PURDUE
UNIVERSITY

2010-2011
ANNUAL REPORT

FALL 2011

RAY W. HERRICK LABORATORIES

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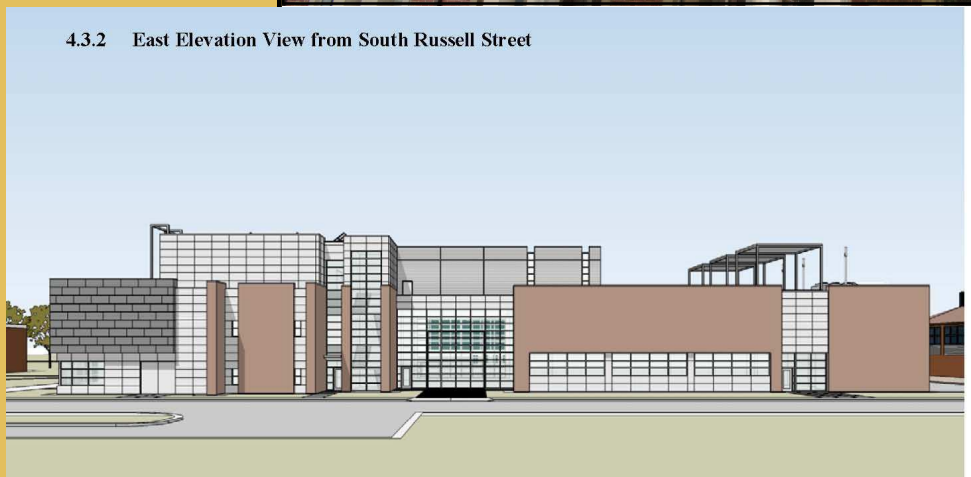


Drawing of the new Herrick Laboratories Building

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.

2010-2011 HIGHLIGHTS

Research	***Last Year***	***This year***
Research expenditures (*academic year)	$6,395,399	$7,996,181
	(Building)	$1,553,619
	(PCSI*)	$2,601,523
Number of sponsors as of September 2011	31	17
Research assistants as of September 2011	76	82
Archival papers published (*calendar year)	68	51
Contracts in force for next academic year (July 2011-June 2012)	5,542,937	** $3,563,890
Proposals pending in September (HL share)	$8,539,178	$5,905,968
Education		
Graduate students as of September	87	83
MS	44	37
Ph.D.	43	46
Students graduated (*calendar year)	18	24
MS	11	13
Ph.D.	7	11
Undergraduate/graduate "research experience" students	29	19
Visiting scholars, Post Doctoral Students, Visiting Research Assistants	16	13
Fellowships	6	10
Grant-in-Aid	2	1
Student Paper/Poster/Thesis Awards	7	4
Technology Transfer		
Conferences/Workshops held (*academic year)	8	9
Conferences planned in the next 2 years	3	3
Short Courses held (*academic year)	2	4
Herrick Labs reports to sponsors (*academic year)	13	12
Conference and journal papers (*calendar year)	133	133

- Academic Year - July 2010 → June 2011 and Calendar Year - January 2010 → December 2010
- * - no HERL co-PI on Project
- ** - HERL Research Only

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 serves as administrative assistant for the Herrick Laboratories' conferences and short courses. Additional support staff includes Donna Cackley, secretary.

HERRICK LABS FACULTY RESEARCH INTERESTS

Doug Adams, professor of mechanical engineering. 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.

Robert J. Bernhard, currently vice president for research at Notre Dame University, but continues his road-tire research at Herrick Laboratories. PhD 1982, Iowa State University. Tire/Pavement noise, acoustics, noise and vibration control, and validation of numerical methods.

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. 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, professor 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, assistant 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
- Board of Directors, Institute of Noise Control Engineering (2007-2010)

Jim Braun
- Associate Editor of the International Journal of HVAC&R Research
- Editorial Board, Journal of Building Performance Simulation
- Editorial Board, Building Simulation: An International Journal
- Chair, ASHRAE Research Administration Committee (RAC)
- Member, ASHRAE Technology Council
- Member, ASME Task Force on Integrated/Efficient Building Equipment and Systems
- Member, Scientific Committee for the 2009 Inter. Conference on Sustainable Development in Building and Environment, Chongqing University of China
- Member, Scientific Committee for 2009 Compressors - 7th Inter. Conference on Compressors and Coolants, Papiernicka, Slovak Republic

Yan Chen
- 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
- Member, Editorial Board, Frontiers of Mechanical Engineering in China
- Associate Editor, IFAC Journal of Control Engineering Practice
- Associate Editor, Journal of Electronic Imaging
- Guest Editor, Focused Sections on Healthcare Mechatronics, IEEE/ASME Transactions on Mechatronics
- Member, Management Committee, IEEE/ASME Transactions on Mechatronics
- Member, Executive Committee, ASME Dynamic Systems and Control Division

Patricia Davies
- President, Institute of Noise Control Engineering, April 1, 2008 – 2010, Past-President 2010-2012
- NAE Technology for a Quieter America Committee (report published Oct. 2010)
- Member, ASA Noise Committee

HERRICK FACULTY PROFESSIONAL ACTIVITIES (CONTINUED)

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

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
- Advisory Board Member, Purdue Convocations
- Steering Committee Member, 11th Annual Colloquium on Inter. Engineering Education, Iowa State University, Ames, IA, Oct. 2009
- Roundtable Panelist, In Times of Global Financial Crisis: Impacts on Cooperative Education & Industrial Partners, WACE (World Association of Cooperative Education) Conference, Vancouver, BC, June 2009

Panagiota Karava
- Member, American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- Member, International Building Performance Simulation Association (IBPSA)
- Researcher, Canadian Solar Buildings Research Network (SBRN)
- Member, American Wind Engineering Association
- Member, ASCE Task Committee on Computer Aided Wind Engineering, 2008-present
- Member, Scientific Committee for the 5th International Symposium on Computational Wind Engineering, Chapel Hill, NC, May 2010
- Member, Scientific Committee for the 1st International High Performance Building Conference, July 2010
- Member, Scientific Committee for the 12th International Conference on Indoor Air Quality and Climate, Austin, TX, June 2011

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

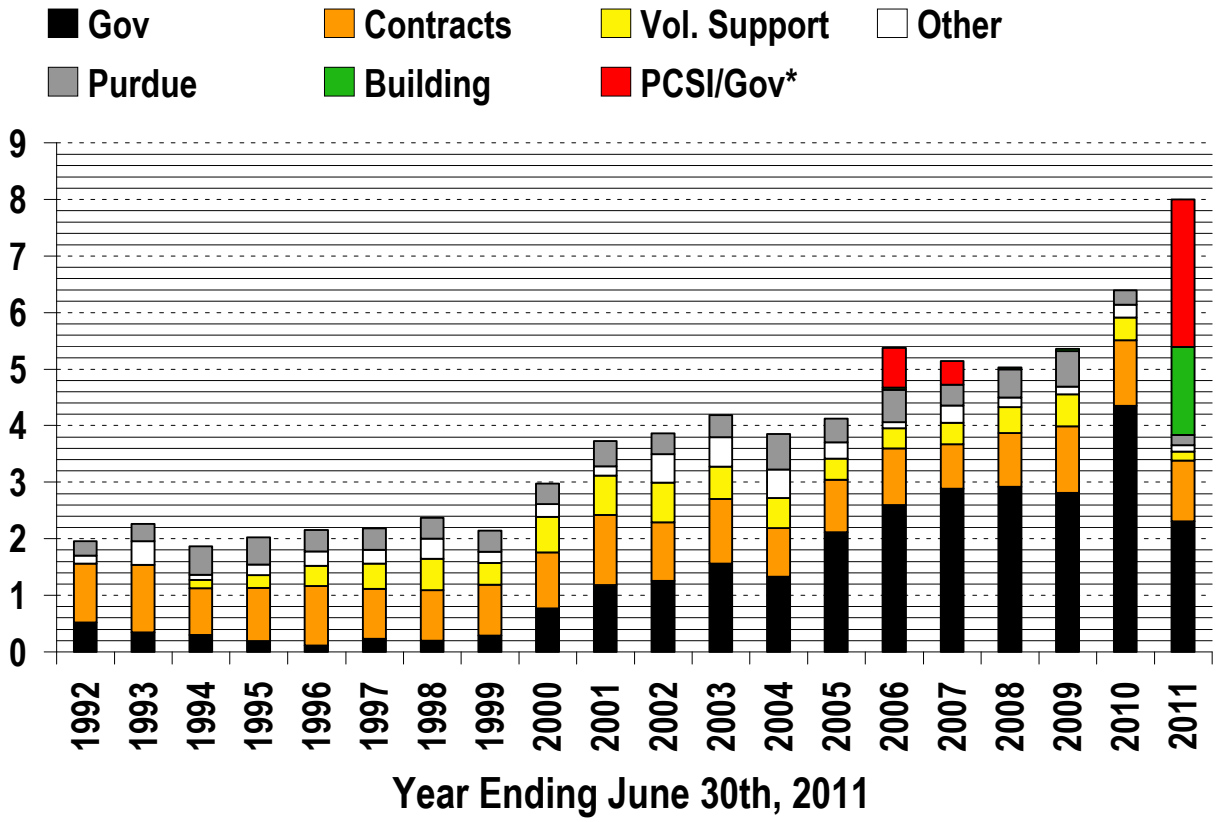
Ming Qu
- Member, Board of Directors, Indiana Renewable Energy Association, 2010-
- Chair, Technical Committee on Building Energy Systems and Optimization Methods, Architectural Engineering Institute, 2010-

Jeff Rhoads
- Member, ASME Student Design Committee
- Member, ASME Technical Committee on Vibration and Sound
- Member, ASME Micro-and Nanosystems Technical Committee

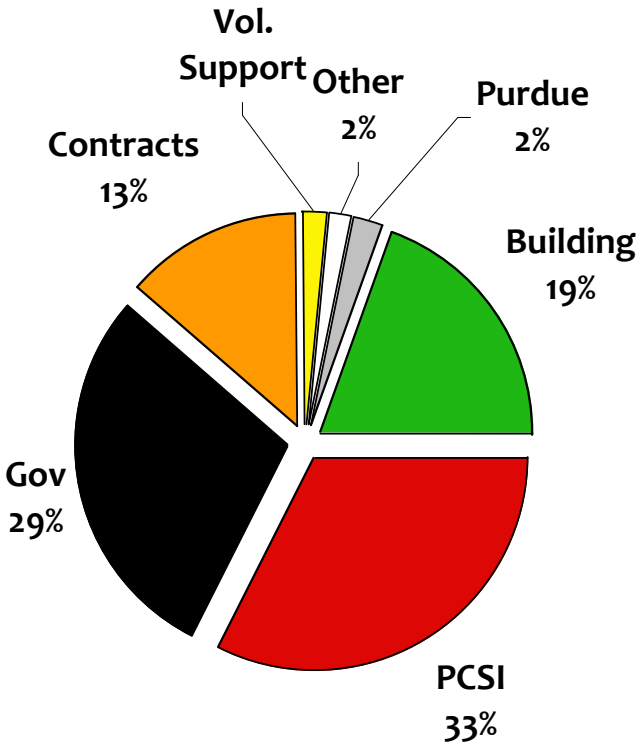
Greg Shaver
- Associate Editor, IFAC Control Engineering Practice Journal

Thanos Tzempelikos
- Member, American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- Member, Architectural Engineering Institute (AEI) of the American Society of Civil Engineers
- Member, International Building Simulations
- Member, International Solar Energy Society
- Board Member, Solar Energy Society of Canada
- Advisory Member, International Commission of Illumination, Canadian Chapter
- Member of Organizing Committee, 1st, 2nd, 3rd, 4th Canadian Solar Buildings Conferences, 200-2010
- Member, Undergraduate Committee, School. Of Civil Engineering, Purdue University, 2009-2010
- Chairman, 1st International High Performance Buildings Conference, Purdue University, 2010
- Member, Technical Advisory Committee, Indoor Air 2011 International Conference
- Member, Steering and Technical Committee, Architectural Engineering 2011 Conference
- Member, Technical Review Panel for Green Building Technologies, EPA, 2009

2010-2011 EXPENDITURES

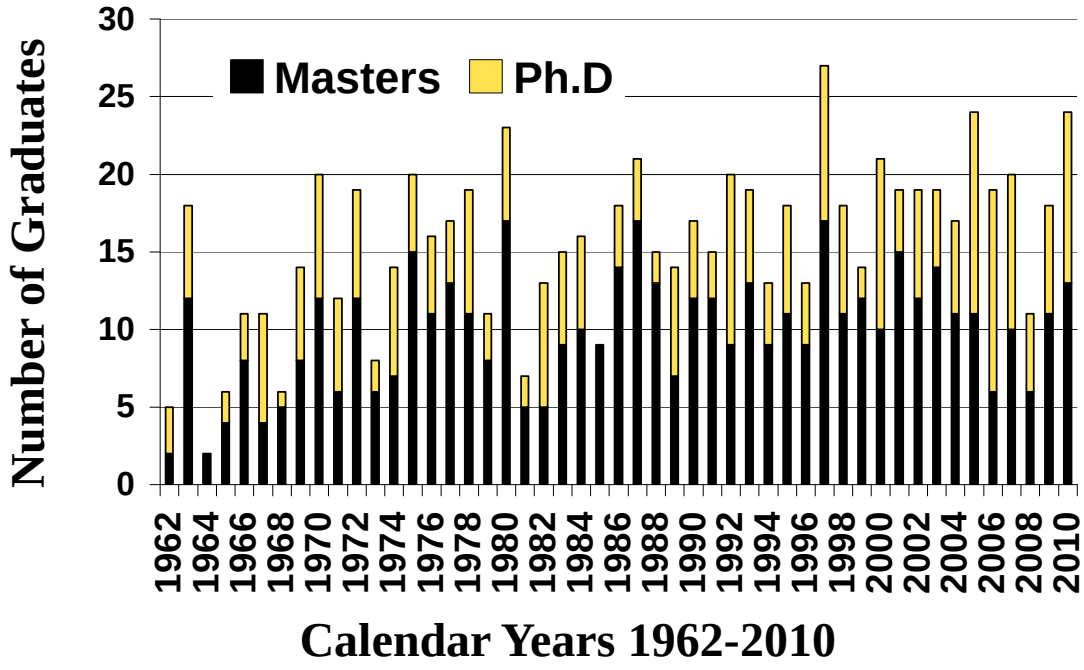


Expenditures for PCSI projects not involving Herrick faculty (other than Doug Adams) are shown in red.



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

Ian Bell received the William E. Fontaine Memorial Fellowship
Tyler Dare received the Ward A. Lambert Graduate Teaching Fellowship
Clothilde Giacomoni received the Helen and John Lozar Fellowship
Carrie Hall received a NSF Graduate Student Fellowship and the Chateubriand Fellowship from the French Embassy
Gurneesh Jatana received the Ross Fellowship
Mingang Jin received the Ross Fellowship
Vijay Kumar received the Ward A. Lambert Graduate Teaching Fellowship
Margaret Mathison received Bilsland Dissertation Fellowship, School of Mechanical Engineering
James Mynderse received a Purdue Graduate School Summer Research Grant

Grants-in-Aid

Abhinav Krishna received an ASHRAE Grant-in-Aid

Awards

Tyler Dare won the Student Paper Competition Award at Noise-Con 2010
Margaret Mathison received the Magoon Award, School of Mechanical Engineering
Andrew Jessop received USDOT FAA Centers for Excellence Outstanding Student of the Year Award
Abhiva Krishna awarded the Best Poster Award at the CTRC Bi-Annual Conference

CURRENT HERRICK LABS STUDENTS

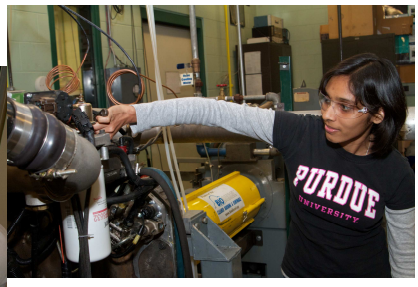
Student	Major Professor	Thesis Subject
Gayatri Adi	Shaver	Modeling, design and control of advanced power train
Varun Agrawal	Yao	Adaptive robust control of flexible cable driven surgical robotic devices
Yousof Azizi	Davies	Modeling of polyurethane foam and seat dynamics
Christian Bach	Groll	Optimizing refrigerant distribution in evaporators
Nikhil Bajaj	Chiu	Print quality improvement
B. Whitney Belt	Shaver	Mobile data acquisition system calibration & emission testing
David Berdy	Rhoads	Wireless sensors for structural health monitoring
Pranav Bhalerao	Meckl	Fuel systems, fuel injection virtual sensor
Udbhau Bhattiprolu	Davies	System identification techniques for foam systems
Tim Blatchley	Braun	Secondary loop heat pumps
Craig Bradshaw	Groll	Analysis of miniature-scale linear compressors for electronics Cooling
Jie Cai	Braun	Advanced controls for buildings
Stephen Caskey	Groll	Low-temp heat pump
Yiyuan Chen	Yao	Energy saving adaptive robust precision control of electro-hydraulic systems
Howard Cheung	Braun	Modeling and testing of ductless heat pumps
Go Choi	Woodall	Diesel engine enrichment
Scott Dana	Adams	Integrated blade sensing
Tyler Dare	Bernhard	Investigation of tire/pavement noise generation mechanisms
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
Thomas Faussett	Groll	Performance evaluation of walk-in freezer system
Kevin Foertsch	Davies	Aircraft noise
Clothilde Giacomoni	Davies	Human Response
Carrie Hall	Shaver	Fuel flexible combustion control
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
Gurneesh Jatana	Shaver, Lucht	On-engine diode laser measurements
Bonggil Jeon	Horton	Inverse building modeling
Andy Jessop	Bolton	Acoustic radiation from tires
Mingang Jin	Chen	Indoor airflow simulations by fast fluid dynamics
Donghun Kim	Braun	Dynamic modeling of building systems
Nicholas Kim	Bolton	Microperforated materials
Woohyun Kim	Braun	Methods for evaluating diagnostic protocols for packaged air conditioning equipment
Lyle Kocher	Shaver	Variable valve actuation engine research

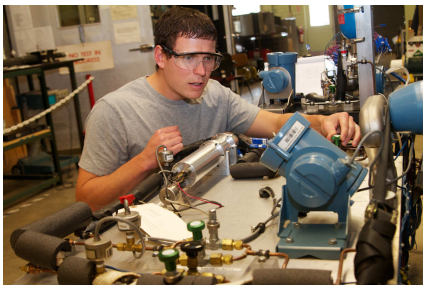
CURRENT HERRICK LABS STUDENTS
(CONTINUED)

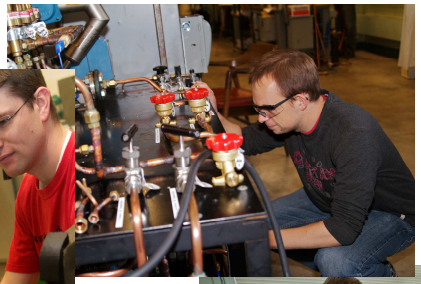
Student	Major Professor	Thesis Subject
Abhinav Krishna	Groll	Organic rankine cycle for electronic waste heat recovery
Derek Kultgen	Groll	Cold climate heat pump
Vijay Kumar	Rhoads	Parametric amplification experiments
Dat Le	Shaver	Real-time estimation & control of rate-shaping for piezo-electric fuel injector
Hsu Chew Lee	Lee	Sound structural transmission
Sangbok Lee	Chiu	HP project
Seungkyu Lee	Bolton	Tire sound radiation
Sheng Liu	Li	Transmission of low frequency sound above a poro-elastic ground
Yangfan Liu	Davies/Bolton	Acoustic arrays
Lu Lu	Yao	Direct/indirect adaptive robust control with quantitative parameter estimation
Andrew Marshall	Davies	Human response to supersonic aircraft noise
Sarah McGuire	Davies	Feasibility of constructing a survey and measurement data base for validating environmental noise metrics
Rick Meyer	Meckl	Modeling and adaptive robust control of fuel cell power systems
Jacob Miller	Rhoads	Characterizing the impact of sound & electromagnetic Waves on the vibrations of solid bodies
James Mynderse	Chiu	Motion and vibration control
Simbarashe Nyika	Braun	Performance evaluation of ductless mini-split units
Jelena Paripovic	Davies	Identification of Material Properties
Ashish Pathak	Chen	Simulations of airliner cabin environment by CFD
Joe Poland	Groll	Acoustically enhanced heat transfer
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
Neha Ruikar	Shaver	Piezo-electric fuel injection—modeling and control
Akhil Salunke	Rhoads	Vibro-impact control
Ryan A. Schultz	Bolton	Porous materials
Bryce Shaffer	Groll	Conduction cooled EIE modules in liquid cooled cabinets
Jin Shen	Shaver	Modeling & control of piezo-electric actuated fuel injector
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
Karla Stricker	Shaver	Combustion and controls
Vaidyanadan Sudaram	Davies/Bajaj	Seat-occupant dynamics
Raymond Sutjiono	Meckl	Integration and coordination of diesel aftertreatment systems
Hongdan Tao	Li	Sound structural transmission

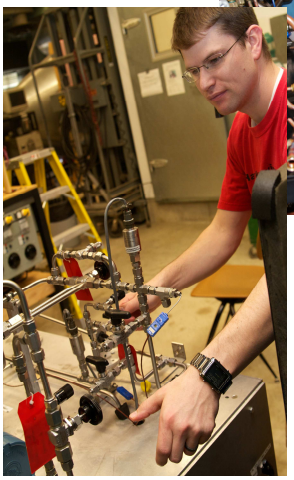
CURRENT HERRICK LABS STUDENTS
(CONTINUED)

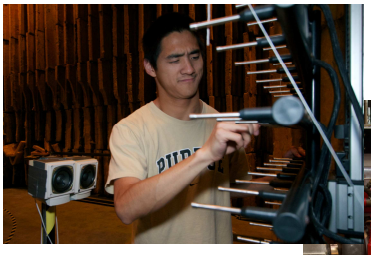
Student	Major Professor	Thesis Subject
Bao Tong	Li	Environmental acoustics
Sara Underwood	Adams	Composite damage detection using laser vibrometry
Dan Van Alstine	Shaver	Variable valve actuation engine research
Arun Viswanathan	Li	Wind buffeting noise of vehicles
Ashish Vora	Shaver	Fuel-flexible PHEV control
Bryan Wang	Adams	Prognostic-driven engineered ground vehicles
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
Brandon Woodland	Braun/Groll	Organic rankine cycle with solution circuit for waste heat recovery
Guangqing Xue	Chen	Infectious disease transmissions in airliner cabin
Yan Xue	Chen	Simulations of natural ventilation in and around buildings
David Yuill	Braun	Prognostic protocol evaluator
Anne Zakrajsek	Nauman	Foam systems for helmets

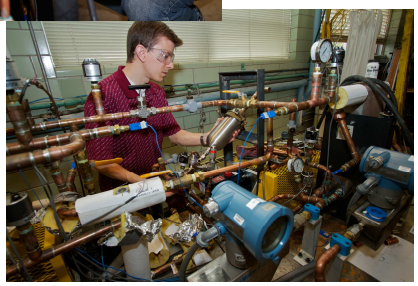












2010 HERRICK LABS GRADUATES

Chaitanya Bhat	MSME	Influence of Electronic Injection Parameters on Combustion-Induced Noise in a Small Diesel Engine
Carson Budde	MSME	Impact Force Identification for Composite Helicopter Blades Using Minimal Sensing
Joshua J. Cummins	MSME	Center of Gravity Effects Using Forced Vibration Response Operational Data
Yash Deshmukh	MSME	Measurement of Foam Properties and Modeling of Layered Foam Systems
Shreekant Gayaka	PhD	An Adaptive Robust Approach to Actuator Fault-Tolerant Control in Presence of Uncertainties and Input Constraints
Jitendra Gupta	PhD	Respiratory Exhalation/Inhalation Models and Prediction of Air borne Infection Risk in an Aircraft Cabin
Derek Hengeveld	PhD	Development of a System Design Methodology for Robust Thermal Control Subsystems to Support Responsive Space
Gauri Joshi	MSME	Planar Whole-Body Vibratory Response of a Nonlinear Multi-Body Model of a Seat-Occupant System with Polyurethane Foam
Vijay Kumar	MSME	Vibration Attenuation and Amplification
Sarah McGuire	MSME	Effects of Aircraft Noise
Rajani Modiyani	MSME	Effect of Intake Valve Closure Timing on Effective Compression Ratio and Gas Exchange Process of a Modern Diesel Engine
Amit Mohanty	PhD	Some Generalizations to the Theory of Adaptive Robust Control and Its Application
Shashikant More	PhD	Aircraft Noise Characteristics and Metrics
Chris A. Satkoski	MSME	Modeling, Estimation, and Control of a Piezoelectric Actuated Fuel Injector
Ryan E. Schultz	MSME	Light-Off Temperature Shift as a Detection Method of Catalyzed Diesel Particulate Filter Nonmethane Hydrocarbon Oxidation Efficiency Degradation
Hsin-Chien Shih	MSME	Modeling and Control of an Electro-Hydraulic Arm
Yoon-Shik Shin	PhD	Numerical and Experimental Investigation of Noise from Small Scale Axial Fans Focusing on Inflow Condition and Acoustic Source Type
David B. Snyder	PhD	Soy-Based Biodiesel Blend Estimation and Accommodation in a Modern Diesel Engine
Bao N. Tong	MSME	Sound Field of a High Speed Airborne Source in a Horizontally Stratified Fluid Medium Above an Impedance Plane
Jonathan White	PhD	Operational Monitoring of Horizontal Axis Wind Turbines with Inertial Measurements
Nathanael Yoder	PhD	The Robust Detection of Cracks in Complex Aerospace Structures Using Nonlinear Vibro-Acoustic Modulation
Matias Zanartu	PhD	Acoustic Coupling in Phonation and its Effect on Inverse Filtering of Oral Airflow and Neck Surface Acceleration
Wangda Zuo	PhD	Advanced Simulations of Air Distributions in Buildings
Brandon Zwink	MSME	Nondestructive Evaluation of Composite Material Damage Using Vibration Reciprocity Measurements

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)

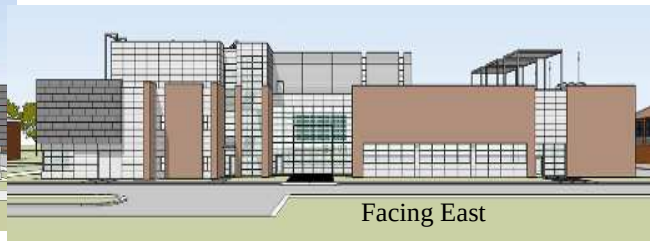
Electro-mechanical Systems Research Area

- 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

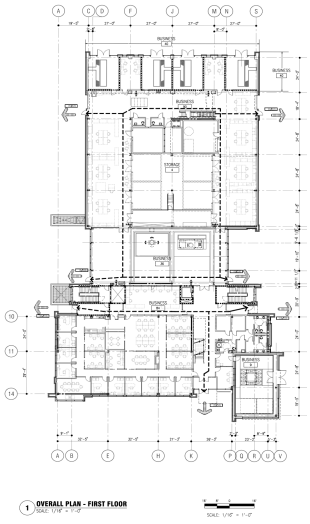
PHASE I: THE CENTER FOR HIGH PERFORMANCE BUILDINGS AT THE RAY W. HERRICK LABORATORIES

This has again been a very interesting year, but I am please to report that in the second week in October we signed the contract and construction is about to start. The final architects' renderings and the first through third layout are shown below. 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



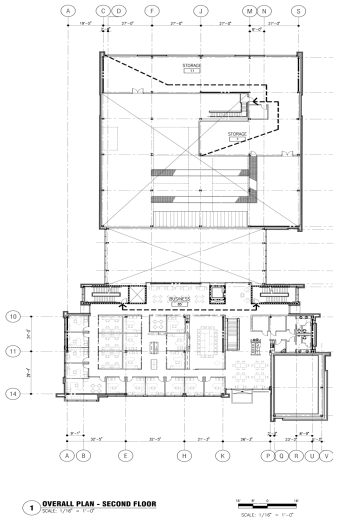
Engines

Thermal Systems

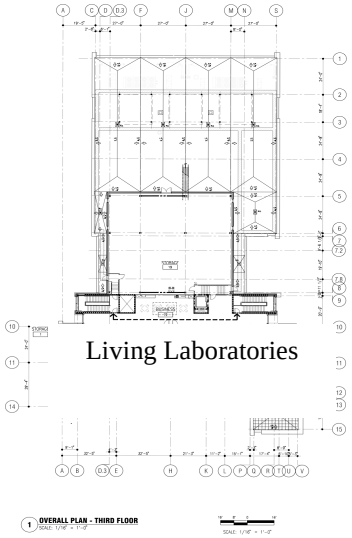
Vibs/Electro-mechanical

Offices & Perception-based Engineering Lab

1st Floor



2nd Floor



Living Laboratories

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.