Mechanical Engineering partment Newsletter

University of New Hampshire, Durham NH

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FEATURED 2015-2016 Senior Design Projects - Page 3

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Ocean Engineering Highlight - Page 4

WildCat Tales -Pages 6-7

Nuts and Bolts Fundraising - Page 8

SPOTLIGHTS

Graduate: Student: Baole Wen - Page 2

Faculty: Greg Chini - Page 2

Undergraduate Student: Zachary Patnaude - Page 3

Alumni: Rob Bujeaud - Page 5

Company: Turbocam International-Page 5

Nuts and Bolts Fundraising:

Please consider giving a tax deductible donation to the ME General Fund. To donate, visit the CEPS

homepage at https://giving. unh.edu/cepsme and select the Donate tab located on the far right menu bar to select an ME fund. THANK YOU!

AWord From the Chair

I hope that everyone has had a wonderful fall season. We are definitely in the home stretch here for the semester, and our students are looking forward to a well-deserved winter break.

One of the toughest questions that I receive when meeting with perspective students and parents is what exactly does a mechanical engineer do. While this seems like an easy enough question, mechanical engineers are of course involved with a large range of technologies which prevents a straight forward response. In this issue, you will read about Prof. Greg Chini, who epitomizes this through the range of research that this one faculty member conducts in fluid dynamics, from ocean and atmospheric fluid mixing to blood flow through alveolar geometries to high-intensity discharge lamps. The student highlights (both undergraduate and graduate) though focus on alternative energy technologies, which is of course an important topic for humanity and the planet. We are proud of the fact that our students and faculty are engaged in such altruistic endeavors. Such examples help me clarify the importance and diversity of potential careers for mechanical engineers to prospective students.

I hope that you enjoy this issue and have a wonderful holiday season. Please continue to send your alumni updates. We (and your former classmates) enjoy learning what is new in your lives (both professional and personal). We hope to see and/or hear from you in 2016!

> Brad Kinsey Professor and Chair, Mechanical Engineering Department



Awards & News

Congratulations to Harold Davis '63 (left) who recieved the College of Engineering and Physical Science (CEPS) Distingushed Alumni Award at the CEPS Scholarships Ceremony in October.

Professor Marko Knezevic has been chosen to receive the Young Leader Professional Award by The Minerals, Metals and Materials Society (TMS). This award will be presented to Professor Knezevic on February 16th in Nashville, Tennessee.

Congratulations to John H. "Jack" Smith '50 (right) who recieved the Hubbard Family Award in September for service to Philanthrophy.

Students in the new BSOE program took to the sea on October 10th aboard the Gulf Challenger for a field trip.



"Airbus Americas has donated an A320 elevator (section of an aircraft wing) valued at \$500,000 to the University of New Hampshire. The 20-foot-long part designed for flight control on the aircraft's tail will be used to support education and research in the university's Flow Physics Facility, the largest wind tunnel of its type in the world." Check out the full article online.

Professor Martin Wosnik gave an introductory presentation in INCO 460 Deflategate. Professor Wosnik showed the homework problem that presented a pretty thorough analysis of the actual football pressure data – which ended up being exactly where the ideal gas law said it would be. Read the full story in the Boston Globe.

Volume II, Issue IV

FACULTY & GRADUATE SPOTLIGHT

Professor Chini



Background Image: A snapshot of the density field taken from a direct numerical simulation of porous medium convection performed by Prof. Chini's former IAM Ph.D. student, Baole Wen.

Professor Greg Chini's research falls under the broad umbrella of Physical Applied Mathematics, an interdisciplinary area at the intersection of mathematical analysis, high-performance scientific computing, and physical and engineering science. His focus is on the application of nonlinear mathematics to important environmental, energy, and resource challenges facing society, particularly those involving fundamental fluid dynamical phenomena. Chini attributes his love of fluid dynamics to the countless hours he spent as a youth observing the waters of the St. Lawrence River while fishing with his father for the elusive muskellunge. This interest prompted him to pursue degrees in Aerospace Engineering, first at the University of Virginia and then at Cornell University, where he earned his Ph.D. with a concentration in mathematical fluid dynamics. Since joining the UNH ME faculty in 1999, Professor Chini has pursued a diverse array of research projects spanning topics in mathematical geoscience, industrial fluid mechanics, and even pulmonary

alveolar micromechanics. Much of his work involves the derivation of rationally simplified mathematical representations of shear- and buoyancy-driven flows in the ocean surface boundary layer and in fluidsaturated porous media, which are needed for improved modeling of weather, climate, pollutant dispersal, and carbon capture and sequestration. More recently, Professor Chini has developed a new theory that correctly predicts the acoustically-driven "streaming" flows employed by lighting engineers to improve the energy efficiency of high-intensity discharge (HID) lamps. Since 2010, he has served as a founding co-director of the CEPS Ph.D. Program in Integrated Applied Mathematics (IAM). Professor Chini has been a visiting researcher in applied mathematics at Nottingham University, the California Institute of Technology, and UCLA's Institute for Pure and Applied Mathematics, and he is a regular participant in the annual Woods Hole summer program in Geophysical Fluid Dynamics.

BAOLE WEN



Baole Wen was a member of the inaugural (2010) class of students in the Integrated Applied Mathematics (IAM) Ph.D. Program at UNH. Baole worked with Prof. Greg Chini to pursue his research interests in mathematical fluid dynamics, interests he traces back to his undergraduate studies in China. Using advanced analysis and computer simulations, Baole investigated buoyancy-driven flows in fluid-saturated porous media (like wet soils). His research was motivated by applications in carbon capture and sequestration, in which CO2 from a power plant is pumped underground and released into a porous rock layer. Since the CO2 is

less dense than the salty water (brine) in the rock pores, it rises until its vertical migration is inhibited by an overlying impermeable rock layer. The CO2 then spreads laterally, dissolving into the brine and making the brine top heavy. When buoyancy-driven convection sets in, the dissolution rate is dramatically increased and the CO2 is considered to be safely sequestered. Consequently, improved understanding of the smallscale convective flow is crucial for this geo-environmental application. Baole first abstracted a simplified mathematical model of this phenomenon so that he could focus on the fundamental flow and transport mechanisms. He then



performed computer simulations, which revealed that the flow self-organizes into recurring quasi-coherent structures. Finally, Baole computed steady and time-periodic solutions corresponding to these quasi-coherent flow patterns. By quantifying the stability and heattransport properties of these solutions, he provided new insights into porous medium convection. Baole's research was supported by UNH fellowships and funding from NSF. Baole is now working as an ICES Postdoctoral Fellow at the University of Texas at Austin, where he is continuing his research in mathematical geoscience.

UNDERGRADUATE SPOTLIGHT **Alternative Energies with Zachary Patnaude**

Engineering student with a passion for alternative energies. Zach's interests of study include control systems, thermal systems, heat transfer and fluid dy-

namics. Zach graduated with an A.A.S in Heating, Ventilation, and Air Conditioning from Manchester Community College in 2009. Starting in 2008, Zach began working at Water Energy Distributors Inc., a geothermal heat pump distribution, design and consulting firm. Some

of the highlights of Zach's research and work at Water Energy include co-authoring a research paper, with colleague and mentor Carl Orio, for Zach is currently applying for the Ac-

performance. fer Zach also went on a consulting trip to Hyderabad, India in June of 2014, performing thermoconductivity testing on a standing column well to aid in properly sizing

the ground loops for a cooling-only ground source heat pump application.

Zach Patnaude is a senior Mechanical ASHRAE in 2014, titled "Eight Years celerated Master's Program to continue of Operation of 615 Ton Geothermal his education towards a M.S. in Mechan-Nursing Home in Northern Tier". The ical Engineering. After graduation this paper spotlighted the standing column May, Zach will be returning full-time to well temperatures fluctu- Water Energy performing geothermal ation over time and (ground source) and other HVAC systheir thermal trans- tem design, analysis, and implementation.



2015-2016 SENIOR DESIGN PROJECTS:

ME 755- Competition (C) and Industry (I) Projects	ME 755- Research (R) and Other (O) Projects	TECH 797- Ocean Competition (C), Research (R), Industry (I), and Other Projects
Aerocats (C)	Atmospheric Boundary Layer Simulation (R)	Remotely Operated Vehicle (ROV) (C)
ET NAVSwarm (C)	Bubble Trap Mechanism (R)	Aquaponics in Developing Nations (R)
Firefighting Robot (C)	Carbon Nanotube Testing (R)	Autonomous Surface Vehicle (R)
Formula SAE Car (C)	Drag Plate Project (R)	Low Fequency Acoustic Projector (R)
LunaCats (C)	Low Frequency Transducers (R)	Ocean Acidification (R)
QuadSat (C)	Microtube Bending Machine (R)	Tidal Turbine Development Platform: Seakeeping and Safety (R)
Campus Crusier (I)	Solar Receiver Heat Loss Analysis (R)	Wave Energy Conversion Bouy (R)
CoolSim (I)	Study on Seed-Coat Inspired Materials (R)	Wingtip Devices for Marine Applications (with focus on turbines and Vehicles) (R)
GE Aviation- Seal Slot Inspection Project (I)	Testing Machine for Continuous Tension-Compression of Sheet Metal (R)	
Sig Sauer-Hammer Impact Efficiency (I)	3D Printed Ski Bindings (O)	nd Assass Is
Smart Building-Manchester Dept. of Public Works (I)		

OCEAN ENGINEERNG SPOTLIGHT

Twofour Broadcast (U.K.) films TV segment on USS Albacore at UNH

When UNH media services passed along an inquiry from the British production company TwoFour Broadcast regarding



the USS Albacore, current and former members of the ME Department went the extra mile to help out. TwoFour was going to be filming at the USS Albacore in Portsmouth, and wanted somebody to help explain the hydrodynamics and set

up a model demonstration.

"The schedule was tight and we needed a scale model of the Albacore." said M.E. Associate Professor Martin Wosnik. "But I have always been intrigued by submarines so I started asking around." (ME IT/Technologist) Sheldon Parent remembered that (retired ME Instructor) Gerry Sedor was involved with Albacore Park. Sedor put Wosnik in touch with board member Ken Herrick, who worked on the USS Albacore at Portsmouth Naval Shipyard in the late 1950s and early 60s.

"The submarines that were in service in WWI and WWII were essentially based on surface ships – they were designed to move fast on the surface but were very slow and easy targets under water" explains Wosnik.

"The USS Albacore was the first submarine whose shape was really optimized for



Above: On the bridge of the USS Albacore, from left: Ken Herrick, Gregory Taylor-Power, Pete Bachant, John Turner. Hidden behind the periscope: Ivo Nedyalkov.



hydrodynamic performance under water, continuing a development that began with the 'Type XXI' sub Germany developed towards the end of VVVII. The Albacore took hydrodynamic performance to a new level. The main idea is that the hull, with its elliptical nose shape and length over beam ratio, minimizes total drag-- which is the sum of viscous drag and pressure drag. The Albacore was the first sub that was able to go faster than 30 knots under water. Now if you combine this with propulsion that does not require air intake and exhaust, such as nuclear power, then you can both go fast and stay submerged for a long time. This fundamentally changed submarine warfare."

Wosnik and graduate students went to Albacore Park for a personal tour of the sub with Ken Herrick, who also brought a set of original blueprints. ME PhD candidate Pete Bachant created a CAD model, which was 3D-printed by Sheldon Parent at 1:144 scale. Wosnik built a 1:144 scale model of a WWII sub for comparison. For experiments in the ME 18"x18" wind tunnel, PhD candidate Michael Allard supplied a "made-for-TV" virtual instrument panel, and ME lecturer Ivo Nedyalkov and graduate students John Turner and Ian Gagnon helped with experiments on the day of filming. "It was a team effort", commented Wosnik, "and even at this small scale we were able to demonstrate significant reduction in drag for the Albacore."

The show is titled "Impossible Engineering", and its subject

is the Royal Navy's nuclear submarine HMS Astute, with one segment on the USS Albacore. It is broadcast in the U.S. on the Science Channel.

Left: Proessor Martin shows the drag on submarines – the diagram that explains it all.



Above: the 1:144 scale model of USS Albacore in the $18" \times 18"$ test section of the Mechanical Engineering "student wind tunnel".

ALUMNI/COMPANY SPOTLIGHT

Rob Bujeaud



Rob Bujeaud is a 1987 graduate of the University of New Hampshire with a Bachelor of Science in Mechanical Engineering and an MBA from New Hampshire College. He and his wife live in Rochester, NH, as their kids have grown and moved on. He joined TURBOCAM in 1988, leaving for a three-year hiatus from 1992 to 1995. He was named Vice President of Engineering in 1998.



When Rob first joined Turbocam, there were only two other people; the owner and a machinist. "In those days, everybody did everything – machining, deburring, measurement, packing, shipping, customer calls, etc. The changes that have taken place since then have been significant and challenging, but necessary. Change for the sake of change is usually dangerous in business. But change for the sake of improvement and growth is critical."

Rob serves on the ME Industrial Advisory Board and frequently gives presentations in class on resume writing and interviewing skills. Rob has also collaborated with several ME faculty members on research over the years.





Leading designers and manufacturers of high performance turbomachinery around the world rely on TURBO-CAM to take their ideas and products to market. Privately owned and headquartered in Barrington, N.H., with 750 employees in eight countries, TURBO-CAM produces bladed components for rocket, aircraft, and truck engines, using more than 100 five-axis milling machines, electrochemical machining, additive manufacturing, and other complex manufacturing processes.

Their engineering work, quality, and customer service must be excellent. But, at the end of the day, Rob believes that everything always comes back to people; "the people we work with, the families we serve through the jobs we create, the work environment we create, the customers we serve, and the vendors that help us to do what we do." He feels very fortunate to work with and for such great people.

TURBOCAM's Mission: TURBO-CAM exists as a business for the purpose of honoring God, creating wealth for its employees, and supporting Christian service to God and people.

TURBOCAM seeks to accomplish this purpose by achieving excellence in the manufacturing of turbomachinery parts by Five-Axis machining and related technologies and satisfying the needs of their customers for Quality, Price, Delivery and Service.

As we interact with our customers, suppliers, and employees we hold our-

selves accountable to God's law expressed in the Bible. We are committed to integrity in our business and personal relationships.

Note: Over one third of the engineers at TURBOCAM are UNH Graduates.





Timothy Roemer, BSME '13

I just finished my first trimester at Kimball Union Academy in Meriden, NH. As the STEM Program Coordinator, I run the KUA Maker Space and coach the STEM Team which is working on an ROV to identify invasive aquatic plant species. I also teach AP physics II, several math courses, and am a dorm parent (a mix between a college resident assistant and a resident director).



Geoffrey Howe, BSME '13

I am currently working in the nuclear fluids and mechanical engineering department at Portsmouth Naval Shipyard and love the work. I've been able to travel for work all over the country including to the prototype reactor site in upstate NY, to San Diego CA, and to Pearl Harbor HI. *After a short 6 years engagement*, I got married on October 5, 2013. We purchased a house in Barrington, NH in July 2014. On January 7, 2015 we had our first child, a daughter, Ember Howe.

Fred Meissner, BSME '13

My girlfriend Becca Cole (a UNH ChE grad), our dog, and I spent the last two months driving across the country on a 12,003 mile roadtrip. We spent most of our time hiking, backpacking, and running; the things we love to do most. I took a lot of pictures. The USA is a massive, diverse, and beautiful country which was amazing to explore, but we're happy to be back in Durham for a few months while we plan our next move. View all of their travel photos on the Mechanical Engineering Facebook page.



Charles (Chas) Sullivan, BSME '11 Chas built a 3D printed electronic skateboard controlled by an iPhone. He presented the skateboard at one of the largest auto shows in the United States for SEMA in Las Vegas.



Dan Madnick, BSME '10

I recently graduated with a Master of Engineering degree from the University of Connecticut. For the capstone project, I worked with another student to study joint efficiency in backing bar welded structures. I started in the Master's program in May 2012 and have been working towards the degree over the last 3 years. It has been a very rewarding experience and I have gained a lot of knowledge from the program. It has helped me grow as a person and broaden my knowledge as an engineer. I've been working at Electric Boat in Groton, CT since I graduated from UNH and I am about to hit my 5 year mark on July 13th. It has been an amazing and rewarding time in my life. It's great to sit back and reflect on the experiences and people I have met along the way, with my time at UNH highly valued. My wife, Samantha, and I are about to look forward to. Both Sam and I were also promoted to senior positions in our respective careers, which has made the last year or so quite exciting.



Fernando Vazquez, BSME '08

Fernando works at Berkshire Manufactured Products located in Newburyport, MA and has just been promoted from Project Engineer to Lean Manager.

Maureen (Richard) DeLoffi, BSME '04

My husband Matt, and I recently had a baby girl, Sydney. She was born in early August. To the right is a picture of Sydney in her Halloween costume! I am working at Waters Corporation in Milford, MA as a Process Engineer.





Wade Bartlett, BSME '89, MSME '94

These days I'm a self-employed engineering consultant, doing a lot of accident analysis work. I'm also a part-time officer for the Town of Middleton. I recently received the Congressional Law Enforcement Award for Dedication and Professionalism at a ceremony in Concord, attended by the entire NH Congressional Delegation. View the videos and more photos on the Mechanical Engineering website.



Karl Leinsing, BSME '88

Karl has developed a small, quiet, compact travel size sleep apnea device for HDM. He also has two UNH students working for him as interns, Nicholas Chagnon and Joe Durant (both are juniors in the ME department) and is passing on what he has learned over the past 30 years.

Mary Perkins, BSME '83

Below is a photo from the wedding of Kevin Perkins (BSME 11) to Brianna O'Connell (class of 2011, not ME) on August 22, 2015. Also in photo are Mary (McDonough) and Steve Perkins, both BSME '83, and Lee Perkins, BSME '54. The wedding was held at the Seacoast Science Center in Rye, NH. Other guests are also UNH Alum.



Nuts & Bolts Fundraising

Please consider giving a tax deductible donation to the M.E. General Fund, which will support all senior design projects, or to one of two identified funds, Precision Racing and Lunabotics Teams. This will provide the teams the resources necessary to be successful without having to focus extensively on fundraising.

To donate, visit the CEPS homepage, and select the Donate tab located on the far right menu bar. From there you can select one of the three Mechanical Engineering funds (or others of interest, e.g., Engineers Without Borders, Society of Women Engineers, etc.).

Please help support our students and the Mechanical Engineering program for the future and beyond. Please contact Mike McCarthy for more information.









We would like to stay connected with our alumni and friends and would welcome your newletter contributions and suggestions.

Please send your news items, e.g. awards, promotions, personal updates, memories of UNH, and suggestions to Lauren Foxall at lauren.foxall@unh.edu

> Newsletter Coordinators: Lauren Foxall (designer/creator/editor), Tracey Harvey (editor/public relations), and Barbaros Celikkol (Chief)

If you would like to make a financial contribution to the ME Department please go to: https://giving.unh.edu/cepsme

Check out full length stories and pictures on the Mechanical Engineering website: http://ceps.unh.edu/mechanical-engineering/