PURDUE
UNIVERSITY

2011-2012
ANNUAL REPORT

FALL 2012

RAY W. HERRICK LABORATORIES

140 S. Martin Jischke Drive
West Lafayette, IN 47907-2031

Phone: 765-494-2132
Fax: 765-494-0787
E-mail: rhlab@ecn.purdue.edu

From the J.C. Allen collection, courtesy of Purdue University Libraries, Archives & Special Collections

***Above*: Herrick Labs 2012**

***Left*: Herrick Labs Bldg. 1912**

HERRICK LABORATORIES
PURDUE UNIVERSITY™

THE RAY W. HERRICK LABORATORIES

The Ray W. Herrick Laboratories were founded in the mid-1950's as a research laboratory for studying the effects of climate control and for the design of improved climate control equipment. The Labs have grown and evolved into a center where graduate education and engineering research are combined in close partnership with industry in order to develop people and results of great importance. The Herrick Labs goal is to sustain a culture of excellence in an environment of partnership and shared resources.

The research programs of the Herrick Labs can be described in four general areas; electro-mechanical systems, noise and vibration control, perception based engineering, and thermal systems. The community at the Herrick Labs, which includes the faculty, staff, students, and sponsors, is focused on results that are both fundamental research discoveries and of practical importance to sponsors.

The educational experience at the Herrick Labs combines the traditional training of aspiring researchers with exposure to industrial needs and culture. Students study in a strong peer education environment with active mentoring from faculty and sponsors. Nearly 800 Masters and PhD candidates have graduated from the Herrick Labs.

The engagement/service programs are highlighted by the well established conference and short course activity sponsored by the Herrick Labs. In addition, technology transfer to sponsors is an integral part of a majority of the research programs. The researchers at the Herrick Labs are also widely published across the spectrum of publications from academic journals to the popular press.

MISSION

An institution dedicated to graduate education and engineering research with emphasis on technology transfer to industry.

VISION

To overcome the barriers between knowledge creation, transfer, and utilization and to become leaders of how graduate education and engineering research are done in partnership with industry.

GOALS

1. To build upon the research excellence of the *Noise and Vibration Control Research Area*, the *Heating, Ventilation, Air-Conditioning, and Refrigeration Research Area* and the *Electro-Mechanical Systems* to enhance their national and international visibility and grow the reputation of these areas as the top research programs in the world.
2. To identify emerging research areas that are synergistic with laboratory focus.
3. To develop a proactive evolutionary strategy for the Laboratories to ensure its long-term stability and growth.
4. To improve the educational environment at the Labs so that its graduate students are multi-functional engineers who rate as the top engineering graduates in the country.
5. To continually monitor the technology transfer process by which research results are transferred to sponsors and the engineering community such that the labs will be recognized as *the* premier source of practical cutting edge research in our areas of expertise.
6. To continually grow the research environment at the Labs for the benefit of the students and faculty at the Labs.

2011-2012 HIGHLIGHTS

Research	***Last Year***	***This year***
Research expenditures HERL only (*academic year)	$3,841,039	$5,016,103
Building Expenditures (*academic year)	$1,553,619	$10,882,857
Number of sponsors as of September 2012	17	31
Research assistants as of September 2012	82	85
Archival papers published (*calendar year)	51	65
Contracts in force for next academic year (July 2012-June 2013)	$2,949,634	$3,388,265
Proposals pending in September (HL share)	$5,905,968	$6,786,566
Education		
Graduate students as of September	83	85
MS	37	42
Ph.D.	46	43
Students graduated (*calendar year)	24	27
MS	13	19
Ph.D.	11	8
Undergraduate/graduate "research experience" students	19	17
Visiting scholars, Post Doctoral Students, Visiting Research Assistants	13	13
Fellowships	10	9
Grant-in-Aid	1	4
Student Paper/Poster/Thesis Awards	4	8
Technology Transfer		
Conferences/Workshops held (*academic year)	9	8
Conferences planned in the next 2 years	3	3
Short Courses held (*academic year)	4	8
Herrick Labs reports to sponsors (*academic year)	12	10
Conference and journal papers (*calendar year)	133	140

- *Academic Year - July 2011 → June 2012 and Calendar Year - January 2011 → December 2011

Administrative and Support Staff

Professor Patricia Davies serves as director of the Ray W. Herrick Laboratories. Judy Hanks is her administrative assistant. The research programs are assisted by the mechanical and electronics shops: Gilbert Gordon, electronic shop coordinator; Bob Brown, mechanical shop coordinator and building deputy; and Frankie Lee, mechanical technician. Ginny Freeman and Kim Stockment serve as administrative assistants for the Herrick Laboratories' conferences and short courses. Additional support staff includes Donna Cackley, secretary.

HERRICK LABS FACULTY RESEARCH INTERESTS

Doug Adams, Kenninger professor of renewable energy and power systems. PhD 2000, University of Cincinnati. Experimental nonlinear dynamics and system identification, diagnostics and prognostics, health monitoring, system-level modeling (compressors, suspensions, exhausts, mounts).

Anil K. Bajaj, Head and professor of mechanical engineering. PhD 1981, University of Minnesota. Nonlinear oscillations in structures, chaotic dynamics, stability analysis, flow-induced vibrations, perturbation techniques, mistuned structures, and localization of modes, drum and disk brake squeal-friction induced vibrations, modeling of carseat-occupant dynamics, and modeling/identification of polyurethane foam properties.

J. Stuart Bolton, professor of mechanical engineering. PhD 1984, University of Southampton. Acoustics, models of porous noise control materials, optimal design of noise control materials and treatments, physical properties of noise control materials, analysis of tire vibration and sound radiation, nearfield acoustical holography, visualization of motor vehicle passby sound radiation, and machinery noise source identification.

James E. Braun, Herrick professor of mechanical engineering. PhD 1988, University of Wisconsin. Thermal systems measurements, modeling, analysis, design optimization, and control optimization with applications to air conditioning and refrigeration equipment and systems.

Jun Chen, assistant professor of mechanical engineering. PhD 2004, Johns Hopkins University. Experimental fluid dynamics; development of flow diagnostic techniques; flow dynamics in stratified environment; and turbulent flow measurements and modeling.

Qingyan (Yan) Chen, Reilly professor of mechanical engineering. PhD 1988, Delft University of Technology. Indoor and outdoor airflow modeling by computational fluid dynamics and measurements, protection of buildings from chemical/ biological warfare attacks, building ventilation systems, indoor air quality, airline cabin environment.

George T.-C. Chiu, professor of mechanical engineering. PhD 1994, University of California at Berkeley. Mechatronics, modeling/control of digital imaging and printing systems, signature embedding for image/document security, material delivery systems for micro-fabrication, assistive devices for patient handling and movement, motion control, embedded systems/control, and perception-based engineering.

Patricia Davies, professor of mechanical engineering, Director of the Ray W. Herrick Laboratories. PhD 1985, University of Southampton. Signal processing and data analysis applied to mechanical systems, condition monitoring, vibration measurement, sound quality and perception-based engineering, nonlinear system identification, modeling of car seat-occupant dynamics and modeling and identification of foam properties.

Eckhard A. Groll, professor of mechanical engineering. Director of office of professional practice. PhD 1994, University of Hannover, Germany. Thermal sciences as applied to advanced HVAC&R systems, components, and working fluids: alternative refrigeration technologies, vapor compression systems, natural refrigerants, compressor research, heat exchangers analysis, miniatur refrigeration systems for electronics cooling.

W. Travis Horton, assistant professor of civil engineering. PhD 2002, Purdue University. Thermal sciences and energy conversion systems, including heating, air conditioning, refrigeration, and electrical systems; combined heat and power systems, and building energy modeling techniques.

Panagiota Karava, assistant professor of civil engineering. PhD 2007, Concordia University. Natural/hybrid ventilation, building airflows, building-integrated photovoltaic-thermal systems, building energy modeling & simulation, design & analysis of energy efficient buildings, wind effects on buildings, indoor environment.

Charles M. Krousgrill, professor of mechanical engineering. PhD 1980, California Institute of Technology. Non-linear oscillation, elastic stability, dynamics, vibrations, rotor dynamics, chaos, automotive brake squeal/vibration, and vibration in gearing systems.

Kai Ming Li, professor of mechanical engineering. PhD 1987, University of Cambridge, UK. Environmental acoustics, sound propagation outdoors, noise control in built environments, monitoring of natural and human produced sounds in the environment, computational acoustics, physical acoustics and wave propagation in a complex medium.

Robert P. Lucht, Ralph and Bettye Bailey professor of combustion in mechanical engineering. PhD 1981, Purdue University. Laser diagnostics; diode-laser-based sensors; gas turbine and internal engine combustion; materials processing and synthesis; combustion science; and fluid mechanics and heat transfer.

Peter H. Meckl, professor of mechanical engineering. PhD 1988, Massachusetts Institute of Technology. Motion and vibration control of high-performance machines, adaptive control, virtual sensing, and diagnostics. Applications to manufacturing devices, robotics, and automotive engines.

HERRICK LABS FACULTY RESEARCH INTERESTS
(CONTINUED)

Ming Qu, assistant professor of civil engineering. PhD 2008, Carnegie Mellon University. Development & application of energy efficient technologies in buildings, solar cooling & heating systems, building energy supply systems, sustainable building design & analysis.

Jeff Rhoads, associate professor of mechanical engineering. PhD 2007, Michigan State University. Nonlinear dynamics and vibration of macro-, micro-, and nanomechanical systems, micro- and nanoelectromechanical sensor design, mechanical and electromechanical amplifiers, parametrically-excited systems, mechanical and electromechanical radio-frequency (RF) components, system dynamics.

Gregory Shaver, associate professor of mechanical engineering. PhD 2005, Stanford University. Modeling, design and control of advanced powertrains for the purpose of developing clean, efficient and practical approaches to utilizing conventional and alternative fuels. Coordination of combustion process with aftertreatment systems and hybrid powertrains. Novel combustion methodologies: Homogeneous Charge Compression Ignition (HCCI), clean diesel.

Thanos (Athanasios) Tzempelikos, assistant professor of civil engineering. PhD 2005, Concordia University. Design of energy-efficient buildings, indoor environment, dynamic facades, lighting controls, integration of green and renewable technologies, solar energy applications, building energy modeling & simulation.

Bin Yao, professor of mechanical engineering. PhD 1996, University of California at Berkeley. Coordinated control of intelligent and high performance electro-mechanical/hydraulic systems; mechatronics; robotics; automotive control; optimal adaptive/robust controls; nonlinear observer design and neural networks for virtual sensing, modeling, fault detection, diagnostics, and adaptive fault-tolerant control; data fusion.

HERRICK FACULTY PROFESSIONAL ACTIVITIES

Anil Bajaj
Contributing Editor, Nonlinear Dynamics Journal

Stuart Bolton
Advisory Board Member, Noise Control Engineering Journal
Vice President for Publications, Institute of Noise Control Engineering , (2011-)
Technical Program Committee, Noise-Con 2013

Jim Braun
Editorial Board, Journal of Building Performance Simulation
Editorial Board, Building Simulation: An International Journal
Associate Editor, International Journal of HVAC&R Research
Chairman, 2012 Int'l Refrigeration and Air Conditioning Conference, Purdue University

Yan Chen
Consultant, The Canaan Company, 2012
Editor-in-Chief, Building and Environment (BAE) Journal
Member, Advisory Board, Energy and Buildings
Member, Departmental Review Panel**,** Dept. of Building Services, Hong Kong Polytechnic University

George Chiu
Fellow of the Society for Imaging Science and Technology (IS&T)
Member, American Society of Mechanical Engineers (ASME)
Member, Institute of Electrical and Electronic Engineers (IEEE)
Vice-Chair, Executive Committee, ASME Dynamic Systems & Control Division, 2012-present
Member, International Federation of Automatic Control (IFAC) Technical Committee on Mechatronic Systems, 2005-present
Member, Executive Committee, ASME Dynamic Systems and Control Division, 2010-2012
Editor, Journal of Imaging Science and Technology, 2012-present
Member, Editorial Board, Frontiers of Mechanical Engineering, 2008-present
Associate Editor, Journal of Control Engineering Practice, 2007-present
Program Chair, the 2016 American Control Conference, Boston, MA, June 2016
Registration Chair, The 2012 American Control Conference, Montreal, Canada, June 2012

Patricia Davies
Past President, Institute of Noise Control Engineering (INCE)
INCE Board of Directors , and General Chair, NoiseCon 2013 Conference

HERRICK FACULTY PROFESSIONAL ACTIVITIES (CONTINUED)

Eckhard Groll
- Regional Editor for the Americas, International Journal of Refrigeration
- Advisory Board Member, Karlsruhe House of Young Scientists, Karlsruhe Institute of Technology
- Director-at-Large, ASHRAE Board of Directors
- Chair, USNC/IIR (U.S. National Committee of the Int'l Institute of Refrig.), 2007-2011
- ASHRAE Advisory and Scientific Committee member: 11th CLIMA 2013 Congress, Prague Czech Republic, June 16-19, 2013
- Steering Committee Member: 15th Annual Colloquium on Int'l Eng. Education, Newport, Rhode Island, Nov. 2-4, 2012
- Steering Committee member: ASHRAE/NIST Refrigerants Conference, NIST, Gaithersburg, MD, October 29-30, 2012
- General Conference Chair: 21st Int'l Compressor Engineering Conference at Purdue, 14th Int'l Refrigeration & Air Conditioning Conference at Purdue, and 2nd Int'l High Performance Buildings Conference at Purdue, July 15-19, 2012

Panagiota Karava
- Member, American Society of Heating, Refrigerating and Air-Conditioning Engineers, 2008-present
- Member, International Building Performance Simulation Association (IBPSA), 2005-present
- Member, American Wind Engineering Association, 2008-present
- Member, US Building Simulation Association, 2009-present
- Organizing Committee, 2nd Int'l High Performance Buildings Conference at Purdue University, 2012
- Member, ASHRAE Technical Committee 4.3, TC 6.7, and TC 4.10, 2008-present
- Member, ASCE Technical Committee on Environmental Wind Engineering, 2009-present

Bob Lucht
- Associate Editor, American Institute of Aeronautics and Astronautics Journal
- Associate Editor, Optics Express

Peter Meckl
- Associate Editor, IEEE Transactions on Control Systems Technology
- Chair, ASME Dynamic Systems and Control Conference Editorial Board
- Finance Chair, 2013 American Control Conference

Ming Qu
- Secretary/Treasurer 2012-2013, Executive Committee, Solar Energy Division (SED) of ASME
- Chair, Technical Committee of Conservation and Solar Buildings, SED of ASME
- Chair, Technical Committee on Building Energy Systems and Optimization Methods, Architectural Engineering Institute, 2010-

Jeff Rhoads
- Program Chair, 2012 ASME Inter. Design Engineering Technical Conferences, 6th Inter. Conf. on Micro– and Nanosystems, Chicago, IL 2012
- Co-Organizer, Symposium on Emerging Applications in Dynamic Systems at the 2012 ASME Inter. Design Eng. Technical Conf, 24th Conf. on Mechanical Vibration and Noise, Chicago, IL, 2012.
- Co-Organizer, Symposium on the Dynamics of MEMS and NEMS at the 2012 ASME Inter. Design Engineering Technical Conf., 6th Inter. Conf. on Micro– and Nanosystems, Chicago, IL, 2012.
- Member, ASME Technical Committee on Vibration and Sound
- Member, ASME Micro-and Nanosystems Technical Committee

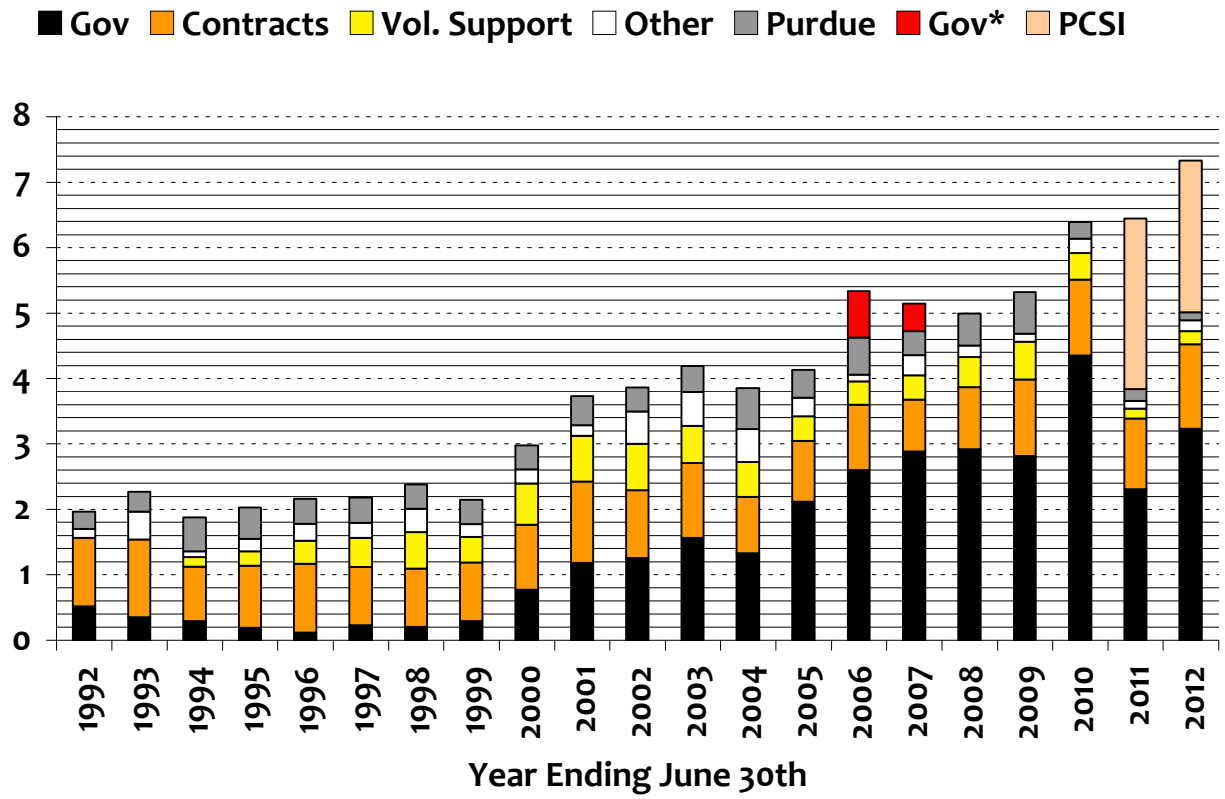
Greg Shaver
- Associate Editor, IFAC Control Engineering Practice Journal
- Associate Editor, ASME Journal of Dynamic Systems and Control

Thanos Tzempelikos
- Associate Member, American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- Voting Member and Subcommittee Chair of ASHRAE Fenestration Technical committee
- Member, Architectural Engineering Institute (AEI) of the American Society of Civil Engineers
- Member, International Building Simulation Association
- Member, International Solar Energy Society
- Chairman, 1st and 2nd International High Performance Buildings Conferences, Purdue University, 2010,2012
- Member of technical review panels for EPA, DOE, and other government-funded research proposals

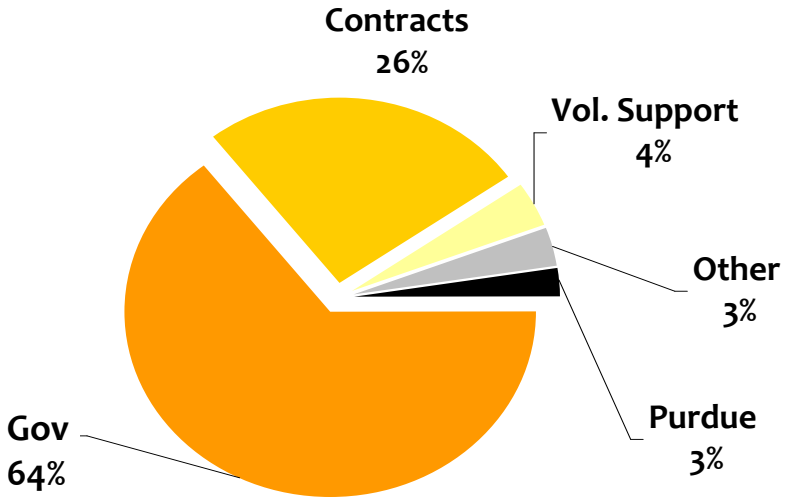
2011-2012 EXPENDITURES

Distribution of Research Expenditures for July 2011 to June 2012, HERL and PCSI only

Additional Building Expenditures: $10,882,857-2012; $1,553,619-2011
HERL Research Expenditures $5,016,103-2012; $3,841,039-2011

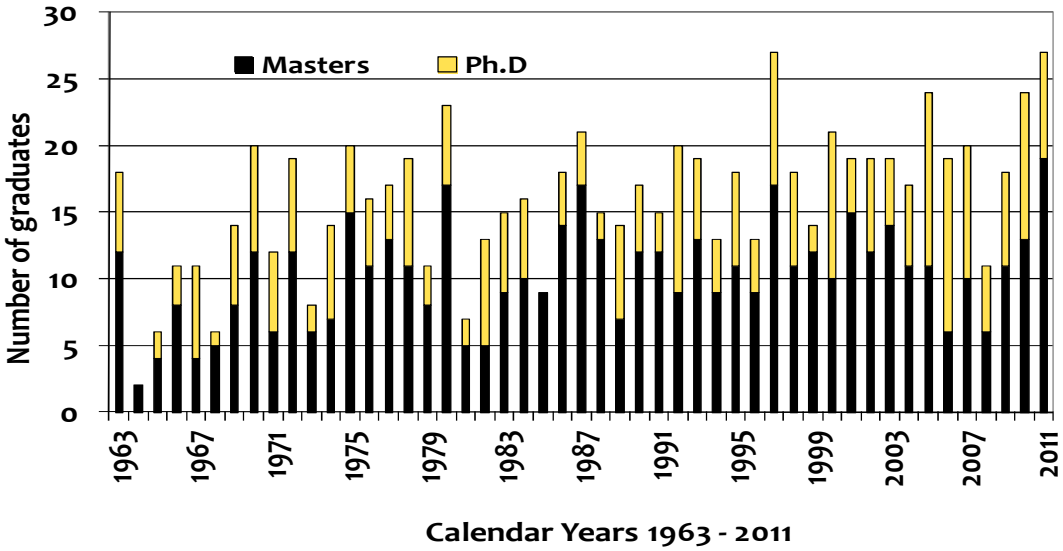


Distribution of Research Expenditures for July 2011 to June 2012, HERL only



HERRICK LABS EDUCATION PROGRAMS

The primary educational program at the Herrick Labs is thesis based graduate education. We believe that the experiential learning, the open-ended and integrative nature of thesis based research is outstanding preparation for both academic and industrial careers. To complement the student/advisor relationship, the Labs offer a learning community to the student. This community includes an outstanding cohort of graduate students as well as a staff prepared to support and teach. In many cases, the student's research is sponsored. Sponsor representatives also participate in educational activities with the student. We also have programs where graduate students do internships in industry or government laboratories. In total we believe this is an outstanding educational opportunity for our graduate students.



Fellowships

Janene Silvers received the Ward A. Lambert Graduate Teaching Fellowship
Craig Bradshaw received the Ward A. Lambert Graduate Teaching Fellowship
Andrew Hjortland received the Laura Winkelman Davidson Fellowship
Jacob Miller received the Charles C. Chappelle Fellowship
Ashish Vora received the Frederick N. Andrews Fellowship
Anne Zakrajsek received the Winifred Beatrice Bilsland Strategic Initiatives Fellowship
Michael Hayward received the Ross Fellowship
Jie Cai received the Ross Fellowship
Sarah McGuire received the Henry Ford Scholarship

Grants-in-Aid

Sugirdhalakshmi Ramaraj received an ASHRAE Grant-in-Aid
Howard Cheung received an ASHRAE Grant-in-Aid
Abhinav Krishna received an ASHRAE Grant-in-Aid
Ki Sup Lee received an ASHRAE Grant-in-Aid

Awards

Abhinav Krishna was awarded a CTRC poster award
Gayatri Adi won best presentation (2nd overall out of 70+) at 2011 International Conference on Advances in Energy Research held on campus of IIT Bombay, India
Ian Bell received Open Access Award from the Purdue Libraries
Ed Koeberlein received the best presentation award at 2011 American Control Conference
Sarah McGuire received the Leo Beranek Award
Ned Troxel received the Magoon Teaching Award, School of Mechanical Engineering
James Mynderse received the Magoon Teaching Award, School of Mechanical Engineering
Hongdan Tao received The National Council of Acoustical Consultants (NCAC) Student Travel Award

CURRENT HERRICK LABS STUDENTS

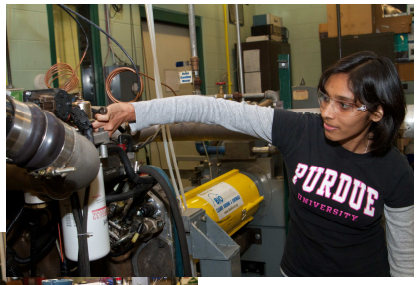
Student	Major Professor	Thesis Subject
Varun Agrawal	Yao	Adaptive robust control of flexible cable driven surgical robotic devices
Yousof Azizi	Davies	Modeling of polyurethane foam and seat dynamics
Christian Bach	Groll	Optimizing refrigerant distribution in evaporators
Nikhil Bajaj	Chiu	Print quality improvement
David Berdy	Rhoads	Wireless sensors for structural health monitoring
Udbhau Bhattiprolu	Davies	System identification techniques for foam systems
Tim Blatchley	Braun	Secondary loop heat pumps
Jie Cai	Braun	Advanced controls for buildings
Rui Cao	Li	Predicting outdoor sound
Stephen Caskey	Groll	Low-temp heat pump
Chun Chen	Chen	Person-to-person transmission of airborne infectious diseases
Howard Cheung	Braun	Modeling and testing of ductless heat pumps
Scott Dana	Adams	Integrated blade sensing
Chuan Ding	Shaver	Modeling & control of high efficiency diesel engines
Abhijit Dingare	Meckl	Multi-objective optimization of injection in a small diesel engine
Joonyup Eun	Chiu	Print quality improvement
David Fain	Shaver	Advanced mode combustion with low reactivity fuels and valve train flexibility
Scott Flueckiger	Groll	Supercritical CO2 heat transfer
Kevin Foertsch	Davies	The number-of-events as a predictor variable in aircraft noise annoyance models
Adam Fogarty	Shaver, Meckl	EcoCAR2—rear drivetrain design
Akash Garg	Shaver	Super truck
Clothilde Giacomoni	Davies	Human Response
Carrie Hall	Shaver	Fuel flexible combustion control
Dong Han	Groll	Optimizing heat pump performance
Michael Hayward	Davies	Separation of noise sources in diesel engines
Andrew Hjortland	Braun	Integrated virtual sensing and decision support for HVAC equipment
Seth Holloway	Horton	Annual performance comparison of fixed speed, variable speed, & mini-split A/C systems
Harshad Inamdar	Groll	Analysis of air-side heat exchange fouling
Bilwa Jadhav	Shaver	EcoCAR2 student vehicle competition
Nelson James	Braun, Groll	Liquid flooded ericksson cycle heat engine
Rita Jaramillo	Braun	Free cooling technologies
Gurneesh Jatana	Shaver, Lucht	On-engine diode laser measurements
Bonggil Jeon	Horton	Inverse building modeling
Andy Jessop	Bolton	Acoustic radiation from tires

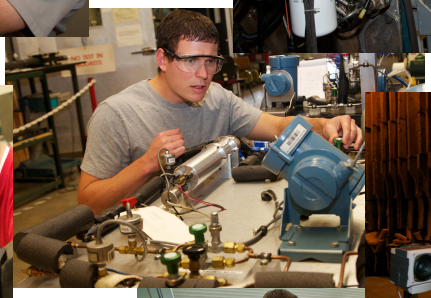
CURRENT HERRICK LABS STUDENTS
(CONTINUED)

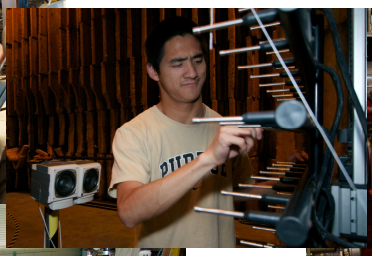
Student	Major Professor	Thesis Subject
Mingang Jin	Chen	Indoor airflow simulations by fast fluid dynamics
Donghun Kim	Braun	Dynamic modeling of building systems
Janghyun Kim	Braun	Modeling of radiant systems
Nicholas Kim	Bolton	Microperforated materials
Woohyun Kim	Braun	Methods for evaluating diagnostic protocols for packaged air conditioning equipment
Abhinav Krishna	Groll	Organic rankine cycle for electronic waste heat recovery
Derek Kultgen	Groll	Cold climate heat pump
Dat Le	Shaver	Real-time estimation & control of rate-shaping for piezo-electric fuel injector
Seungkyu Lee	Bolton	Tire sound radiation
Wei Liu	Chen	Inverse modeling of built environment
Yangfan Liu	Davies/Bolton	Acoustic arrays
Lu Lu	Yao	Direct/indirect adaptive robust control with quantitative parameter estimation
Mark Magee	Shaver	Super Truck/VVA
Andrew McMullen	Davies	Effects of aircraft noise
Jacob Miller	Rhoads	Characterizing the impact of sound & electromagnetic waves on the vibrations of solid bodies
Simbarashe Nyika	Braun	Performance evaluation of ductless mini-split units
Jelena Paripovic	Davies	Identification of Material Properties
Brad Pietrzak	Shaver	Modeling and controls of piezo-electric fuel injection
Aakash Rai	Chen	Simulations of ozone distributions in aircraft cabin environ ment using computational fluid dynamics
Nishi Railkar	Shaver	Advanced mode combustion control
Sugi Ramaraj	Groll	Refrigeration injected scroll compressor
Leighton Roberts	Shaver	Enabling high efficiency combustion via valve train flexibility
Amanda Ruhno	Groll	Analysis of residential oven heat flows
Neha Ruikar	Shaver	Piezo-electric fuel injection—modeling and control
Nicholas Sakamoto	Bolton	Noise source identification
Akhil Salunke	Rhoads	Vibro-impact control
Jin Shen	Shaver	Modeling & control of piezo-electric actuated fuel injector
Zhu Shi	Y. Chen/J. Chen	Energy efficient building hub
Sai Shirsikar	Meckl	Compensation of fuel quantity variation in multiple pulse injection
Janene Silvers	Adams	Active vibration control of fuselage structure
Yuanpei Song	Groll/Braun	Low temperature high performance heat pump
Tom Spicer	Groll	Thermo management of washing machines
Vaidyanadan Sudaram	Davies/Bajaj	Seat-occupant dynamics
Raymond Sutjiono	Meckl	Integration and coordination of diesel aftertreatment systems
Hongdan Tao	Li	Sound structural transmission

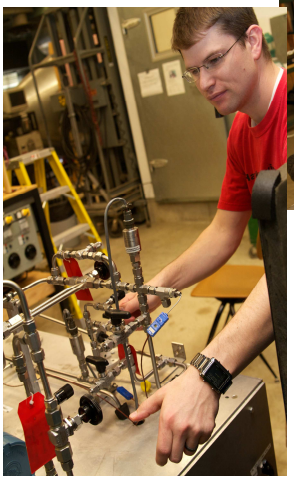
CURRENT HERRICK LABS STUDENTS
(CONTINUED)

Student	Major Professor	Thesis Subject
Prateek Tayal	Meckl	NO:NO2 estimation for diesel oxidation catalyst
Bao Tong	Li	Environmental acoustics
Sara Underwood	Adams	Composite damage detection using laser vibrometry
Aniket Vagha	Meckl/King	Classification tool to detect engine anomalies
Dan Van Alstine	Shaver	Variable valve actuation engine research
Srinivas Varanasi	Bolton/Siegmund	Acoustic barriers
Arun Viswanathan	Li	Wind buffeting noise of vehicles
Ashish Vora	Shaver	Fuel-flexible PHEV control
Haojie Wang	Chen	Reducing energy use by using solar energy and wind for natural ventilation
Ben Warman	Meckl	Analysis of diesel engine performance data to identify anomalies
Daniel Woods	Rhoads	The thermomechanical, near-resonant response of energetic materials
Brandon Woodland	Braun/Groll	Organic rankine cycle with solution circuit for waste heat recovery
Yan Xue	Chen	Simulations of natural ventilation in and around buildings
Bin Yang	Groll	Cold climate heat pump
David Yuill	Braun	Prognostic protocol evaluator









2011 HERRICK LABS GRADUATES

Ian Bell	PhD	Theoretical and Experimental Analysis of Liquid Flooded Compression in Scroll Compressors
Nasir Bilal	Ph.D.	Design Optimization of the Suction Manifold of a Reciprocating Compressor Using Uncertainty and Sensitivity Analysis
Charles Butner	MSME	Investigation of the Effects of Bolt Preload on the Dynamic Response of a Bolted Interface
Yiyuan Chen	MSME	Modeling and Precise Control of an Electro-Hydraulic System with Energy-Recovering via Valve and Accumulator Reconfiguration
Won Hong Choi	MSME	Influence of the Cavity Mode on Tire Surface Vibration
Tiffany DiPetta	MSME	Development and Verification of a Diagnostic Cleat for Detecting Faults in Military Wheeled Vehicles
Frank Eberhardt	MSME	Study of the Feasibility of Estimating Combustion Noise Radiation in Reverberant Environments
Matthew Houtteman	MSME	Applications of Eigenmode Coupling to Damage Detection in Beams
Andrew Huang	MSME	Environmental Acoustics
Janette Jaques Meyer	PhD	Using Impact Modulation to Identify Loose Bolts in a Satellite Structure
Ravindra Kakade	MSME	Fault Detection Using Spectral Methods: Wavelets and Correlation Techniques
Nicholas Kim	MSME	Numerical Modeling of Microperforated Acoustical Materials
Ed Koeberlein	MSME	Physics-Based Modeling and Estimation of Exhaust Manifold Filling Dynamics on a Diesel Engine Equipped with Flexible Intake Valve Actuation
Yan-Fu Kuo	PhD	Improving Tone Consistency and Reducting Calibration Frequency for Color Electrophotography
Ki Sup Lee	PhD	Air Distribution Effectiveness and Thermal Stratification with Stratified Air Distribution Systems
Robert Leffler	MSME	Power Plant Waste Heat Rejection and Utilization Options
Sheng Liu	PhD	The Propagation of Sound from a Monopole and Directional Source Near a Layered Ground
Yangfan Liu	MSME	Sound Field Reconstruction and its application in Loudspeaker Sound Radiation Prediction
Margaret Mathison	PhD	Modeling and Evaluation of Advanced Compression Techniques for Vapor Compression Equipment
Alan Meyer	MSME	Damage Identification for Healthy Monitoring of Ground Vehicle Through Active Probing of Vehicle Response
Ranjit More	MSME	Diagnostics of Advanced Diesel Fuel Injectors
Tyler Robbins	MSME	Development and Verification of Data Analysis Strategies for Characterizing Military Helmet-Head Performance
Hyun Jun Shin	MSME	The Use of Microperforated Materials as Duct Liners
Ned Troxel	MSME	Precision Motion Control of Electro-Hydraulic Systems with Energy Recovery
Matt Vargo	MSME	Compressor Performance Testing
Miao Wang	PhD	Modeling Airflow and Contaminant Transport in Enclosed Environments with Advanced Models
Guangqing Xue	MSME	Design Tool for Under-Floor Air Distribution System

HERRICK LABS TECHNOLOGY TRANSFER PROGRAMS

2012

July 14-19 Twenty-first International Compressor Engineering Conference
Fourteenth International Refrigeration and Air Conditioning Conference
Second International High Performance Buildings Conference
Compressor, Refrigeration and Buildings Short Courses

2010

July 10-15 Twentieth International Compressor Engineering Conference
Thirteenth International Refrigeration and Air Conditioning Conference
First International High Performance Buildings Conference
Introduction to Compressors (Compressors 101) Short Courses
Supermarket Refrigeration Systems Simulation Tools—Status and Recent
High Performance Building Technologies Short Course

May Short Course for Delphi Company, Kokomo, IN

May CLIMA World Congress, Antalya, Turkey

2009

July Los Alamos National Laboratory Dynamics Summer School, Lectures on Nonlinear

Vibration,
Marie Curie Action SICON, Stability, Identification, and Control in Structural Dynamics,
University of Liege, Belgium, Master Series on Identification and Prognosis in Structural Systems,

August INTER-NOISE 2009, Ottawa, Ontario, Canada,
Tutorial for Integrated Systems Health Management Workshop, AFRL

September 9th Healthy Buildings Conference, Syracuse, NY

October Symposium on Research on the Transmission of Disease in Airports and on Aircraft,

Transportation Research Board of the National Academies, Washington DC

November 6th International Symposium on HVAC, Nanjing, China
Engineering Congress on “Alternative Energy Application: Option or Necessity?”
Kuwait City, Kuwait

2008

July 12-17 Nineteenth International Compressor Engineering Conference
Twelfth International Refrigeration and Air Conditioning Conference
Compressor and Refrigeration Short Courses

MAJOR RESEARCH FACILITIES

Thermal Systems Research Area

- Two 7000 ft^3 psychrometric rooms with –10° to 130°F temperature range
- Two room indoor air quality (IAQ) laboratory
- Psychrometric wind tunnel with dust injection system
- Large HVAC equipment lab with 90 ton centrifugal chiller
- Two computer controlled compressor load stands for small compressors
- Many bench test facilities and special experimental setups

Noise and Vibration Research Area

- 25 by 20 by 18 ft reverberation room
- Anechoic room with useful volume 12 by 12 by 12 ft
- Hemi anechoic room with useful volume 41 by 27 by 18 ft
- 8 by 8 ft audiometric room
- Acoustical materials laboratory
- Two wheel chassis dynamometer with 67 inch rollers
- Anechoic wind tunnel with 18 by 24 inch test section and flow velocity up 120 mph
- Three 1000 lb_f hydraulic shakers with 4 inch stroke
- Two 400 lb_f electromagnetic shakers
- 64 microphone acoustical holography array and 90 channel data acquisition system

Perception Based Engineering

- 8 by 8 ft audiometric room
- Printer image quality facilities
- Binaural measurement system and sound quality estimation software
- Steering wheel vibration perception facility
- Two room indoor air quality (IAQ) laboratory
- Perception Based Engineering Lab *(future*) (combined thermal, acoustic, motion, and visual perceptions)

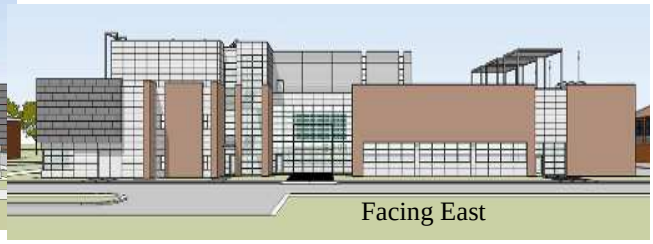
Electro-mechanical Systems Research Area

- 1500 psi 3-axis electro-hydraulic robot
- Four post experimental electro-hydraulic lift system
- Diesel engine control load stand with eddy current dynamometer, EGR, and exhaust after-treatment with transient emissions analyzers
- Gasoline engine control load stand with eddy current dynamometer and transient emissions analyzer
- Prognostics modeling and simulation facility
- Thermal/acoustic test facility
- Environmetrics material conditioning chamber
- MTS static/dynamic/fatigue test apparatus
- Large inventory of vibration and acoustics sensors and actuators

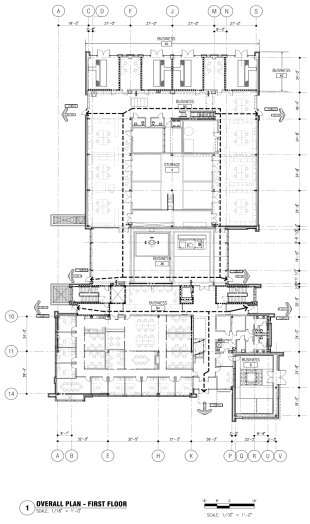
PHASE I: THE CENTER FOR HIGH PERFORMANCE BUILDINGS AT THE RAY W. HERRICK LABORATORIES

The building is progressing well. After signing the contract with construction company (Kettelhut) in early October 2011, construction started immediately. Due to the very mild winter in 2011-2012 we have made great progress on the building, it is almost fully enclosed. The project is on schedule and it is anticipated that we will move in in August 2013 on or ahead of schedule. We are also working on Phases II (acoustics) and Phase III (the replacement and expansion of the technical support area and also addressing storage, rig fabrication and staging needs).

Facing South



Facing East

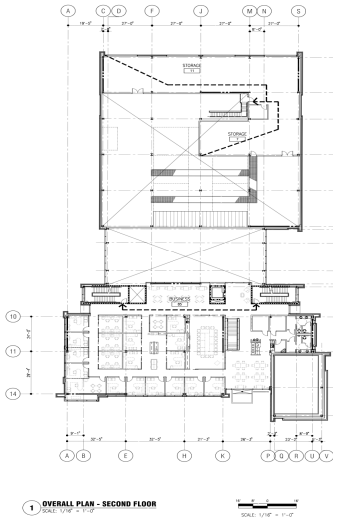


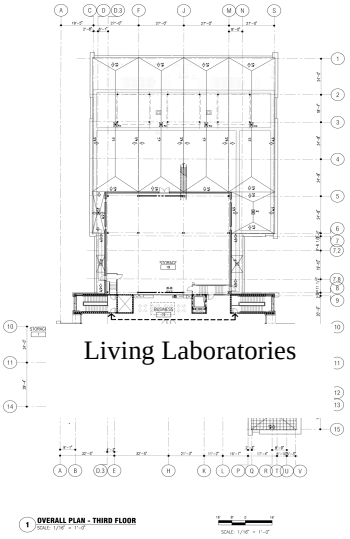
Engines

Thermal Systems

Vibs/Electro-mechanical

Offices & Perception-based Engineering Lab





Living Laboratories

1st Floor

2nd Floor

3rd Floor

There are a lot of naming opportunities in Phase I and Phase II. Contact the Director if you are interested in donating to the laboratory rebuild and expansion: daviesp@purdue.edu, rhlab@purdue.edu, 765 494 9274 or 765 393 2132.