Ray W. Herrick Laboratories

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Herrick Newsletter

Herrick Laboratories PURDUE UNIVERSITY

Inside This Issue:

Upcoming Events:

July 12-13, 2014 Short Courses
July 14-17, 2014 Compressor, Refrigeration & Building Conferences
Fall 2014 Industrial Advisory Committee Meeting

Southwest corner of Ray W. Herrick Laboratories - Fall 2013

New Building Dedicated November 8, 2013

Herrick faculty, staff, students and the Industrial Advmisory Committee members pose in front of the new Ray W. Herrick Laboratories.

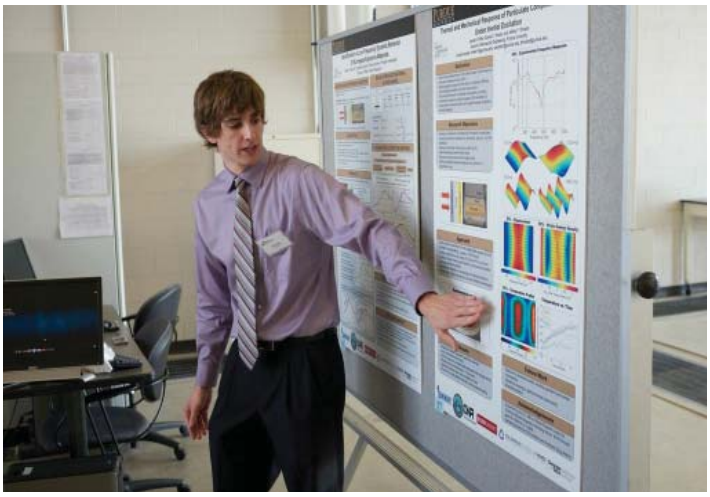
Over 55 years ago, Ray W. Herrick Laboratories began when Professor William Fontaine was talking with Ray Herrick, the owner of Tecumseh Products Company. They talked about establishing a graduate student thesis-oriented laboratory where students worked on industry-funded projects for research subjects of their theses. Their vision of integrating engineering research with industry grew into what is now a world-renowned research facility. The facility started in a 1920s horse barn, renovated and expanded in the mid-1960s to accommodate the growing needs of research and office space. Years later, the idea of building a new Herrick Laboratories was raised and the rest is history! It took many years of planning, fundraising, and designing, but it finally came into fruition! We moved into the new Ray W. Herrick Laboratories building in mid-October and the Dedication was held on Friday, November 8, 2013. We are still using the original building and fund raising continues for a new acoustics wing and technical support area.

A tent was set up on the east side of the building for the ceremony. Two graduate students - Brandon Woodland and and Jelena Paripovic – welcomed everyone and introduced the dignitaries. They each gave speeches on certain aspects of the new facility, such as what the new labs means for the College of Engineering by Leah Jamieson, Dean of Engineering; what the new labs means for the School of Mechanical Engineering and the students by Anil Bajaj, School Head; the history of the expansion by Patricia Davies, Director of Herrick Laboratories; and donor remarks from John Galbraith, Vice President of Research, Development and Engineering at United Technologies (Carrier); and Dr. Howard Harary, Acting Director of the National Institute of Standards and Technology (NIST) Engineering. President Mitch Daniels also spoke on the world-wide significance that the new state-of-the-art research facility will make in the future.

Following the ribbon-cutting ceremony, a reception in the new High-Bay Flexible Lab was held and tours were given to the attendees, which were hosted by our graduate students. (more pictures on page 6)

Industrial Advisory Committee Meeting - November 7-9, 2013

Seungkyu Lee (left) explains the fan noise control research that he worked on with 3M Corporation. His research is about fan noise control done by attaching the microperforated materials on the fan housing. The research is based on the idea that the microperforated housing treatment would create the finite level of flow resistance that could reduce turbulance flow in the tip clearance region and so reduce tip noise. In this study, fan noise levels were quantified on the basis of the blade passage tone level.



Jacob Miller (left) explains the thermal patterns developed in a surrogate explosive plate in response to direct resonance excitation. It is hoped that the generation of heat within plastic-bonded explosives may lead to an outgassing of vapor and, in turn, increase success of detection when using existing trace vapor detection technologies. The effect of varying explosive crystal/binder ratios is also being investigated.

Brandon Woodland (left) explains his research on Organic Rankine Cycles (ORC). Many energy sources exist that are of a lower grade or quality than traditional fossil fuels. An ORC can utilize these heat sources. It operates on the same principle as a steam power plant. However, instead of steam, an ORC uses an organic working fluid such as a refrigerant or a hydrocarbon. Two modifications that can improve the effectiveness of ORCs include: 1) the use of working fluid mixtures, and 2) two-phase flash expansion of the working fluid. More power from a low-grade heat source could encourage more investment in the technology. This would also result in better energy utilization where low-grade heat is currently being thrown away. Other appliations of the technology include high-temperature waste heat recovery from internal combustion engines and distributed cogeneration using solar or other renewable heat sources.

Industrial Advisory Committee Meeting - November 7-9, 2013

The Industrial Advisory Committee (IAC) held its annual fall meetings on Thursday, November 7 though November 9. It was held in conjunction with the Dedication of the new Herrick Laboratories facility. The meeting began at 1:30 on Thursday in the Edward and Lucille Eisele Conference Room located in the new Herrick Laboratories. After the introductions and welcome by Chairman Terry Manon, Patricia Davies gave the State of the Laboratories Report. Anil Bajaj, Head of Mechanical engineering gave an update on the School of Mechanical Engineering. Maureen McCann, Director of the Discovery Park Energy Center and Michael Moaveni (IAC member) also gave a presentation on progress of the Strategic Plan Development. The IAC then enjoyed a tour of the new building.

Xing Jin and Ashish Vora presenting their research to the Industrial Advisory Committee.

One of the highlights of the IAC meetings is the Student Poster Show, which was held on Friday morning. Presentations and demonstrations were given in the original and new buildings depending on where the students' research was being done.

After group photos and lunch, breakout sessions were held that focused on the new research opportunities enabled by the special facilities in the new Herrick builiding.

The Dedication followed at 3:30 (see front page article). The special day ended with a dinner hosted by President Mitch Daniels at the Kurz Atrium in the Armstrong Hall of Engineering.

On Saturday morning, Prof. Jeff Rhoads and his wife, Janine hosted a brunch before the Purdue/Iowa football game. Everyone enjoyed themselves with food, games, and a lot of fun. Thank you, Jeff and Janine!

Here are some highlights of the Student Poster show.

Prateek Tayal (above) is explaining to the IAC members the purpose of his project and that is to relate light-off temperature of a gaseous species to NO/NO_2 ratio. Once light-off temperatures and NO/NO_2 ratios have been determined for various cased, appropriate models for estimating NO/NO_2 ratio as function of light-off temperature will be developed. Aging in the DOC can be detected with shifts in the light-off temperatures at which hydrocarbons or other gaseous species are converted. As a Diesel Oxidation Catalyst (DOC) ages, its light-off temperature will increase. It thus becomes a potential indicator of oxidation efficiency, thereby providing a mechanism to estimate NO/NO_2 ratio as feed gas to the SCR system.

Andy McMullen (above) talks about some of the acoustic research work at Herrick Labs, which includes sound quality studies and simulations of aircraft and diesel engine noise.

Our New Major Research Facilities

Willis Carrier Laboratory

The Thermal Systems Laboratories: These areas are where the HVAC and Refrigeration component level and system level technology research is conducted as well as research on Air Quality. In the original building there are two psychrometric rooms and in the new building there are four psychrometric rooms (2 pairs) with a temperature range of -10° to 130° F. Each psychrometric room is 7000 cu ft. The psychrometric rooms are designed to accommodate ASHRAE/ARI standard test procedures used in rating unitary air-conditions and heat pumps up to a capacity of 5 tons of refrigeration (18 kW). There is a new indoor air quality lab and a room for testing large equipment..

Geothermal Field Interface (left) in the West Theermal Sciences Wing

The Living Laboratory: The whole of the new building is a living laboratory where the building environment is being studied. it includes a 16 bore geothermal field and plug-and-play heat rejection for experiments in the engines and thermal sciences laboratories, and four nearly identical office spaces with each unit housing 20 graduate students. Each 34 ft by 37 ft office is reconfigurable in different ways and have separate support systems. This enables direct comparisons of alternative technologies for windows, lighting, comfort delivery, controls, and acoustic treatments. The normal temperature range is 65F to 75 F but his can be extended to 55F to 85F. Relative humidity can be varied from 20% to 80%.

One of the 4 Living Laboratories - home for Herrick Labs' graduate students

Engines Research: The two engine test stands in the original building and the four test cells in the new building are home to engine and hybrid systems controls research that is focused on improving efficiency, reducing engine emissions and developing efficient and environmentally friendly systems for using alternative fuels. Currently the four new test cells and associated systems will suppport 670, 350, 150 and 150 HP engine testing, respectively, but space and utilities are planned so that upgrading to higher horsepower and higher levels of emissions testing are possible as research progresses.

Test Cell 1 in the Cummins Power Lab in the new Herrick Building

Our New Major Research Facilities - continued

Perception-based Engineering Laboratory showing the 6 degree-of-freedom TEAM shaker

Perception-Based Engineering (PBE) Laboratory (left) researchers study people's perceptions of stimuli, their influence on satisfaction, comfort, annoyance and performance and the relationship between those outcomes and the system, design and operational parameters. PBE faculty work on projects related to touch interfaces, sound and vibration quality, image quality and depth perception, display design and graphics optimization, effects of noise on performance, and human-computer interaction. This 43ft by 28ft laboratory houses a TEAM 6 degree-of-freedom shaker, which can be covered when not in use. Lighting, temperature (55F-85F), humidity (20% to 80%) and sound can be finely controlled, and the room can be re-configured as several small isolated rooms or one larger room, thus simulated various types of environments.

High-Bay Flexible Laboratory

West Thermal Sciences Wing looking at High-Bay Laboratory

Small Scales Vibrations Laboratory

High-Bay Flexible Laboratory (center left) and Small-Scale Vibrations Laboratory (below left): These house Electro-Mechanical and Vibrations research. This is comprised of two parts: an open 36ft by 87ft high-bay area with segmented floors for vibration isolation between experiments, and a smaller lab for smaller scale experiments. The high-bay area can house large shakers, such as a 35 kN TIRA electrodynamic shaker that can be used to reproduce vibration profiles and has in-built hydraulic power supplies for hydraulic shakers. In this area the vibration and dynamics of larger structures can be examined such as building components, vehicle suspension systems, wind turbine blades, road vehicle and aircraft and space structures. The small-scale lab includes apparatus for dynamic testing of materials and small structures to investigate their nonlinear dynamic behavior and to identify structural and material models.

Dedication Pictures

Grad student speakers, Brandon Woodland and Jelena Paripovic

Don Coates, Mike Moaveni, Ray Cohen, Jack Elson, Carl Johnson

President Mitch Daniels

Herrick Labs Director, Dr. Patricia Davies

Current Herrick Labs students posing in front of our new building

Ribbon-cutting dignitaries

Bi-annual Conferences to be Held July 14 - 17, 2014

2014 Purdue Conferences

Compressor Engineering
Refrigeration and Air Conditioning
High Performance Buildings

Herrick Laboratories
PURDUE UNIVERSITY

CONFERENCES JULY 14-17, 2014 | SHORT COURSES JULY 13, 2014

ABOUT THE CONFERENCES

It has been a tradition since 1972 for the Ray W. Herrick Laboratories at Purdue University to sponsor the venue for the opportunity to exchange ideas, information and cutting-edge research in the area of refrigeration technology, compressors, high performance buildings and closely related fields. In today's economy, it is important to maintain your professional contacts and to keep current on the latest research. Thus, plan to join us in July, 2014!

REGISTRATION INFORMATION

Short Courses	
Advanced Full Registration Fee (by May 25, 2012)	$500
Full Registration Fee (after May 25, 2012)	$575
Conferences	
Advanced Non-Author Registration Fee (by May 16, 2014	$700
Non-Author Registration Fee (by May 16, 2014)	$775
Presenting Author Registration Fee (by May 16, 2014)	$650
Student Registration (presenting one paper)	$250
Student Registration (presenting two papers)	$450
Student Registration (presenting three papers)	$650
Non-Author Student Registration	$300
Group Registration Fee (6 people from same company and location, by May 16, 2014)	$3500

Conference registration and other fees may be paid online via credit card.
Registration rates will rise after the early registration deadline of May 16, 2014.
Visit www.conf.purdue.edu/compressor2014 for additional information.

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https://engineering.purdue.edu/HerrickConf

Christian Bach on Evaporators

Christian Bach, Ph.D. candidate working with Professors Eckhard Groll, Jim Braun and Travis Horton

Why am I interested in evaporators? They are used in vapor compression systems, and vapor compression systems are the heart of almost all cooling and refrigeration systems. In the US alone, if you take the residential as well as the commercial air conditioning (AC) and add commercial refrigeration to it, you will need about 240 average sized coal power plants to operate these systems . Therefore, there is a huge potential for energy savings If you can find a method that reduces the power consumption by only 2%, and this method gets applied to all systems, then you will be able to take 5 coal power plants offline! While the 300 million people in US consume a significant amount of energy, the US is rather small compared to the projected world population of about 11 billion. However, the US and its population can serve as a role model to the rest of the world, and therefore doing the right thing definitely matters. So why am I studying evaporators? I wrote my diploma thesis about the evaluation of an adaptive cooling controller and got really interested in learning more about them.

The biggest misconception about evaporators is that they are simple and boring devices: just take a bunch of fins, pull some tubes trough them and voilà – an evaporator! Fortunately, it is not quite that straightforward. The tubes in the evaporator need to be designed to effectively evaporate and superheat the refrigerant, which typically enters the evaporator as a two-phase mixture of liquid and vapor. Furthermore evaporators in AC and refrigeration systems typically have multiple parallel circuits, which make it necessary to distribute the refrigerant between these circuits. This is done with refrigerant distributors which, in theory, should deliver the same amount of refrigerant and vapor to each of the evaporator's circuits. If all circuits are of the same length and layout you would then expect equal surface usage for evaporation and equal exit superheats – which leads to good system performance. For the 4 systems that I tested, one of them in multiple configurations, equal exit superheats almost never occurred.

Refrigerant distributions are significantly affected by the inlet flow conditions. The first system that I tested was a 3-ton (17.6 kW) walk in cooler refrigeration system which had significant space constraints, forcing the manufacturer to directly connect the distributor and the Thermostatic Expansion Valve (TXV). The resulting refrigerant maldistribution caused a penalty of 4% in the system's coefficient of cooling performance (COP) and 6% in cooling capacity when compared to using individual circuit flow control. If additional airside maldistribution is applied, as would occur due to uneven fouling or frost build up, the potential for improvement increases and can reach up to 30% in extreme cases.

Rooftop air conditioning units with economizers are widely used in commercial buildings and are of special interest when it comes to flow maldistribution. The economizer allows taking in fresh ambient air to fulfill ventilation requirements but this causes significant temperature and humidity maldistribution at the evaporator inlet. A COP improvement in the range of 1.5% to more than 16% is possible by using individual circuit flow control rather than a conventional EXV and distributor. Most importantly, the largest COP improvement was achieved with a half open damper at high ambient temperature, which is a condition that also leads to high cooling loads.

Individual circuit control was achieved by using a hybrid control approach where small balancing valves are inserted into the feeder tubes. These balancing valves contribute significantly to the cost of the system. Therefore, the next logical step was to find a way to make these valves as well as the hybrid control concept itself cheaper – which was done in collaboration with Emerson Flow Controls. The resulting prototype 2-step flow control valves were first tested in our EXV test stand and then employed in a reduced hybrid control approach (paired circuits) within a cold climate heat pump (CCHP). The resulting performance improvement was similar to the one of a previously tested heat pump with full hybrid control scheme. The CCPH is also used to test different system configurations and vapor injected compression.

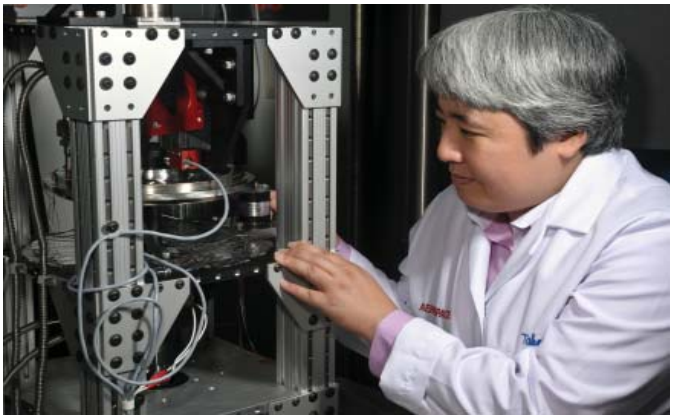
The results of my work are available in form of papers (http://docs.lib.purdue.edu/herrick/) and project reports (CEC, DOE). Last but not least: best thanks to my advisors as well as Frank, Bernhard, Tim and others that made these projects possible.

[1] Calculations based on http://www.eia.gov/, Table E1A(2008), Energy Explained, and FAQ (2013).

[2] Prof. Rosling, Don't Panic - The Truth About Population G rowth, BBC, 2013. Definitely worth watching!

[3] Kim, J.-H., Braun, J. E., Groll, E.A. (2009a). Evaluation of a hybrid method for refrigerant flow balancing in multi-circuit evaporators. International Journal of Refrigeration, 32(6):1283.

Alumni Reflections



Dr. Yoshimi Takeuchi (Herrick Alum, MS 1991, PhD 1997) in her lab with bearing test rig. Credit: Photo taken by Elisa Haber

Greetings Herrick Labbers! For some, this message might be a blast from the past.

I look back fondly at my Purdue years, where in 1997—after a long but enjoyable student tenure—I graduated with a PhD from Herrick Labs (HERL). I remember unparalleled support and camaraderie; especially the picnics and roasts where Fritz, Bob and the gang prepared food with us starving students. I enjoyed spending time with fellow students, staff and professors, but also took academia very seriously. As I saw it, my "job" entailed performing fracture mechanics investigations on thermal barrier coatings for my "boss," Dr. Klod Kokini (major professor), publishing approximately 18 papers and conference presentations from my Masters thesis and PhD dissertation.

Today, I'm a professional researcher analyzing bearing thermal properties for spacecraft applications. My official job title is: Senior Engineering Specialist at The Aerospace Corporation here in sunny Los Angeles, California. I've relished building and running a lab and mentoring up-and-coming engineers, technicians and interns. Participating in each person's development has proved the highlight of my career and in turn, I've grown from each interaction. I've also shared my expertise by actively participating in professional societies, writing papers in various publications and chairing ASTM bearing symposia/workshops.

I've learned through life that giving back pays rich dividends to both the giver and receiver. So volunteering became an important part of my journey. I participated in the Revlon Run Walk for Women (cancer research), a backpack drive for underprivileged kids through Friends and Helpers, and organized a presentation on Japanese-American history, where two former WWII veterans from the 442nd battalion and Military Intelligence Service (MIS) conveyed their experiences.

All this takes me back to HERL. We cannot forget the struggles that today's students endure. These future leaders need modern tools, including an interactive world-class shop to enhance their learning potential. For this reason, I have made periodic donations to the HERL machine shop and asked others to do the same. Your contribution will leave a lasting impact by helping tomorrow's students achieve their dreams.

If you would like to make a donation, make the check payable to: Purdue Foundation. Note on the check that the donation is for: Herrick Labs Building Fund - New Tech Services/Shop. Please mention in the accompanying letter that your donation is for the "Ray W. Herrick Laboratories Building Fund – New Technical Services/Shop." Make sure your contact information is in the letter (address, phone and/or email). If the company you work for matches donations, please include the company's name and address. Send the check and letter to Director Patricia Davies c/o Donna Cackley at the Ray W. Herrick Laboratories address listed on the back of this newsletter. She will forward it to the University Development Office, who'll handle all paperwork and ensure that your gift is acknowledged for tax purposes.

The present and future HERL students will be forever grateful.
All Hail, Herrick Labs! *Yoshimi Takeuchi*

Carrie Hall, Ph.D. 2012

Looking back it amazes me how much my life changed over the 5 years I was at Herrick. I came to Purdue for my grad work right after finishing my undergraduate and knew absolutely no one when I moved to the area. My first week at Purdue I also started research at the Herrick Labs and at that point I had no idea how much of my life would be lived out in that building and how many close friends I would make there. After bonding over long hours of engine troubleshooting and testing, you make friends for life.

Since graduating at Purdue, I've taken a position as an assistant professor at the Illinois Institute of Technology in Chicago. I have my own graduate students and am always challenged to give them the support that I received from the exceptional faculty and staff at Herrick. I'm also working on revitalizing some of IIT's old engine laboratories and as we plan out the lab and discuss things like lab safety my mind still automatically asks "What would Bob say about this?". This past November, I was able to also come back for the opening of "new Herrick" and while admittedly I'm a tad bit jealous that I'll never get to use those new labs, I can't wait to see what comes out of those who do.

People News

Faculty Honors

Professor **George Chiu** has been elected a Fellow of the American Society of Mechanical Engineers (ASME) for his outstanding engineering research and education achievements. Prof. Chiu is an active researcher in the areas of dynamic systems and control and mechatronics. He is especially well known for his contributions in motion control and applying advanced system and control techniques to digital printing and imaging systems. Many of his discoveries have been implemented in commercial products and systems. Prof. Chiu has authored or co-authored 50 archival journal articles and more than 120 conference articles and advised 14 Ph.D. and 25 MS students. He is also a Fellow of the Society for Imaging Science and Technology.
(https://www.asme.org/wwwasmeorg/media/ResourceFiles/AboutASME/Honors%20Awards/Fellows/Fellows-All-2013.pdf)

Professor **Robert Lucht,** the Ralph and Bettye Bailey Professor of Combustion in Mechanical Engineering, has been elected a Fellow of the American Institute of Aeronautics and Astronautics (AIAA). The distinction of Fellow is conferred by AIAA upon outstanding members of the Institute who have made notable and valuable contributions to the arts, sciences, or technology of aeronautics or astronautics.

AIAA is the world's largest technical society dedicated to the global aerospace profession. With more than 35,000 individual members worldwide, and 90 corporate members, AIAA brings together industry, academia, and government to advance engineering and science in aviation, space, and defense. The first AIAA Fellows were elected in January 1934. Since then, there have been 1805 people given this honor, of which only 975 are currently living. Orville Wright was the first of 210 elected to Honorary Fellow and there are 69 currently living. Today, AIAA Honorary Fellows and AIAA Fellows are the most respected names in the aerospace industry.
(https://www.aiaa.org/SecondaryTwoColumn.aspx?id=20413)

Professor **Jeffrey Rhoads** was inducted into the Purdue University Teaching Academy. The Teaching Academy was developed in 1996 to provide a means to elevate teaching and learning at Purdue, and to recognize outstanding faculty and staff who contribute to the learning environment. The first induction ceremony was in 1997. Since that time, more than 200 faculty and instructors have been receognized and inducted into the Teaching Academy.

Working closely with the Center for Instructional Excellence (CIE), the Teaching Academy also serves as a cadre of experienced teachers and educators that can be a resource to new teaching faculty or faculty who have an interest in learning or trying different techniques used by academy members. The Teaching Academy website will be expanded to provide points of contact for any of the members of the Teaching Acdemy who can serve as mentors, advisors or experienced guides for other faculty at the University. (http://www.purdue.edu/cie/teachingacademy/index.html)

Student Honors

Nelson James won first place in the Technical Presentation Competition at the 37th Annual Board Meeting and Conference for the GEM National Consortium. Nelson is a 2nd year Master's GEM Fellow studying Mechanical Engineering with Prof. James Braun and Prof. Eckhard Groll. His presentation was on his summer research project, Absorption Heat Pump Water Heaters. His summer research internship was with Oak Ridge National Laboratory, who sponsored his trip to the GEM Annual Conference in San Juan, Puerto Rico.

Udbhau Bhattiprolu received the best presentation award at the 2013 International Conference on Recent Advances in Structural dynamics, in Pisa, Italy. Udbhau is a Ph.D. student working withh Prof. Anil Bajaj and Prof. Patricia Davies. His presentation was on their paper entitled "Efficient Predictions of the Steady-Sate Response of a Beam Interacting with Viscoelastic Materials".

Dat Le, Ph.D. student of Prof. Greg Shaver, has received a Best Presentation Award at the 2013 American Control Conference for his presentation entitled" Dynamic Modeling of Piezo-Electric Injector-Enabled Rate Shaping".

Congratulations!

People News (Continued)

Ray and Lila Cohen

Ray Cohen Reaches 90

Ray Cohen was the second Director of the Herrick Laboratories starting his term in 1971, following Bill Fontaine who was the founding Director. He handed off the job to Bob Bernhard in 1993 who subsequently handed it off to Patricia Davies, the current Director.

Ray celebrated his birthday with a dinner party on November 30th at the Dish Restaurant in Valparaiso, IN. About 120 attendees helped Ray celebrate. They included four dozen family members, some from as far away as the east and west coasts, and the youngest – his great-grandson age two. Others included some of Ray's former students and colleagues from Purdue, and friends primarily from Lafayette, Chicago and Valparaiso.

A few of his family and friends made comments after the dinner, but everyone seemed anxious to hear from Ray. After making his remarks, he told a few that he probably bored many of the attendees but he had fun remembering and recounting many of his experiences during his career. He said that he had led a lucky life but that his real luck was to have so many family and friends who made his life so memorable and so much fun.

Graduations

David Berdy (Ph.D. 2013). Kinetic Energy Harvesting from Low Frequency Sources. David's employment information is not known at this time.

Stephen Caskey (MSME 2013). Cold Climate Field Test Analysis of an Air-Source Heat Pump with Two-Stage Compression and Economizing. Stephen is staying to pursue his Ph.D.

Steffen Ebling (MSME 2013). Carbon Dioxide Compressor Load Stand. Steffen returned to his job in Germany.

Scott Flueckiger (Ph.D. 2013). Multiscale Simulation of Thermocline Energy Storage for Concentrating Solar Power. Scott took a position with The Aerospace Corporation in El Segundo, CA

Akash Garg (MSME 2013). Exhaust Thermal Management Using Intake Valve Closing Timing Modulation. Akash took a position with Cummins Inc. in Columbus, IN.

Michael Hayward (MSME 2013). Identification and Modification of Dominant Noise Sources in Diesel Engines. Michael has accepted a position with Cummins Inc. in Columbus, IN.

Andrew Jessop (Ph.D. 2013). Near-Field Pressure Distributions to Enhance Sound Transmission Through Multi-Layer Materials. Andy's employment information is not known at this time.

Woo Hyun Kim (Ph.D. 2013). Fault Detection and Diagnosis for Air Conditioners and Heat Pumps Based on Virtual Sensors. Woo Hyun is working at The Pacific Northwest National Lab in Richland, WA.

Lu Lu (Ph.D. 2013). A Performance-Oriented Multi-Loop Control of Systems with Constraints and Uncertainties. Lu's employment information is unknown at this time.

Jelena Paripovic (MSME 2013). Characterization and Modeling of Materials Used in Improvised Explosive Devices. Jelena is staying at Herrick Labs to pursue her Ph.D.

Anchalika Pathak (MSME 2013). Design and Construction of an Organic Rankine Cycle Test Stand. Anchalika's employment is unknown at this time.

Nishigandha Railkar (MSME 2013. Investigation of Operating Range Capability of Gasoline Fueled Compression Ignition. Nishi's employment information is unknown at this time.

Akhil Salanke (MSME 2013). Control of Impacting Dynamical Systems. Akhil's employment is not known at this time.

Sai Shirsikar (MSME 2013). Estimation of Fueling Variation in Multipulse Injection. Sai is working for Cummins Inc. in Columbus, IN.

Hongdan Tao (Ph.D. 2013). Propagation of Sound in the Vicinity of Rigid Porous Interfaces.

Aniket Vagha (MSME 2013). Strategy for Health Monitoring and Fault Detection in Heavy Duty Diesel Engines. Aniket is working for Cummins Inc. in Columbus, IN.

Yan Xue (MSME 2013). Determination of Heat Transfer in Under-Floor Plenums in Buildings with Under-Floor Air Distribution Systems. Yan is staying to pursue her Ph.D.

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News about You and Address Changes

We are always interested in hearing your news, like weddings, births, and job promotions, and we want to be kept up-to-date on current addresses. Please send notes to Donna Cackley or to the e-mail address below. Don't hesitate to let us know of other alums that have moved or changed jobs. Photos are always welcomed and encouraged.

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