Greetings to everyone!

This year’s annual report shows the important work of the faculty and students over the past 12 months in the department. As you turn the pages, you will see the many activities they have been engaged in is remarkable. Examples include development of sophisticated, three-dimensional composite material computer simulations capable of predicting physical performance, as well as air quality management in commercial aircraft cabins.

Many undergraduate students are involved with research being conducted by faculty. In addition, the undergraduate students obtain hands-on experience with the design and fabrication of prototypes required by the industrial sponsors of their two-semester sequence capstone senior design course. Competition student design teams supported by the department include SAE Formula, SAE Mini Baja, SAE Aero and the AIAA UAS Design Team. The SAE Aero and UAS teams placed second and fifth, respectively, in national competitions.

The mission of the department is “to (1) provide rigorous and challenging educational experiences at both the undergraduate and graduate levels to enable students to attain their full potential; (2) conduct scholarship that is of national and international repute to generate new knowledge and technology for the benefit of society; and (3) provide service through outreach programs to our profession, the state, and the nation.” Research is recognized to encompass more than funding alone. Research efforts of the faculty shown in this annual report reveal the department’s research activities and accomplishments that have contributed to the fulfillment of this part of the mission. The publications, including books, journal articles and conference proceedings, give a measure of the breadth and depth the faculty has achieved in research.

Major laboratories started and currently supported by the department are the Institute of Environmental Research (IER), the National Gas and Machinery Laboratory (NGML), the semiconductor materials and radiological technologies (SMART) laboratory and the aircraft cabin environment research (ACER) laboratory. These embody the focus research areas in the department. IER performs research relating to understanding how the human body responds to the surrounding indoor environment. NGML supports all aspects of the natural gas industry and improves large-bore gas engine turbochargers. The SMART laboratory designs, fabricates, tests and supplies special nuclear radiation detectors for many applications. The ACER laboratory investigates the transport of disease-containing particulate material inside commercial aircraft cabins. Other significant areas of research in the department include composite materials, nanotechnology, aircraft controls, non-invasive measurements and others. Listings and descriptions in this annual report show the progress made this past year by the department’s faculty.

The department continues to offer off-campus, web-based master’s degree programs in mechanical engineering and nuclear engineering through the Division of Continuing Education. The faculty are active in many professional organizations where significant positions are held. Over the past year, the faculty have been recognized for several important awards relating to their research work and professional service.

Donald L. Fenton
Professor and Department Head
Mechanical and Nuclear Engineering
Kansas State University
3002 Rathbone Hall
Manhattan, KS 66506-2906
785-532-5610
E-mail: fenton@ksu.edu
Donald L. Dunn  
- Ph.D., Nuclear Engineering, North Carolina State University, 1974  
- M.S., Nuclear Engineering, North Carolina State University, 1970  
- B.S., Electrical Engineering, University of Notre Dame, 1968  
Research: Radiation physics and engineering including nondestructive testing, quantitative analysis, and detection of hidden explosives and contraband; radiation shielding; radiation transport analysis; Monte Carlo simulation; and mathematical modeling and inverse analysis.  
Teaching: Nuclear engineering

William L. Dunn  
- Ph.D., Nuclear Engineering, University of Illinois (Urbana-Champaign), 1974  
- M.S., Mechanical Engineering, University of Illinois (Urbana-Champaign), 1970  
- B.S., Mechanical Engineering, Kansas State University, 1969  
Research: Refrigeration, thermal systems design, combustion and thermodynamics.  
Teaching: Thermal/fluid systems

Ali E. Abdou  
- Ph.D., Nuclear Engineering, University of Wisconsin Madison, 2005  
- M.S., Computational Science, University of Wisconsin Madison, 2003  
- M.S., Nuclear Engineering, University of Wisconsin Madison, 2002  
- B.S., Nuclear Engineering, Alexandria University, Egypt, 1992  
Teaching: Nuclear engineering

B. Terry Beck  
- Ph.D., Mechanical Engineering, Oakland University, 1978  
- M.S., Mechanical Engineering, Oakland University, 1974  
- B.S., Mechanical Engineering, Oakland University, 1971  
Research: Experimental heat transfer, fluid mechanics, two-phase flow and optical measurements.  
Teaching: Thermal/fluid systems

Amy R. Betz  
- Ph.D., Mechanical Engineering, Columbia University, 2011  
- M.S., Mechanical Engineering, Columbia University, 2008  
- B.S., Mechanical Engineering, The George Washington University, 2006  
Research: Convective heat transfer, multiphase systems, microfluidics, microfabrication and interfacial transport phenomena.  
Teaching: Thermal/fluid systems

Liang-Wu Cai  
- Sc.D., Mechanical Engineering, Massachusetts Institute of Technology, 1998  
- M.S., Solid Mechanics, Chinese Academy of Sciences, 1988  
- B.S., Solid Mechanics, University of Science and Technology of China, 1985  
Research: Phononic materials, wave phenomena, nondestructive evaluation, mechanics of composite materials and computational mechanics.  
Teaching: mechanics, materials and design

Steven J. Eckels  
- Ph.D., Mechanical Engineering, Iowa State University, 1993  
- M.S., Mechanical Engineering, Iowa State University, 1991  
- B.S., Mechanical Engineering, Dordt College, 1988  
Research: Experimental fluid mechanics and two-phase flow.  
Teaching: Thermal/fluid systems

Mohammad H. Hosni  
- Ph.D., Mechanical Engineering, Mississippi State University, 1989  
- M.S., Mechanical Engineering, Louisiana State University, 1984  
- B.S., Mechanical Engineering, Southern University, 1981  
Research: Fluid mechanics, heat transfer, experimental techniques and uncertainty analysis.  
Teaching: Thermal/fluid systems

Byron W. Jones  
- Ph.D., Mechanical Engineering, Oklahoma State University, 1975  
- M.S., Mechanical Engineering, Oklahoma State University, 1973  
- B.S., Mechanical Engineering, Kansas State University, 1971  
Research: Indoor environmental engineering, transportation vehicle environmental control systems, human thermal systems simulation, and thermal/fluids measurements and instrumentation.  
Teaching: Thermal/fluid systems

Kevin B. Lease  
- Ph.D., Mechanical Engineering, University of Iowa, 1994  
- M.S., Mechanical Engineering, University of Iowa, 1990  
- B.S., Mechanical Engineering, University of Iowa, 1988  
Research: Theoretical, computational and experimental aspects of deformation, fatigue and fracture of engineering materials.  
Teaching: mechanics, materials and design

Sameer I. Madanshetty  
- Ph.D., Mechanical Engineering, Yale University, 1989  
- B.Tech, Mechanical Engineering, IIIT New Delhi, India, 1975  
Research: Physical acoustics, multiphase fluid mechanics, acoustic microcavitation, active sound cancellation, and engineering design for translating basic science research into novel products and processes.  
Teaching: Thermal/fluid systems

Douglas S. McGregor  
- Ph.D., Nuclear Engineering, University of Michigan, 1993  
- M.S., Nuclear Engineering, University of Michigan, 1992  
- M.S., Electrical Engineering, Texas A&M University, 1989  
- B.S., Electrical Engineering, Texas A&M University, 1985  
Research: Design, development and deployment of radiation detectors and detection systems; nuclear measurements of various ionizing and non-ionizing radiation; semiconductor device physics, semiconductor device design and semiconductor device fabrication.  
Teaching: Nuclear engineering
David A. Pacey
- Ph.D., Mechanical Engineering, Kansas State University, 1989
- M.S., Mechanical Engineering, Kansas State University, 1979
- B.S., Agricultural Engineering, Kansas State University, 1974

Research: Instrumentation and measurement systems, machine design, fluid power hydraulics and dynamic system modeling.
Teaching: mechanics, materials and design

Dale E. Schinstock
- Ph.D., Mechanical Engineering, University of Kansas, 1994
- M.S., Mechanical Engineering, University of Kansas, 1992
- B.S., Mechanical Engineering, University of Kansas, 1989

Research: Unmanned aerial vehicle (UAV) systems including control, guidance and remote sensing systems; electromechanical systems; machine and motion controls; and servo systems.
Teaching: dynamic systems and controls

J. Kenneth Shultis
- Ph.D., Nuclear Science and Engineering, University of Michigan, 1968
- M.S., Nuclear Science and Engineering, University of Michigan, 1965
- B.A.Sc., Engineering Physics, University of Toronto, 1964

Research: Remote sensing, transport theory and radioactive transfer, risk analysis, radiation protection and shielding, numerical analysis, radiological assessment and utility power analysis.
Teaching: nuclear engineering

Gurpreet Singh
- Ph.D., Mechanical Engineering, University of Colorado at Boulder, 2007
- M.S., Mechanical Engineering, University of Colorado at Boulder, 2006
- B.E., Mechanical Engineering, Govt. College of Engineering Pune, India, 2003

Research: Nanotechnology, fabrication and characterization of small-scale structures involving individual carbon nanotubes, hybrid NWs and other multifunctional nano-materials.
Teaching: mechanics, materials and design

Gregory L. Spaulding
- M.S., Mechanical Engineering, Kansas State University, December 1984
- B.S., Mechanical Engineering, Kansas State University, August 1980

Research: Design, control and analysis of mechanical components and systems.
Teaching: dynamic systems and controls

Daniel V. Swenson
- Ph.D., Civil Engineering, Cornell University, 1986
- M.S., Mechanical Engineering, Carnegie Mellon University, 1978
- B.S., Mechanical Engineering, Kansas State University, 1972

Research: Interactive implementation of finite-element methods; linear, nonlinear and dynamic fracture; coupled hydraulic/thermal/stress analysis of geothermal reservoirs; and topological representation of problem geometry.
Teaching: mechanics, materials and design

J. Garth Thompson
- Ph.D., Mechanical Engineering, Purdue University, 1967
- M.S., Mechanical Engineering, Purdue University, 1962
- B.S., Mechanical Engineering, Brigham Young University, 1960

Research: Automatic control systems, especially digital and embedded control systems; aircraft avionics; navigation and control automation; and simulation and design.
Teaching: dynamic systems and controls

Youqi Wang
- Ph.D., Engineering, Shanghai Jiao Tong University, China, 1985
- M.S., Structural Mechanics, Shanghai Jiao Tong University, China, 1982

Research: Nano-scale simulation, mechanics of composites, manufacture and processing of composites, finite-element analysis and textile processes.
Teaching: mechanics, materials and design

Kevin M. Wanklyn
- Ph.D., Mechanical Engineering, Kansas State University, 2008
- M.S., Mechanical Engineering, Kansas State University, 2002
- B.S., Mechanical Engineering, Kansas State University, 2000

Teaching: thermal/ fluid systems

Warren N. White
- Ph.D., Mechanical Engineering, Tulane University, 1985
- M.S., Electric Power Engineering, Rensselaer Polytechnic Institute, 1977
- B.S., Electrical with Honors, Tulane University, 1974

Research: Control theory, control design for nonlinear electromechanical systems with emphasis on underactuated systems, holonomic and non-holonomic dynamic systems, vibrations, measurements and instrumentation, and estimating building heat loads created by electric power equipment.
Teaching: dynamic systems and controls

X. Jack Xin
- Ph.D., Mechanical Engineering, University of Sheffield, U.K., 1992
- B.S., Mechanics, University of Science and Technology of China, 1985

Research: Finite-element method, powder consolidation, nano-scale layered materials, fracture, fatigue, composite materials, computational mechanics, dislocation theory and constitutive modeling.
Teaching: mechanics, materials and design

Youqi Wang
- Ph.D., Engineering, Shanghai Jiao Tong University, China, 1985
- M.S., Structural Mechanics, Shanghai Jiao Tong University, China, 1982

Research: Nano-scale simulation, mechanics of composites, manufacture and processing of composites, finite-element analysis and textile processes.
Teaching: mechanics, materials and design
Triga Mark II
The Kansas State University TRIGA Mark II nuclear reactor facility supports academic and education programs, research, industrial service and outreach. The reactor, which is entering its 50th year of operation, is licensed to operate at up to 1.25 MW. Students in the MNE nuclear option utilize the reactor in two reactor operation laboratory classes, and as a neutron and gamma source for a radiation-detection course. The facility provides sample irradiations and tours for many other courses within the university, and provides tours for area students from grade school to college age. The research capabilities of the reactor include a variety of neutron beams for detector testing, internal imaging using neutron radiography and tomography, tracer isotope production, and trace element analysis via neutron activation analysis. The facility is staffed almost entirely by licensed undergraduate student operators, thereby providing both an excellent opportunity for the students and supporting the manpower needs of the local nuclear power industry. The facility is an educational resource for numerous pre-college groups and programs, including the Boy Scouts, ESSI and Engineering Scholarship Day. http://www.mne.ksu.edu/research/centers/reactor

SMART lab
The semiconductor materials and radiological technologies (SMART) laboratory is a unique facility dedicated to the research and development of new and innovative radiation detector technologies. Established in 1997, it is one of the largest and most diverse university-based radiation detector development laboratories in the United States. A variety of detectors are investigated and fabricated, which include compact low-power semiconductor neutron detectors, high-resolution room-temperature-operated semiconductor gamma-ray spectrometers, pixelated devices for gamma-ray or neutron imaging, and neutron-beam-fabricated detectors. Further, the SMART lab is involved with all aspects of solid-state detector development, including materials purification, crystal growth and characterization, detector modeling and design, detector fabrication, testing and characterization, electronics design and final packaging.

The SMART lab spans more than 6000 square feet of lab space divided into specialized research labs, including two crystal-growth labs, a crystal segmenting and polishing lab, a 500 sq ft class 1000 clean room, a 1000 sq ft class 100 clean room, two detector testing and characterization labs, a workshop and tool room, a characterization and analysis lab, and an electronics shop. The SMART lab serves as a center for undergraduate and graduate student education as well as a facility to accommodate funded research projects from various government and industrial sponsors. The SMART lab is conveniently located next to the KSU TRIGA Mark II nuclear reactor, thereby allowing for straightforward testing of various radiation detectors. Detectors and systems designed in the SMART lab have resulted in 12 allowed U.S. patents with several additional patents pending. SMART lab researchers were awarded an R&D 100 Award in 2005 for an innovative gamma-ray spectrometer design, and an R&D Award in 2009 for development of the microstructured semiconductor neutron detectors and accompanying electronics. The award is presented by R&D Magazine as one of the 100 most technologically significant inventions of the year. Students and faculty performing research in the SMART laboratory have generated more than 160 scientific papers. Over the years, the laboratory has benefited from numerous sponsors, including DTRA, NSF, the DOE NEER Program and the DOE NNSA, amounting to more than $14M in extramural research support. http://www.mne.ksu.edu/research/centers/SMARTLab

The National Gas Machinery Lab
The National Gas Machinery Lab (NGML), an institute of the College of Engineering at Kansas State University, is home to the turbocharger test and research facility, which is capable of full-performance turbocharger testing. The NGML is also recognized for substantial research involving use of natural gas in the heating and cooling of built environment and industrial processes. From engineering students to leading researchers, the NGML represents skill and dedication. Together, cross-disciplinary teams methodically apply science and engineering fundamentals to real-world problems. As emission requirements tighten, demand for this independent turbocharger test facility continues to grow. This state-of-the-art facility includes the following:

- well-engineered and instrumented test cell that meets ASME and SAE test codes
- fully calibrated data acquisition system that meets Nuclear Regulatory Commission requirements
- software interface with the data acquisition system that eliminates human error and provides automated report generation
- natural gas burner to heat air entering the turbine that allows a test to be conducted under simulated engine exhaust field conditions
- ability to change operating condition parameters while under test to field operating conditions

http://www ngml.ksu.edu

The Institute for Environmental Research
The Institute for Environmental Research (IER) is an interdisciplinary research center for the study of the thermal interaction of people and their surroundings. It is one of the few centers in the world with controlled environmental chambers and supporting instrumentation necessary to study the aspect of human comfort. IER research deals with thermal comfort, thermal stress, clothing systems, indoor environmental engineering and related topics. The institute is part of the Kansas State University College of Engineering. It works in cooperation with many different academic departments throughout the university. This cooperation includes use of facilities not available at the institute and, more importantly, it includes the ability to draw upon the faculty and students of these departments. This structure provides a great deal of flexibility, making it practical to bring together interdisciplinary teams needed for our research programs and allowing us to provide a comprehensive approach to thermal-environmental research.

The institute was established in 1963 following the gift of a sophisticated environmental chamber from the American Society of Heating, Refrigerating and Air-Conditioning Engineers. Today, the institute occupies 5,500 square feet of laboratory and office space on the Kansas State University campus. Eight computer-controlled environmental chambers are now available for use. Essentially any indoor thermal condition can be simulated (e.g., radiant heating, fluctuating temperatures, etc.). Extreme thermal environmental conditions can also be simulated with possibilities ranging from arctic to desert to tropical conditions. These chambers are supported by instruments for measuring and recording thermal-environmental parameters and human physiological responses to the thermal environment.

http://www.k-state.edu/ier

Nanoscience and engineering laboratory
The nanoscience and engineering lab in the mechanical and nuclear engineering department is located in the basement of Rathbone Hall. Two undergraduate and two doctoral students currently work in the lab. Assistant Professor Gurpreet Singh is the lab director.

Below is a summary of major research achievements from the year 2011-2012:

- Microwave processing of SiBCN-carbon nanotube composite. We demonstrated synthesis of PDC-MWCNT composites by microwave irradiation (in a domestic microwave oven). Our research has shown that the most effective polymer-to-ceramic conversion occurs during the first few minutes of microwave exposure. The proposed process takes a fraction of the time required by the conventional process and hence offers energy and time savings, and a cost-effective alternative. Furthermore, the high-temperature oxidation resistance of the microwave specimen is comparable to or better than that of Si(B) CN-MWCNT composites prepared by conventional routes (about eight hours processing time). This is also graduate student Romil Bhandava’s Ph.D. project.
Research

Lithium-ion rechargeable battery research. Our lab demonstrated synthesis of a free-standing composite paper consisting of a polymer-derived ceramic STOc functionalized carbon nanotube (CNT) network. The paper was prepared by vacuum filtration of CNT followed by drop coating of polysiloxane polymer on its surface. We utilized this paper as an independent anode material in rechargeable lithium-ion batteries and thereby, simplified the anode design by eliminating the binder, conductive additives and current collector metal. The composite paper anode weighs ~37% less than those made using conventional copper substrates. We expect to have more results on this work by the end of 2012.

Advanced black coatings for laser thermal detectors (61.16 μm and 10.6 μm wavelengths): We recently demonstrated improved damage threshold of Si/B-CN-AWCCNT composite coatings against high-power laser irradiation (up to 15 kW/cm²). Our primary aim is to develop a coating material that has high optical absorbance in the infrared range, high thermal conductivity and high temperature oxidation resistance. The next generation of calorimeters (or thermal detectors) for high-power lasers and other energy applications must be able to absorb 100 kW/cm² without damaging the calorimeter. The current calorimeter capacity is approximately 0.1 kW/cm². Therefore, from thermal and mechanical considerations, this presents a huge technical challenge. To provide a perspective on this challenge, we note that at 100 kW/cm², the heat flux is 1000 times larger than that experienced one mile away from ground zero during a one-megaton nuclear bomb detonating on the Earth’s surface.

Fabric mechanics group
The fabric mechanics group at Kansas State researches woven and braided fabrics. Software developed by the group uses a digital fiber consisting of a chain of rod elements connected by frictionless pins, with contact between adjacent fibers. Several digital fibers are assembled into a yarn, with yarns optionally assembled into tows. The yarns (or tows) can then be woven or braided into fabrics. Because the fabric is modeled at the micro-scale, it is possible to predict the as-woven geometry of the fabric. The image above shows the geometry of a 3-D woven unit cell, which can be replicated to define a fabric and then used directly in a simulation. Alternately, the geometry can be provided to other users for use in creating a finite-element model of the fabric. Comparisons of the predicted woven geometry and the experimentally observed geometry show good correlation.

The software developed at Kansas State can be used in dynamic simulations to predict penetration and draping of the fabric. Explicit integration is used and, because of the large number of elements in the digital fiber, the option is provided for parallel processing on a computer cluster.

Automonomous vehicle systems lab
The autonomous vehicle systems lab operates and performs research with several unmanned aerial systems (UAS), including both fixed-wing and rotary-wing aircraft. Expertise of the lab includes real-time navigation and control solutions, and photogrammetric processing of imagery. The lab works cooperatively with researchers in agronomy and geography and with the unmanned aircraft systems program office at K-State Salina. It also works cooperatively with an open-source worldwide autopilot group, OpenPilot, to which it has made significant contributions. Recent accomplishments include 1) development of real-time monocular-camera-based navigation solutions for rotary-wing aircraft, which simultaneously builds 3-D maps of the environment and provides position information needed for guidance and control; 2) development of automatic tuning algorithms for autopilots; and 3) automated production of digital terrain models from stereo pushbroom imagery.

Radiation measurement applications laboratory
The Kansas State University radiation measurement applications (RMA) laboratory has been providing state-of-the-art facilities to conduct research into the application of radiation to the measurement of physical properties of matter and to support teaching, research and service activities in the area of radiation measurement applications. The RMA laboratory seeks to be an internationally recognized center for the investigation and use of radiation measurement applications.

The lab demonstrates the following:

- Numerous radiation detectors, including—
  - 80% and 20% high-purity germanium detectors
  - lithium-drifted silicon (Si-Li) detector
  - numerous NaI(Tl) scintillation detectors
  - various gas detectors
  - plastic scintillating fibers
  - two europium doped lithium isolate neutron detectors
  - Tektronix TDS 420 digitizing oscilloscope
  - Multiple portable and rack-mounted electronics modules including several Canberra multichannel analyzers (MCAs) and associated Genie 2000 Software
  - Two high-precision computer-controlled stepping motors
  - 16-channel data acquisition board and MCA and multiscalar boards
  - 450 kV X-ray machine source, 5-MeV betatron and various radioisotope check sources

Microfluidics laboratory
The microfluidics laboratory, located in the basement of Rathbone Hall, is currently being developed by Assistant Professor Amy Betz. In microfluidics systems, surface forces dominate over inertial forces and gravity, therefore changing the behavior of multiphase systems. In the microfluidics laboratory, we research the manipulation and control of multiphase microfluidic systems to address problems in health, energy and the environment. Current projects include the following:

- Bipolar surfaces for enhanced boiling heat transfer
- High heat transfer rates delivered by boiling are needed in industrial applications such as thermal generation of electricity, metallurgy, electronics cooling and food processing. By using the same micro-manufacturing techniques used in the semiconductor industry, we can pattern surfaces with hydrophilic and hydrophobic spots. During boiling, heat transfer bubble dynamics can be controlled by manipulating the size and shape of the hydrophobic patterns. Control of bubble dynamics can improve the reliability and efficiency of boiling heat transfer.
- Flow-rate measurement and leak detection using radioactive and inert tracers
- Although the laboratory is primarily used for research, it also has supported courses such as nuclear reactor laboratory, industrial design projects, special topics, radiation measurement applications and reactor applications virtual laboratory.

http://www.mne.ksu.edu/research/laboratories/radiation-measurement-applications-laboratory

- Segmental flow to enhance heat and mass transfer in microchannels
  - In 2011, approximately 1% of U.S. electricity consumption was used to cool servers and data centers. By implementing enhanced liquid cooling techniques, the U.S. could save 20 billion kWh (equivalent to 10 million barrels of crude oil) of energy each year. One proposed enhanced cooling method is the use of segmented flow in microchannel heat sinks. Segmental flow is a two-phase dispersion pattern that occurs in channels with hydraulic diameters small enough for surface forces to dominate over body forces such as gravity. The continuous phase, which is in contact with the wall, is referred to as plugs, while...
the dispersed phase is referred to as slugs. In this flow pattern, the slugs move faster than the continuous phase, causing recirculating wakes in the bulk flow. These recirculating wakes enhance heat and mass transfer.

Controlling and mitigating frost formation
Frost is formed when humid air comes in contact with a solid surface at a temperature below the dew point and the freezing temperature of water. The formation of frost can have severe consequences. Applications for frost-mitigating surfaces include refrigeration systems, aircraft, and power transmission.

Aircraft cabin environment research laboratory
Air travel is an inherent part of modern society, and it is important that the aircraft cabin be a healthy, disease-free environment for passengers and crew. The aircraft cabin environment research laboratory is a 10,000 ft² laboratory developed to conduct research on aircraft cabin environments and aircraft environmental control systems. It has an 11-row mockup of a wide-body aircraft, which includes actual aircraft air supply and distribution systems that can recreate the same environmental conditions encountered in aircraft operation. Supported by the Federal Aviation Administration, the private aviation industry and Kansas State University Targeted Excellence Program, we have been conducting, for more than 10 years, research to study contaminant spread and removal in aircraft. Current research focuses on the spread of disease in aircraft cabins, means to minimize disease spread and contaminate from the engine bleed air supplied to the aircraft cabin. Whether it is the everyday cold, deadly disease outbreaks like SARS or avian flu, or the H1N1 flu pandemic, it is essential we understand the risk of disease transmission in the aircraft cabin, and take the most effective and appropriate measures to mitigate it. Likewise, it is important the air supplied to the aircraft cabin be free of harmful contaminants. While human health is the key driving motivation for this research, there is a compelling underlying economic consideration. The traveling public must be confident that flying is safe and healthy if there is to be a strong aviation industry.

Ali E. Abdou

B. Terry Beck

Amy R. Betz

Liang-Wu Cai

William L. Dunn
- Dunn, WL. and J.K. Shulits (2011), Exploring Monte Carlo Methods, Elsevier Science,
Publications


Byron W. Jones


Kevin B. Lease


Douglas S. McGregor


Publications

J. Kenneth Shultis


Gurpreet Singh

- Bhandavan, W. Kahn, E. Mansfield, J.H. Lehtonen, and G. Singh*. Synthesis of Polymer-Derived Ceramic Si(B)CN Composite by Microwave-Induced Interfacial Polarization. ACS Applied Materials & Interfaces (2011).
- Advances in Nanomaterials and Nanostructures: Ceramic Transactions, Volume 229, Publisher, John Wiley & Sons (2011).

Youqi Wang


Warren N. White


X. Jack Xin

Grants

Alli E. Abdou
- Establishment of Nuclear Engineering Faculty Development and Assistance Program at Kansas State University, NRC, May 2010-April 2013, $345,000

B. Terry Beck
- Determine the Effect of Duct Fittings on Air-Flow Traverse, ASHRAE, July 2005-June 2011, $60,808
- Development of a Water-Based, Critical Flow, Non-Vapor Compression Cooling Cycle, US DOE, October 2010-September 2012, $429,610
- Nanosecond Photography for Bubble Visualization and Measurement, PAX Streamline, May 2010-April 2011, $74,943
- Quantifying the Effect of Processing Steel and Concrete Variables on the Transfer Length in Pretensioned Concrete Cables, US DOT, May 2011-October 2013, $289,429

Liang-Wu Cai
- Two-Dimensional Tunable Phononic Materials Research, NSF, June 2005-May 2011, $218,000
- Introducing Finite-Element Methods into Undergraduate Engineering Courses through a Module-Based Approach, NSF, March 2008-February 2012, $149,985
- Two- and Three-Dimensional Broadband Acoustic Metamaterials via Homogenization and Multiple Scattering from Arrays of Natural Minerals, US DOD, January 2009-March 2012, $384,000
- Metamaterials for Acoustic Cloaking, ONR ACENTECH, June 2010-March 2012, $70,000
- Acoustically Tailored Composite Rotorcraft Fuselage Panels, NASA, February 2011-December 2012, $75,656

William L. Dunn
- Establishment of Nuclear Engineering Faculty Development and Assistance Program at Kansas State University, NRC, May 2010-April 2013, $345,000
- Online Nuclear Engineering Laboratory (1Lab): Virtual Reactor Experiments, NRC, July 2010-June 2011, $160,000
- Expeditorial Capabilities Consortium, M2 Technologies, August 2010-August 2012, $927,085
- Collaborative Distance Education Course on Radiations and Dosimetry in Nuclear Health Physics, NRC, August 2011-August 2012, $39,123
- Development of a Distance Education Course Sequence on Probabilistic Risk Assessment and Fire Protection, August 2011 – August 2012, $184,791

Steven J. Eckels
- A Study of Long-Range Acoustic Propagation, US DOD, September 2009-September 2011, $60,300
- Development of a Water-Based, Critical Flow, Non-Vapor Compression Cooling Cycle, US DOD, October 2010-September 2012, $429,610
- Aircraft Recirculation Filter for Air Quality and Incident Assessment, FAA, February 1, 2009 – December 31, 2011, $120,000
- Contamination Measurement Methods, FAA, July 1, 2008 – December 31, 2011, $75,000

Jeffrey A. Geuther
- Educational and Research Infrastructure Enhancement at the Kansas State University Reactor, US DOE, August 2010-August 2011, $141,846
- Hexagonal Boron Nitride-Based Neutrons, NSF, September 2010-August 2011, $101,983
- Voluntary Security Enhancements for the Research and Test Reactor at Kansas State University, Sandia National Laboratory, February 2011-December 2013, $52,401
- GNEP Readiness at KSU-Direct Summer Internship Experience for Faculty, Graduate and Undergraduate Students, US DOE, September 2007-August 2012, $59,616

Mohammad H. Hosni
- Nuclear Energy University Programs Fellowship and Scholarship Support, US DOE, July 2009-June 2017, $10,000
- Sponsor Research Agreement - KSU Project Agreement, Boeing, November 2005-October 2015, $193,000
- GNEP Readiness at Kansas State University-Direct Summer Internship Experience for Faculty, Graduate and Undergraduate Students, DOE, September 2007-August 2011, $99,616
- Aircraft Cabin Environmental Security Proposal, KSU Target of Excellence, July 2008-June 2011, $641,000
- Air Contamination Measurement Methods (Task#5), FAA, July 2008-December 2011, $75,000
- Contamination Transport in Aircraft Cabins, Phase 2, FAA, February 2009-December 2011, $80,000
- Development of a Water-Based, Critical Flow, Non-Vapor Compression Cooling Cycle, Caitin Inc., October 2009-September 2012, $429,610
- Online Nuclear Engineering Laboratory (1Lab): Virtual Reactor Experiments, US NRC, July 2010-June 2011, $160,000
- Further Studies of Infectious Disease Transmission in Airliner Cabins, FAA, March 2010-December 2011, $106,806
- Nanosecond Photography for Bubble Visualization and Measurement, PAX Streamline, May 2010-April 2011, $74,943
- Experimental Characterization of the Movement of Airborne Live Pathogens in a Commercial Aircraft Cabin Environment, Center for Disease Control, July 2010-December 2011, $24,000
- Experimental Characterization of the Gaseous and Particulate Transport in a Commercial Aircraft Cabin Environment, Center for Disease Control, July 2010-December 2011, $24,000
- Sponsorship of the Big 12 Engineering Summit, FAA, October 2011-October 2011, $10,000
- Collaborative Distance Education Course on Radiation and Dosimetry in Nuclear Health Physics, NRC, August 2011-August 2012, $39,123
- Development of a Distance Education Course Sequence on Probabilistic Risk Assessment and Fire Protection, NRC, August 2011-August 2012, $184,791
Byron W. Jones
- Aircraft Recirculation Filter Research for Incident Assessment, FAA, January 2006-December 2011, $410,000
- In-Flight Sensor System and Database Deployment, FAA, January 2008-August 2014, $70,000
- Air Contaminant Measurement Methods, FAA, July 2008-December 2011, $75,000
- Contaminant Transport in Airliner Cabins, FAA, February 2009-December 2011, $80,000.
- Further Studies of Infectious Disease Transmission in Airliner Cabins, FAA, March 2010-August 2014, $107,000
- Sensors and Prognostics to Mitigate Blended Air Contamination Events, FAA, March 2010-August 2014, $297,000
- Exposure to Flame Retardants in Commercial Aircraft, FAA, March 2010-August 2014
- Experimental Characterization of the Movement of Airborne Live Pathogens in a Commercial Aircraft Cabin Environment, Center for Disease Control, July 2010-December 2011, $24,000
- Experimental Characterization of the Gaseous and Particulate Transport in a Commercial Aircraft Cabin Environment, Center for Disease Control, July 2010-December 2011, $24,000

Kevin B. Lease
- Care Management for Bonded Composite Repair, WSU, August 2011-July 2012, $25,000
- Kansas Space Grant Consortium, WSU, January 2011-January 2012, $116,955

Douglas S. McGregor
- Vapour Growth and Matalurgical Characterization of Mercury Iodide (HgI2), US DOD, January 2007-July 2011, $558,958
- Growth and Characterization of Li Ternary Compounds for Solid-State Neutron Detectors, NNSA, September 2008-September 2011, $698,040
- Experimental Characterization of the Movement of Airborne Live Pathogens in a Commercial Aircraft Cabin Environment, Center for Disease Control, July 2010-December 2011, $24,000
- Experimental Characterization of the Gaseous and Particulate Transport in a Commercial Aircraft Cabin Environment, Center for Disease Control, July 2010-December 2011, $24,000

J. Kenneth Shultis
- Establishment of Nuclear Engineering Faculty Development and Assistance Program at Kansas State University, NRC, May 2010-April 2013, $3,192,174
- Technical Assistance on Micro-Pocket Fission Detectors, Battelle Energy Alliance, September 2011-August 2014, $310,435
- Neutron Detector, US DOD, December 2011-February 2012, $373,000
- Microstructured Semiconductor Neutron Detector, US DOD, December 2011-February 2012, $1,204,709

Dale E. Schinstock
- Standardized "Pre-Flight" Exercise Tests to Predict Performance During Extravehicular Activities in a Lunar Environment, NASA, July 2010-June 2011, $1,192,194
- Micro-Geometry of 3-D Woven SiC and Carbon Fiber Preforms, NASA SBIR, January 2011-January 2012, $24,000
- Performance During Extravehicular Activities in a Lunar Environment, NASA, July 2010-June 2011, $1,192,194

J. Garth Thompson
- Graduate Student Support Supplement to “An Engineering Partnership between Kabul University and Kansas State University,” with Y. Ebadi and M. Schlatter, April 2010 - June 2011, $200,000

Youqi Wang
- Long-Term Remote Monitoring of FRP Bridge, KDOT, July 2006-June 2012, $141,601

Gurpreet Singh

Support for the Unmanned Aerial Systems Team, Various sources, Sept 2010-June 2011, $21,000

Xiaojiang J. Xin
- Introducing Finite-Element Methods into Undergraduate Engineering Courses through a Module-Based Approach, NSF, March 2008-February 2012, $149,985

J. Garth Thompson
- Support for the Unmanned Aerial Systems Team, Various sources, Sept 2010-June 2011, $21,000

Youqi Wang
- Long-Term Remote Monitoring of FRP Bridge, KDOT, July 2006-June 2012, $141,601

Warren N. White
- Wind Energy and Sustainability, WSU, September 2010-September 2012, $64,000

Xiaojiang J. Xin
- Introducing Finite-Element Methods into Undergraduate Engineering Courses through a Module-Based Approach, NSF, March 2008-February 2012, $149,985
Ali E. Abdou
- Radiation Protection and Health Physics Licensee from ENRIN Argentina and NRC Egypt
- Member, American Nuclear Society
- Member, American Physical Society
- Member, American Vacuum Society
- Member, IEEE
- Member, MNE honors and awards committee
- Reviewer for IEEE, Computer Physics and Communications
- International steering committee, International Center for Dense Magnetized Plasma ICDMP, Warsaw, Poland

B. Terry Beck
- Member, ASME
- Chair, young engineers paper contest committee, ASME Fluids Engineering Division (FED)
- Member, Sigma Xi
- Member, Tau Beta Pi
- Member, ASEE
- Member, Pi Tau Sigma
- Member, ASEE
- Member, Tau Beta Pi
- Director, MNE reactor safeguards committee
- Member, board on codes and standards, ASME
- Member, IARW scientific advisory council
- Member, IVAR Education committee member, Session organizer for “problem solution session”
- IHAR newsletter coordinator
- Director and lecturer, industrial refrigeration workshop
- Member, College of Engineering, executive committee

Mohammad H. Hosni
- Fellow, American Society of Heating, Refrigerating and Air-Conditioning Engineers
- Member, ASHRAE standards committee member: ASHRAE TC 9.3 transportation air-conditioning
- Member, ASHRAE TC 8.5
- Member, ASHRAE  standards committee
- Member, American Society for Engineering Education
- Member, Society of Sigma Xi
- Member, College of Engineering, executive committee
- Member, College of Engineering, academic standards committee
- Member, College of Engineering, program assessment coordinating committee

Steven J. Eckels
- Member, ASHRAE
- Committee member, graduate council
- Chair, College of Engineering, professional experience committee
- Member, KS-State Online Advisory Council (KSOAC)
- Faculty adviser, SAE Aero Design Team, College of Engineering

Amy R. Betz
- Member, ASME
- Reviewer, Applied Physics Letters
- Reviewer, ACS Applied Materials and Interfaces
- Reviewer, Journal of Experimental Heat Transfer

Liang-Wu Cai
- Associate editor, ASME Journal of Vibration and Acoustics
- Member, editorial board, The Open Acoustics Journal
- Chair, planetary sessions, IMECE
- Co-chair, IMECE2011 Symposium on Phononic Crystals and Acoustic Metamaterials
- Co-chair, IMECE2011 Symposium in Acoustic Wave Propagation in Porous Media
- Member, executive committee, ASME NCAD
- Track chair, ASME IMECE 2011
- Faculty adviser, KSU Chinese Students and Scholars Union

William L. Dunn
- Member, American Nuclear Society
- Executive council member, International Radiation Physics Society
- Member, Society of Sigma Xi
- Vice president, North America International Radiation Physics Society
- Editorial board, Applied Radiation and Isotopes
- General chair, 8th Topical Meeting on Industrial Radiation and Radiosotope Measurement Applications (IRMA-8), 26 June – 1 July, 2011, Kansas City, Mo.
- Director, MNE undergraduate program
- Member, MNE undergraduate committee
- Member, MNE distance education task force
- Member, MNE reactor safeguards committee
- Faculty adviser, Alpha Nu Sigma honor society
- Member, College of Engineering, course and curriculum committee
- Member, College of Engineering, academic standards committee
- Member, College of Engineering, program assessment coordinating committee

Byron W. Jones
- Professional Engineer, Montana
- Fellow, American Society of Heating, Refrigerating and Air-Conditioning Engineers
- Member, ASHRAE, ASHRAE TC 9.3 transportation air-conditioning
- Member, ASHRAE standards committee member: ASHRAE TC 9.3 transportation air-conditioning
- Member, Society of Automotive Engineers
- Member, American Society of Engineering Education
- Member, ASSE Engineering Research Council
- Member, American Society of Mechanical Engineers
- Member, Engineers without Borders
- Member, Experimental Aircraft Association
- Technical director, FAA National Air Transportation Center of Excellence for Airliner Cabin Environment Research
- State of Kansas director, DoD Experimental Program to Stimulate Competitive Research

Center for Excellence for Airliner Cabin Environment Research
- State of Kansas director, DoD Experimental Program to Stimulate Competitive Research

Kevin B. Lease
- 2011 ABET coordinator/facilitator/taskmaster
- Undergraduate committee
- Graduate committee
- Industry advisory board committee
- Graduated school liaison
- Director, KSU NASA Space Grant Consortium
- Member, ASTM technical committee e-08 on fatigue and fracture
- Co-chair, ASTM task group E08.08.07 on low-constraint fracture (CTOA/B)
Moderator and core developer, international open-source autopilot, “OpenPilot”

J. Kenneth Shultis
- Member and Fellow, American Nuclear Society (ANS)
- Member, American Associations for the Advancement of Science (AAAS)
- ANSI/ANS-6.4 working group for “Specification for Radiation Shielding Material”
- ANSI/ANS-6.4.2 working group for “Nuclear Analysis and Design of Concrete Radiation Shielding for Nuclear Power Plants”
- Nuclear Energy Standards Coordination Collaborative (NESCC) concrete task group, ANSI/NIST, “Concrete Codes and Standards for Nuclear Power Plants – Recommendations for Future Development,” 2010-present
- Member, College of Engineering international assessment coordinating committee

Gurpreet Singh
- Member, ASME
- Member, ACeTS
- Member, Sigma Xi
- Member, ASTM
- Faculty adviser, Pi Tau Sigma Mechanical Engineering Honor Society
- Member, College of Engineering international programs committee
- Member, Frankenhoff research award committee
- Track co-organizer and session chair on nanotechnology, Materials Science & Technology (MSEC) conference 2011, Columbus, Ohio
- Associate editor, Nanomaterials and Energy Journal, UK

Gregory L. Spaulding
- Kansas Professional Engineer, 16329
- MNE adviser, SAE Mini Baja competition team
- MNE co-chair, open house
- Coordinator, College of Engineering competition teams

Daniel V. Swenson
- Member, ASME
- Member, College of Engineering tenure and promotion advisory committee

J. Garth Thompson
- Fundamentals of Engineering (FE), Utah
- Member, American Society of Mechanical Engineers
- Member, American Institute of Aeronautics and Astronautics
- Member, Pi Tau Sigma
- Member, Society of Sigma Xi
- Director, engineering partnership between Kabul University and Kansas State University
- Faculty adviser, AIAA student chapter
- Adviser, Association for Unmanned Vehicle Systems International (AUVSI) Student Unmanned Air Systems (SUAS) competition team
- Member, department faculty search committee
- Member, department graduate program committee
- Member, department strategic planning committee
- Chair, department honors and awards committee
- Member, college honors and awards committee

Youqi Wang
- Member, American Society of Composites
- Member, College of Engineering diversity committee

Warren N. White
- Member, ASME
- Member, Tau Beta Pi
- ASHRAE Transaction Paper Award
- Member, College of Engineering committee on planning
- Member, College of Engineering scholarship committee
- Reviewer, Institution for Engineering and Technology Control Theory and Applications
- Reviewer, Energy and Buildings
- Faculty adviser, Women in MNE
- Reviewer, ASHRAE
- Chairman, MNE laboratory committee
- Reviewer, IEEE Transactions on Industrial Electronics
- COE open house judge

Xiaojiang J. Xin
- Member, ASME
- Member, MNE undergraduate program and ABET assessment committee
- Member, MNE curriculum review task force
- Advisor, MNE ASME student organization
- Member, College of Engineering program assessment coordinating committee

The mechanical and nuclear engineering department (MNE) offers separate graduate programs in mechanical engineering and nuclear engineering, both leading to master of science and doctor of philosophy degrees. MNE also offers a master of science degree in mechanical engineering via distance learning in order to better serve our students. Our award-winning faculty are engaged in exciting and cutting-edge research projects in state-of-the-art laboratories and research facilities, while our graduate students are excelling inside and outside of the classroom. Research areas and courses include a broad range of both traditional and emerging fields of mechanical engineering and nuclear engineering. With more than $5 million in research funding, many graduate students in our department receive graduate research assistantships (GRA). Several of our students receive graduate teaching assistantships (GTA) with 50-100 percent tuition waiver to help teach laboratory sections. The MNE department also pays for the health insurance of all Ph.D. students.

Programs of study are flexible and tailored to the interests, backgrounds and career goals of each student. Courses from outside the department are often added to programs of study to enhance the students’ experience.

Admission requirements
Applicants must have a bachelor’s degree from an accredited institution. Although students with bachelor’s degrees in mechanical and/or nuclear engineering make up the bulk of our graduate student body, the department welcomes applicants from other fields including other engineering disciplines, mathematics, physics and chemistry. International applicants should also include GRE and TOEFL scores. GRE scores should be no less than 400 verbal, 650 quantitative and 3.0 on analytical writing. TOEFL scores must be above 600 on the written exam or 250 on the computer exam. The IELTS may substitute for the TOEFL. IELTS scores are valid for two years and should be no less than 7.0.

For additional information—
Graduate Program Coordinator
Department of Mechanical and Nuclear Engineering
3002 Rathbone Hall
Kansas State University
Manhattan, KS 66506
E-mail: grad@mne.ksu.edu
Web: http://www.mne.ksu.edu/graduate
The Department of Mechanical and Nuclear Engineering (MNE) has an enrollment of approximately 700 undergraduate students, the largest in the College of Engineering. MNE offers two undergraduate degrees:

1) Mechanical Engineering
2) Mechanical Engineering with a Nuclear Option

Both degree programs allow students flexibility within their program of study. Students are required to take at least 127 hours, 18 hours of which are technical electives chosen from the MNE department, College of Engineering, mathematics, chemistry, physics, biology, business administration and statistics. Students choosing the nuclear option take four nuclear courses, which replace 12 hours of the technical electives.

Students graduating with a mechanical engineering degree are in demand and find jobs in a variety of areas including research and development, design, manufacturing, sales, management, and consulting. Some companies hiring recent graduates include BETIS Atomic Power Laboratory, Black & Veatch, Boeing, Burns & McDonnell Engineering, Cargill, Caterpillar, ConocoPhillips, Delphi, Honeywell, Koch Industries, Raytheon, and Westar Energy.

Real-world experience

K-State MNE students complete a two-semester capstone design course working on projects sponsored and guided by more than 16 different companies.

Many MNE students participate in internships with companies like ADM, Bettis Atomic Power Laboratory, Boeing, Burns & McDonnell Engineering, Cargill, Caterpillar, ConocoPhillips, Harley-Davidson Motor Company, Honeywell, John Deere, Lockheed Martin, Pall Corporation, and Wolf Creek Nuclear Operating Corp.

Student activities

MNE students routinely serve as Engineering Ambassadors and Engineering Student Council representatives, and actively participate in the following student organizations:

- American Nuclear Society
- Society of Automotive Engineers
- American Institute of Aeronautics and Astronautics
- American Society of Mechanical Engineers
- Tau Beta Pi, National Engineering Honor Society
- Pi Tau Sigma Honor Society
- MNE Women

Additionally, our students participate in many national competitions including the following:

- SAE Mini Baja
- Formula SAE
- SAE Aero Design
- AIAA

http://www.mne.ksu.edu/academics/undergraduate
Notice of nondiscrimination
Kansas State University is committed to nondiscrimination on the basis of race, color, ethnic or national origin, sex, sexual orientation, gender identity, religion, age, ancestry, disability, military status, veteran status, or other non-merit reasons, in admissions, educational programs or activities and employment, including employment of disabled veterans and veterans of the Vietnam Era, as required by applicable laws and regulations. Responsibility for coordination of compliance efforts and receipt of inquiries concerning Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Section 504 of the Rehabilitation Act of 1973, the Age Discrimination Act of 1975, and the Americans With Disabilities Act of 1990, has been delegated to the Director of Affirmative Action, Kansas State University, 214 Anderson Hall, Manhattan, KS 66506-0124, (Phone) 785-532-6220; (TTY) 785-532-4807.