flow in A Rotating Horizontal Tube," Proceedings of the 14th U.S. National Congress of Theoretical and Applied Mechanics, VPI, Blacksburg, VA, June, 2002.
- 30-W. Sanders, S.L. Ceccio, D.R. Dowling, and M. Perlin, "The University of Michigan HIPLATE Experiment," Third Symposium on Smart Control of Turbulence, National Maritime Research Institute, Tokyo, Japan, March 2002.

- 31-M. Perlin, W.W. Schultz, J.F. Foss, and M.K. Smith, "Improving Undergraduate Fluid Mechanics Across the Curriculum," American Society for Engineering Education, Annual Meeting, Albuquerque, New Mexico, June 2001.
- 32-Z. Liu, M. Perlin, and W.W. Schultz, "Fluid Flow in a Rotating Circular Cylinder," Proceedings of the Fifth Microgravity Fluid Physics and Transport Phenomena Conference, NASA, Cleveland, Ohio, Aug. 2000.
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50-M. Perlin, "Cross-shore Length Scales of Longshore Bars," *Advances in Coastal Engineering Conference*, University of Delaware, Nov. 1990.

51-M. Perlin and R.G. Dean, "An Efficient Numerical Algorithm for Wave Refraction/Shoaling Problems," *ASCE Coastal Structures '83*, 988-999, March 1983.

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54-R.G. Dean and M. Perlin, "Coastal Engineering Study of Ocean City Inlet, Maryland," *ASCE Coastal Sediments '77*, 520-542, Nov. 1977.

E.4 Refereed Conference Summaries of Abstracts:

E.5 Other Submitted Publications:

Other Manuscripts in Preparation:

1-"Snap Through and Reversal in Internal Flows in Rotating Cylinders," K. Lay, M. Perlin, and W.W. Schultz, *Physics of Fluids*, in preparation.

2-"Liquid slug motion and contact lines in an oscillatory capillary tube", X. Bian, M. Perlin, and W.W. Schultz, *Journal of Fluid Mechanics*, under complete revision.

E.6 Abstracts in Non-Refereed Conference Proceedings:

1-“Experimental Evaluation of Skin Friction along Superhydrophobic Materials in Fully-Developed Channel Flow,” American Physical Society, 68th Annual Meeting of the Division of Fluid Dynamics, 2015 (with J.W. Gose, K. Golovin, A. Tuteja, S.L. Ceccio).

2-“Micro PIV measurements of turbulent flow over 2D structured roughness,” American Physical Society, 68th Annual Meeting of the Division of Fluid Dynamics, 2015 (with J. Hartenberger).

3-“Investigation of Air Perfusion through Porous Media and Super-Hydrophobic Surface Active Gas Replenishment,” 68th Annual Meeting of the Division of Fluid Dynamics, 2015 (J. Gose, K. Golovin, A. Tuteja, S.L. Ceccio).

4-“Evaluation of Drag Reduction via Superhydrophobic Surfaces and Active Gas Replenishment in a Fully-Developed Turbulent Flow,” American Physical Society, 67th Annual Meeting of the Division of Fluid Dynamics, 2014, (with J. Gose, K. Golovin, A. Tuteja, and S. Ceccio).

5-“Turbulent Boundary Layer Facility to Investigate Superhydrophobic Drag Reduction,” American Physical Society, 66th Annual Meeting of the Division of Fluid Dynamics, 2013, (with J. Gose and S. Ceccio).

6-“Traveling waves and fold localization in hovercraft seals,” American Physical Society, 66th Annual Meeting of the Division of Fluid Dynamics, 2013, (with A. Wiggins, S.F. Zalek and S. Ceccio).

7-“Vertical gas injection into liquid cross-stream beneath horizontal surfaces,” American Physical Society, 66th Annual Meeting of the Division of Fluid Dynamics, 2013, (with I.-h. Lee, S. Makiharju, I.-w. Lee and S. Ceccio).

8-“Scaling of Partial Cavity Drag Reduction,” American Physical Society, 64th Annual Meeting of the Division of Fluid Dynamics, 2011, (with S.L. Ceccio, S. Makiharju, S. Schinasi).

9-“Air-Induced Drag Reduction at High Reynolds Numbers: Velocity and Void Fraction Profiles,” American Physical Society, 63rd Annual Meeting of the Division of Fluid Dynamics, 2010, (with B.R. Elbing, S. Makiharju, A. Wiggins, D.R. Dowling, S. Ceccio).

10-“Perturbed Partial Cavity Drag Reduction at High Reynolds Numbers,” American Physical Society, 63rd Annual Meeting of the Division of Fluid Dynamics, 2010, (with S. Makiharju, B.R. Elbing, A. Wiggins, D.R. Dowling, S. Ceccio).

11-“Mean profile of a high-Reynolds-number smooth-flat-plate turbulent boundary layer,” American Physical Society, 63rd Annual Meeting of the Division of Fluid Dynamics, 2010, (with D.R. Dowling, Ghanem F. Oweis, Eric S. Winkel, James M. Cutbirth, S. Ceccio).

12-“Disturbances to Air-Layer Skin-Friction Drag Reduction at High Reynolds Numbers,” American Physical Society, 62nd Annual Meeting of the Division of Fluid Dynamics, 2009 (w/ D.R. Dowling, B.R. Elbing, Simo Makiharju, A. Wiggins, S. Ceccio).

- 13-“Scaling of Polymer Degradation Rate within a High-Reynolds-Number Turbulent Boundary Layer,” American Physical Society, 62nd Annual Meeting of the Division of Fluid Dynamics, 2009 (w/ B.R. Elbing, M.J. Solomon D.R. Dowling, S. Ceccio).
- 14-“Partial Cavity Flows at High Reynolds Numbers,” American Physical Society, 62nd Annual Meeting of the Division of Fluid Dynamics, 2009 (w/ Simo Makiharju, B.R. Elbing, A. Wiggins, D.R. Dowling, S. Ceccio).
- 15-“Wave breaking onset and spectral distribution of energy loss due to laboratory generated breaking waves,” American Physical Society, 62nd Annual Meeting of the Division of Fluid Dynamics, 2009 (w/ Z. Tian, Wooyoung Choi).
- 16-“Diffusion of Drag-Reducing Polymers within a High-Reynolds-Number, Rough-Wall Turbulent Boundary Layer,” American Physical Society, 61st Annual Meeting of the Division of Fluid Dynamics, 2008 (w/ B.R. Elbing, D.R. Dowling, M.J. Solomon, S. Ceccio).
- 17-“Partial Cavity Drag Reduction,” American Physical Society, 61st Annual Meeting of the Division of Fluid Dynamics, 2008 (w/ S. Makiharju, K. Lay, R. Yakushiji, S. Ceccio).
- 18-“Air layer drag reduction,” American Physical Society, 60th Annual Meeting of the Division of Fluid Dynamics, 2007 (w/ B.R. Elbing, E.S. Winkel, D.R. Dowling, S.L. Ceccio)
- 19-“Near-wall PTV measurements in a high-Reynolds-number flat-plate turbulent boundary layer,” American Physical Society, 60th Annual Meeting of the Division of Fluid Dynamics, 2007 (w/ G.F. Oweis, E.S. Winkel, S.L. Ceccio, D.R. Dowling)
- 20-“High-Reynolds-number flat-plate turbulent boundary layer,” American Physical Society, 59th Annual Meeting of the APS Division of Fluid Dynamics, 2006 (w/ E.S. Winkel, J.M. Cutbirth, S.L. Ceccio, D.R. Dowling)
- 21-“Effect of bubble size on micro-bubble drag reduction,” American Physical Society Bulletin, 58th Annual Meeting of the Division of Fluid Dynamics, 2005 (w/ X. Shen, S. Ceccio)
- 22-“An experimental and numerical investigation of thin film flow in an axially rotating horizontal cylinder: Part II”, American Physical Society Bulletin, Vol. 49, 2004 (w/ W.W. Schultz and K. Lay)
- 23-“Ultrasound Preparation of Micro Bubbles for Drag Reduction Experiments”, American Physical Society Bulletin, Vol. 49, 2004 (w/ X. Shen, S. Ceccio, and M. Longo)
- 24-“Bubble size measurements for air injected into a turbulent boundary layer in fresh water, salt water, and surfactant solutions”, American Physical Society Bulletin, Vol. 49, 2004 (w/ E. Winkel, S. Ceccio, D.R. Dowling)
- 25-“An experimental and numerical investigation of thin film flow in an axially rotating horizontal cylinder,” American Physical Society Bulletin, Vol. 48, 2003. (w/ W.W. Schultz and K. Lay)
- 26-“Forced motion of liquid slugs,” American Physical Society Bulletin, Vol. 48, 2003. (w/ W.W. Schultz and X. Bian)

27-“Slug flow in a circular tube,” American Physical Society Bulletin, Vol. 47, 2002. (w/ W.W. Schultz and X. Bian)

28-“The motion of water slugs in horizontally oscillated glass tubes,” American Physical Society Bulletin, Vol. 46, 2001. (w/ W.W. Schultz and M. Agarwal)

29-“Axially rotating horizontal circular cylinder flows of thin films,” American Physical Society Bulletin, Vol. 45, 2000. (w/ W.W. Schultz and Z. Liu)

30-“Film flow inside an oscillating rotating cylinder,” American Physical Society Bulletin, Vol. 44, 1999. (w/ W.W. Schultz and Z. Liu)

31-“Non-intrusive surface tension measurement,” American Physical Society Bulletin, Vol. 44, 1999. (w/ W.W. Schultz)

32-“High Reynolds number oscillatory contact lines,” American Physical Society Bulletin, Vol. 44, 1999. (w/ W.W. Schultz and Z. Liu)

33-“Contact-line dynamics for water waves and high-Re flows,” American Physical Society Bulletin, Vol. 42, 1997.

E.7 **Books:**

Mitigation of Hydrodynamic Resistance, *World Scientific Publishing Co.*, submitted Jan 2014, Authors: Marc Perlin and Steven Ceccio. Published Nov 2014.

E.8 **Chapters in Books:**

1- Marc Perlin, W.Y. Choi, Zhigang Tian, “Plunging Breakers in Deep and Intermediate Waters,” *Annual Review of Fluid Mechanics*, doi: 10.1146/annurev-fluid-011212-140721, Vol. 45, 2013. (Also in E.8 and E.12.)

2-M. Perlin and J.H. Duncan, “Wave Height Measurements”, Handbook of Experimental Fluid Mechanics, Springer, May 2007.

3-M. Perlin and W.W. Schultz, “Capillary Effects on Surface Waves,” Annual Review of Fluid Mechanics, Vol. 32, 241-274, 2000 (Also shown in E.1 and E.12.).

4-J. Hammack, M. Perlin, and D. H. Henderson, “Resonant Interactions Among Ripples,” Nonlinear Topics in Ocean Physics, International School of Physics “Enrico Fermi” Summer Course, 1988. Published in 1991.

E.9 **INVITED Book Reviews:**

1-Ocean Waves: The Stochastic Approach by Michel K. Ochi, Reviewed for *Applied Mechanics Reviews*, 1998.

2-Water Wave Scattering by Barriers by B.N. Mandal and A. Chakrabarti, Reviewed for *Applied Mechanics Reviews*, Nov 2000.

E.10 Government, University, or Industrial Reports:

- 1-Armin W. Troesch and M. Perlin, "Hydrodynamics of Thin Plates," Joint Industry Project, 1998.
- 2-M. Perlin, H. Lin, and C.-I. Ting, "On parasitic capillary waves generated by steep gravity waves: an experimental investigation with spatial and temporal measurements," URI report in Ocean Surface Processes and Remote Sensing, No. 94-01, 1994.
- 3-M. Perlin, "Instabilities of Gravity-Capillary Water Waves," Ph.D. Dissertation, University of Florida, 1989.
- 4-M. Perlin, "Statistical Analysis of Visual Wave Observations and Gage/Radar Measurements," CERC Miscellaneous Paper 84-6, July 1984.
- 5-M. Perlin and R.G. Dean, "A Numerical Model to Simulate Sediment Transport in the Vicinity of Coastal Structures," CERC Miscellaneous Report No. 83-10, May 1983.
- 6-R.G. Dean, R.A. Dalrymple, M. Perlin, and B.Y.-H. Chen, "Sediment Budget and Sand Bypassing System Parameters for Delaware's Atlantic Coast," Delaware Department of Natural Resources and Environmental Control, 1983.
- 7-R.G. Dean, M. Perlin, and S. Schmidt, "Design Flow Conditions near Bottom, Phase I," prepared for the American Gas Association, Aug. 1983.
- 8-R.G. Dean and M. Perlin, "Determination of Shoreward Volume Rate of Transport of Disposed Dredged Material," in "Feasibility Study, Dredging/Nearshore Disposal Plan, Oregon Inlet, N.C.," Wilmington District, U.S. Army Corps of Engineers, 1983.
- 9-R.A. Dalrymple, P.A. Hwang, and M. Perlin, "Ocean Engineering Aspects of Kelp Farming," prepared for Argonne National Laboratory, 1982.
- 10-R.A. Dalrymple and M. Perlin, "An Analysis of Wave Propagation and Hurricane Statistics for Crystal River, Florida," prepared for the Committee of 100, Crystal River, Florida, 1982.
- 11-R.G. Dean, H. Wang, R.A. Dalrymple, R. Biggs, V. Klemas, and M. Perlin, "An Assessment of Shore Erosion in Northern Chesapeake Bay and of the Performance of Erosion Control Structures, Md. Department of Natural Resources, 1982.
- 12-R.A. Dalrymple, M. Perlin, and H. Wang, "Shore Protection Methods, Designs and Costs," in Lake Ontario Shoreline Protection Study, Buffalo District, U.S. Army Corps of Engineers, 1982.
- 13-R.A. Dalrymple and M. Perlin, "Investigation of Maximum Wave Crest Elevation at Bayway Isle," prepared for Seagate Investment, 1981.
- 14-"Coastal Engineering Investigation to Determine the Design Wave and Maintenance Dredging Requirements for Seaview Harbor," R. Cross and M. Perlin, (Woodward-Clyde Consultants), (1980).

15-“Geotechnical Investigation of Shou Du Iron Mine, Shuichang, China,” (Woodward-Clyde Consultants), prepared for Bethlehem Steel Corp., (1980).

16-“Underwater Cone Penetrometer and Vane Shear Testing in the Gulf of Alaska,” G. Tirey and M. Perlin (Woodward-Clyde Consultants), prepared for the USGS, (1980).

17-G. Tirey and M. Perlin, “Underwater Cone Penetrometer Testing to Determine Soil Anchoring Strengths in Port Townsend,” prepared for the Naval Civil Engineering Laboratory, 1980.

18-R.G. Dean, M. Perlin, and W.R. Dally, “A Coastal Engineering Study of Shoaling in Ocean City Inlet,” prepared for the Baltimore District, US Army Corps of Engineers, March 1978.

19-M. Perlin, “A Numerical Model to Predict Beach Planforms in the Vicinity of Littoral Barriers,” Masters Thesis, University of Delaware, 1978.

E.11 Publications (about my research or quotes) in popular press/magazines:

1-“Monty Halls and the Ghost Ship of Thunder Bay,” Tigress Productions for BBC Channel 5, Windiate sinking in the MHL, air date 16 Dec 2013.

2-“Proposed Cloaking Device for Water Waves Could Protect Ships at Sea,” *Science Magazine*, Adrian Cho, 2 March 2012.

3-“Slippery Ships that Float on Air,” *Scientific American*, Dec 2008.

4-“Dialog on the University of Ulsan,” *Gyeongsang Ilbo Newspaper*, Ulsan and Gyeongsang Province, Republic of Korea, 15 May 2007.

5-“Ocean Flyer,” *Engine*, June, 2006.

6-“Slippery Ships Float on Thin Air,” *New Scientist*, 18 Feb 2006.

7-“In Brief,” *Chronicle of Higher Education*, 3 Feb 1995.

8-“On Perlin-Walker research,” *Photonics Spectra*, Feb 1995.

9-“Wave-breaking research with lasers,” *Geotimes*, Vol. 40, May 1995.

E.12 INVITED Publications and Presentations:

1-Invited Presentation, M. Perlin, “Experimental Evaluation of Skin-Friction Drag Reduction along Super-Hydrophobic Surfaces in Fully-Developed Channel Flow”, University of California, Berkeley, CA, Feb. 2016.

2-Invited Presentation, M. Perlin, “On Drag Reduction,” Florida Atlantic University, Boca Raton, FL, Fall 2015.

3-Invited Presentation, M. Perlin, “Passive and Active Super-Hydrophobic Surfaces for Drag Reduction,” Texas A & M University, College Station, TX, 26 March 2015.

- 4-Invited Presentation, M. Perlin, "On the reduction of friction drag," Queen's University Belfast, Civil Engineering, Belfast, Northern Ireland, UK, 12 June 2014.
- 5-Invited Presentation, M. Perlin, "Gas injection for the reduction of friction drag," University College Dublin, School of Mathematical Sciences, Dublin, Ireland, 17 Jan 2014.
- 6-Invited Presentation, M. Perlin, "Gas injection for the reduction of friction drag," University College London, Mathematics Department, London, UK, 8 May 2012.
- 7-M. Perlin and S. Ceccio, *Mitigation of Hydrodynamic Resistance*, World Scientific Publishing Co., Published Nov 2014. (Also in E.7.)
- 8-Marc Perlin, W.Y. Choi, and Zhigang Tian, "Plunging Breakers in Deep and Intermediate Waters," *Annual Review of Fluid Mechanics*, doi: 10.1146/annurev-fluid-011212-140721, Vol. 45, 2013. (Also in E.8 and E.12.)
- 9-Invited Presentation, "Air Layer Drag Reduction," KAIST, Daejeon, Korea, 9 July 2010.
- 10-Invited Presentation, "Air Layer Drag Reduction," Pusan National University, Busan, Korea, 5 July 2010.
- 11-Invited Presentation, "Impact Forces of Wedges on Granular Materials and Subsequent Flows," University of Ulsan, Ulsan, Korea, 24 February 2009.
- 12-Invited Presentation, "Polymer and Bubble Drag Reduction in Large Scale, High Reynolds Number External Flows over a Flat Plate and their Relation to Ship Resistance," Shanghai Jiao Tong University, Shanghai, China, 27 June 2008.
- 13-Invited Presentation, "Nature Assisted Erosion Accretion Systems," Dalian University of Technology, Dalian, China, 19 June 2008.
- 14-Invited Presentation, "Drag Reduction on Large Flat Plates," Pohang University of Science and Technology (POSTECH), Pohang, Korea, 15 June 2007.
- 15-Invited Presentation, "Friction Drag Reduction on Ships," Hyundai Heavy Industries Research & Development, Ulsan, Korea, 8 June 2007.
- 16-Invited Presentation, "Science and Engineering of Friction Drag Reduction on Ships," University of Ulsan, SOTOP, Naval Architecture & Ocean Engineering, Korea, 13 April 2007.
- 17-Invited Presentation, "Engineering of Friction Drag Reduction," Yeungnam University, Mechanical Engineering, Yeungnam, Korea, 23 March 2007.
- 18-Invited Presentation, "Science and Engineering of Friction Drag Reduction on Ships," National Cheng Kung University, Systems and Naval Mechatronic Engineering, Tainan, Taiwan, 29 December 2006.
- 19-Invited Presentation, "Friction Drag Reduction on Ships", United Ship Design and Development Center, Taipei, Taiwan, 26 December 2006.

- 20-Invited Presentation, "Thin Film Flow in an Axially Rotating Horizontal Cylinder," National Taiwan University, Engineering Science and Ocean Engineering, Taiwan, 25 December 2007.
- 21-Invited Publication, R.J. Etter, J.M. Cutbirth, S.L. Ceccio, D.R. Dowling, and Marc Perlin, "High Reynolds Number Experimentation in the U.S. Navy's William B. Morgan Large Cavitation Channel", *Measurement Science and Technology*, Vol. 16, 1701-1709, 2005.
- 22-Invited Publication, Special Issue on Water Wave Measurement, *Measurement Science and Technology*, requested 2005.
- 23-Invited Presentation, W.C. Sanders, J. Cho, D.R. Dowling, M. Perlin and S.L. Ceccio, "Bubble drag reduction at large scales and high Reynolds numbers," 34th AIAA Fluid Dynamics Conference and Exhibit, Portland, OR, 2004, Paper No. 2004-2393.
- 24-Invited Presentation, "Using contact line dynamics to control fluids in microgravity", *Seventh Microgravity Fluid Physics and Transport Phenomena*, Cleveland, OH, June, 2004.
- 25-Invited Presentation, "Air Injected Bubbles in Seawater and Surfactant Mixtures, Impedance Measurements to Determine Bubble Void Fraction," *U.S.-Japan Workshop on Microbubble Friction Drag Reduction*, Maui, HA, Nov 2003.
- 26-Invited Presentation, "Some Thoughts on Microbubble Drag Reduction Diagnostics," *U.S.-Japan Workshop on Microbubble Friction Drag Reduction*, Maui, HA, Nov 2003.
- 27-Invited Presentation, "Asymmetric Axial Tube Forcing to Generate Mean Motion of a Liquid Slug," Istituto Nazionale per Studi ed Esperienze di Architettura Navale (INSEAN), Rome, Italy, 2003.
- 28-Invited Presentation, "Microbubble Drag Reduction at Large Scales and High Reynolds Numbers," University of Liege, Belgium, 2003.
- 29-Invited Presentation, "Bubble Drag Reduction," Istituto Nazionale per Studied Esperienze Di Architettura Navale (INSEAN), Rome, Italy, 2003.
- 30-Invited Presentation, "Microbubble Drag Reduction at High Reynolds Number and Large Scales," Ecole Navales (French Naval Academy), Brest, France, 2003.
- 31-Invited Paper, International Conference on Estuaries and Coasts, Extended by S.Y. Wang, National Center for Comp Hydroscience, 2003.
- 32-Invited Paper, C. Judge, A. Troesch, and M. Perlin, "Initial Water Impact of a Wedge at Vertical and Oblique Angles," *Journal of Engr Math*, Special Water Impact Issue, Vol. 48, 279-303, 2004. (Also shown in E.1.)
- 33-W.W. Schultz, M. Perlin and Z. Liu, "Contact line flow in a rotating horizontal tube," Proceedings of the 14th U.S. National Congress of Theoretical and Applied Mechanics, VPI, Blacksburg, VA, June 2002.
- 34-M. Perlin and W.W. Schultz, "Capillary Effects on Surface Waves," Annual Review of Fluid Mech., Vol. 32, 241-274, 2000. (Also shown in E.1 and E.8.)

35-Invited presentation, “Incipient wind-wave generation,” IUTAM Symposium, Three-dimensional Aspects of Air-Sea Interaction, Sophia-Antipolis, France, May 1998. (with K. Lay).

36-Invited Lecture, Technion—Israel Institute of Technology Mechanical Engineering, “Steep and Breaking (Triply-Periodic) Faraday Waves,” 14 Apr 97.

37-Invited Lecture, Tel Aviv University, Fluid Mechanics and Thermal Sciences, Mechanical Engineering. “Steep and Breaking (Triply-Periodic) Faraday Waves,” 26 Feb 97.

38-Invited Lecture, University of Maryland, Mechanical Engineering Dept. “Faraday waves,” 3 Nov 95.

39-Invited presentation on free-surface/interface phenomena for the IUTAM Congress, Kyoto, Japan, 1996.

40-Invited seminar, “Overview of most-recent Perlin-research efforts” Canada Centre for Inland Waters, 20 Feb 95.

F. TECHNOLOGY TRANSFER

Invention and Technology Disclosure towards patent of “Designing Superhydrophobic Surfaces with Unprecedented Mechanical Durability and Their Utility in Drag Reduction During Turbulent Flow,” Office of Technology Transfer, with A. Tuteja, J. Mabry, S.L. Ceccio, K.B. Golovin, J.W. Gose, M. Boban.

Invention and Technology Disclosure towards patent of “Blast and Impact Resistant Materials and Structures,” Case 2771, Office of Technology Transfer, with D.G. Karr.

Provisional Patent received, Aug-Sep 2004. **Patent approved** 15 April 2009. Patent completed 18 August 2009; U.S. Patent No. 7,575,797.

Invention and Technology Disclosure towards patent of “Nonlinear Oscillator to Control Fluid Flows,” Case 2640, Office of Technology Transfer, with W.W. Schultz.

G. ACTIVITIES ON DIVERSITY AND CLIMATE

As I believe that our traditionally strong engineering curriculum has been increasingly compromised, especially with regard to mathematics, I have retained rigorous standards in my classes, in many instances at the expense of my teaching evaluations. (For support of this latter notion, see the book by Biostatistics Prof. Valen Johnson.) Moreover, to ensure that the students are prepared for the challenges that they will face in the future, I have always sought to elevate the level of rigor.

In keeping with my overall philosophy, to improve and maintain the academic standards and climate in the College of Engineering, I have served on the Scholastic Standing Committee for four years; I have completed four years serving on the Faculty Committee on Discipline; and I presently chair the McIvor Award Committee that recognizes the best dissertation and accomplishments of a Ph.D. student in mechanics. I served for four years as an Engineering Advising Center advisor. Lastly, I am serving on the COE Curriculum Committee, and the Rules Committee (elected). In each of these undertakings, I have dealt fairly and evenly with students, as have others on the committees. Additionally, I served on the College’s Honors and

Awards Committee for two years--this committee's responsibility is of course to serve the faculty uniformly and fairly as it chooses its awardees. In so doing, it fosters a scholarly environment.

Lastly, I have advised three female Ph.D. students (Z. Liu, W.C. Sanders, and M. Wise), and this contributes to the number of women with doctorates in the workplace who serve as role models. In addition, through the NASA SHARP program, I had one African-American female student work in my lab during the summer.

H. SERVICE

H.1 Major Committee Assignments in the Department, College, and/or University:

i) Department:

Director, Marine Hydrodynamics Laboratory, 2011 - .
Experiential Learning, Ad Hoc Committee, 2010.
Dr. Steven F. Zalek, Research Investigator, Casebook Chair, 2009.
Prof. D.G. Karr, Promotion Committee, Member, 2009.
NAME Academic Affairs Committee, Chair, 2005 – 2006.
Chair, NAME UG Job & Intern Preparation – Mock Interviews, Panel Discussion, Resume, 2005 –.
Prof. A.N. Perakis, Promotion Committee, 2005, Chair.
Prof. W.-Y. Choi, Three-year Reappt. Comm., Chair
Honors Committee, 2003- 2008 (Civil & Environmental Engr Dept)
Prof. A.I. Sirviente, Two-year Reappt. & 3-Year Rev. Comm., Chair.
General Funds Committee, 1997-, member.
Colloquium Series, sole member/organizer, 1995-1999.
Chair, NAME Awards Committee, 1996-2004.
Long-range Planning Committee, 1992-1993, member.
Environmental Fluid Mechanics Ad Hoc Committee, 1992, member.
Ocean Engineering Degree Committee, 1990, member.
Curriculum Review Task Force, 1990, member.
Hydrodynamics Curriculum Committee, 1990-1991, member.
Marine Hydrodynamics Laboratory Advisory Panel, member.

ii) College and/or University:

Faculty Committee on Discipline, Fall 2010 - .
COE Rules Committee, **Elected** Winter 2005, member, Chair 2007-2008.
Rackham Dissertation Award Committee, Winter 2005, member.
COE Curriculum Committee, Appointed Winter 2005, member.
COE Honors and Awards Committee, 2003-2005, member.
Support for Interdisciplinary Centers and Initiatives in the CoE, 2002-2003, member.
Internal Five-year Review Committee of NAME, 2001-2002, member.
Academic Rules/Policy Working Group, 2001 – 2002, member, 2003-2004, member
Engineering Advising Center, Faculty Counselor, 2001- 2005.
Co-Chair, COE Ad Hoc Fluid Mechanics Committee, 2000.
COE Faculty Committee on Discipline, 1998 - 2001.
McIvor Award Committee, 1999-present, Chair 2001-2003.
COE Honor and Awards Committee, 1995, 1996, member.

Research Council, OVPR office, 1995-, member.
Search Committee for the Director, Institute for Environmental Science, Engineering, and
Technology, 1995.
Scholastic Standing Committee, 1994-1998, member.

H.2 Service to Government or Professional Organizations:

ITTC Energy Savings Methods Specialty Committee, Secretary, 2014 – .

NSF Panel Review, Fluid Mechanics and Geophysical Fluids, 2006.

Member of the American Physical Society Division of Fluid Dynamics Acivos Dissertation
Award Committee, 2004–2006.

Member of the *International Ship Structures Congress – Environment Committee*. Independent
international oversight Congress, 2003 – 2005.

NASA Panel Review, Interfacial Flows, 17-19 March 2003.

Associate Editor, *Journal of Waterway, Port, Coastal, and Ocean Division*, American Society
of Civil Engineers, 1989-2003.

Member (Fellow, 1998), American Society of Civil Engrs, 1974 – .

Member, American Physical Society, 2000 – .

Professional Engineer, Virginia, 1978 – .

Member, American Society for Engineering Education, 2000-.

Organizer, NSF Workshop on Undergraduate Fluid Mechanics (with W.W. Schultz), held at the
CoE, UM, October 2000.

NASA Requirements Definition Review, “Microscale Hydrodynamics Near Moving Contact
Lines,” (S. Garoff’s microscale space experiment), Glenn Research Center, Cleveland, Ohio,
Oct. 2001.

NASA Science Review Panel, Lewis Research Center, Cleveland, Ohio, Oct. Nov. 1997.

Session Chair, American Physical Society Division of Fluid Dynamics Meeting, 2000, Wash.
D.C.

Organizing Committee, Office of Naval Research, Dynamics of Bubbly Flows: 1992 Program
Review, University of Michigan, July 1992.

Reviewer for the Michigan Department of Natural Resources, Shorelands Management Unit,
July 1995.

H.3 Consulting Arrangements:

Consulting for American Steamship Company (along with S. Ceccio and S. Makiharju).

Formed a Small Business Innovative Research (SBIR) LLC corporation with W.W. Schultz, 2000.

Annual consulting effort with government is small and on the order of a few days. For example, NASA Panel Review, Oct. 2001.

I. OTHER

I.1 Collaborative Activities with Other Faculty and Institutions:

Prof. Miguel Bustamante, University College Dublin. Collaboration on Precession Resonance Phenomena in Surface Waves.

Prof. Miguel Bustamante, University College Dublin. Collaboration on surface comparisons using Sobolev Norms and Dynamic Master-Slave identification of the water wave equations.

Prof. Frederic Dias, University College Dublin. Collaboration on surface roughness effects on oscillatory energy devices: OYSTER.

NEEC with 31 other universities and several colleagues at UM.

NSF proposal entitled “CMG COLLABORATIVE RESEARCH: A combined experimental, numerical and field investigation of steep surface waves” with Co-PIs Wooyoung Choi, NJIT, and Brian Haus, UMiami. Under review.

NSF proposal entitled “IDR: Safeguarding infrastructure through granular-flow dissipation of high-speed impact” with Co-PIs William Schultz and Dale Karr. Under review.

Dalian University of Technology, State Key Laboratory of Coastal and Offshore Engineering, Professor Guohai Dong. *Hai-Tian Scholar*, Dalian, China, 2007-2009 and now 2010-2012. Extended now through 2014 as a Visiting Professor. This is an annual appointment and includes a trip to Dalian annually and collaboration with Ph.D. students and Coastal—Offshore Engineering experiments.

Research with Drs. Benjamin Langhorst and Henry Chu, Idaho National Laboratories, blast tests and experiments with blast panels. Partially funded activity. 2008-2010. New collaborative effort under review by ONR BAA 11-007.

University of Ulsan, Naval Architecture & Ocean Engineering Department, Professor Bum-Sang Yoon and Professor Yoon-Rak Choi, Ulsan, Korea, 2007-2008.

Robert Beck, Steven Ceccio, David Dowling, and I have collaborated on HIFLOW, an ONR-sponsored project to increase the flow speed to 35 m/sec in the world’s largest cavitation tunnel.

Young-Gill Lee, Dept of Naval Architecture and Ocean Engineering, Inha University, Korea, spent his sabbatical visiting and collaborating March 2002 through February 2003.

“Improving Undergraduate Fluid Mechanics Education Through Broad Information Exchange,” NSF, DUE. with W.W. Schultz, ME, and Howard Stone, DEAS Harvard University. \$270,000 proposed. Other universities that submitted proposals within our proposal include Michigan

State (J.F. Foss); Georgia Institute of Technology (M.K. Smith); University of Washington (J. Riley).

William Schultz and I have had numerous collaborative activities including funding by NSF, ONR, NASA.

Steven Ceccio, David Dowling, and I submitted and were awarded a DARPA/ONR drag reduction grant. A subsequent award was received (with Michael Solomon, ChemE) through DARPA.

Ana Sirviente, David Walker, and I collaborated on the ONR Hydrodynamics Initiative proposal.

Dale Karr and I are collaborating on Engineered Materials and on Controlling Fluid-Structure Interaction.

Armin Troesch and I collaborated on his Joint Industry Project with the offshore oil industry.

Oded Gottlieb, Technion-Israel Institute of Technology, and I have collaborated and written a paper on elastically tethered spheres and are continuing to collaborate.

Dale Karr and I have collaborated on modeling Faraday waves.

While on Sabbatical leave, I worked with Professors T. Miloh and L. Shemer at Tel Aviv University.

Proposal to ONR, Tom Swain, by Gottlieb, Perlin, Perkins, and Bernitsas. Funding promised, never materialized.

Joint NSF proposal with Luis Bernal, Aero. Asked to resubmit after initial rejection.

Collaboration with Oded Gottlieb in the summers 1995 and 1996 on Chaos in Faraday waves.

Principal investigator in the Office of Naval Research University Research Initiative (URI) entitled "Ocean Surface Processes and Remote Sensing" under the general directorship of J.F. Vesecky, AOSS. Collaborative work with D.R. Lyzenga, Adjunct Assoc. Research Scientist, NAME, and with R.G. Onstott, Adjunct Research Scientist, AOSS. These joint efforts have provided a significant share of the experimental research of this URI. Along with the URI itself, they have produced a more synergistic relationship between the electromagnetic and the hydrodynamic communities which study air-water-interface phenomena.

Joint ONR contract with W.W. Schultz, MEAM, and D.R. Dowling, MEAM. Faraday-wave physical experiments have been completed. Next, numerical simulations will be undertaken. Publication(s) will result.

Joint ONR contract with L.P. Bernal, Aero. Seminal work in the area of vorticity generated by plunging breakers is being conducted. High-resolution velocity and vorticity fields are being measured. Numerical computations to the break point are being conducted by Y. Cao and will be compared with these measurements.

To complement the theory of S. Gou and W.W. Schultz, MEAM, and A.F. Messiter, AERO, experiments were conducted to verify the extent to which the currents predicted by their theory agrees with that found in physical experiments.

I.2 Seminars in other UM departments or institutions:

See Invited Presentations.

University of Maryland, Mechanical Engineering Department Lecture on Faraday waves. Nov 1995.

Seminar presented in UM Math Department, 1991.

I.3 Outreach Activities:

NASA mentor for NASA SHARP student, Terrika Peterson, summer 2002.

I.4 Other Relevant Information:

I was Co-Chair of a 2010 McIvor Award winner, Dr. Zhigang Kevin Tian.

Students Wendy Sanders and Eric Winkel won the *Outstanding Paper Award for a Young Investigator in Noise* at the 143rd Meeting of the Acoustical Society of America, Pittsburgh, PA, 2002.

My Ph.D. student, Ziyuan Liu, won a Sloan Summer Fellowship, 1999.

Chao-lung Ting, my Ph.D. student won the “Outstanding Graduate Student Award” given by the College of Engineering for the Department of Naval Architecture and Marine Engineering.

I was Co-Chair of a 1996 McIvor Award winner, Dr. Lei Jiang.

Reviewer for the following journals:

Journal of Fluid Mechanics

Physics of Fluids

Experiments in Fluids

Proceedings of the Royal Society, A

Journal of Computational Physics

Journal of Physical Oceanography

European Journal of Mechanics-B/Fluids

Journal of Waterways, Port, Coastal, and Ocean Division

Journal of Geophysical Research, Oceans

IEEE Journal of Ocean Engineering

Journal of Offshore Mechanics and Arctic Engineering

Applied Mechanics Reviews

Langmuir

Journal of Visualization

Coastal Sediments '91 Conference

Reviewer for the following funding agencies:

NASA panel reviews

NASA scientific and engineering space flight experiments

National Science Foundation

NOAA--Sea Grant

Michigan Dept of Natural Resources

Alliance for Coastal Technologies, NOAA