

JERALD A. CATON, Ph.D, P. E.

Gulf Oil/Thomas A. Dietz Professor of Mechanical Engineering

— CURRICULUM VITAE —

**PUBLICATIONS, REPORTS, RESEARCH CONTRACTS,
AND OTHER ACTIVITIES**

Department of Mechanical Engineering

Texas A&M University

College Station, Texas 77843-3123

979-845-4705 (phone)

979-845-3081 (fax)

e-mail: jcaton@tamu.edu

Department web page: www.mengr.tamu.edu

Laboratory web page: www1.mengr.tamu.edu/E3/index.html

March 2010

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TEACHING AND RESEARCH INTERESTS

Thermodynamics, heat transfer, fluid mechanics and internal-combustion engines; alternative fuels; reducing pollutant emissions; modeling engine and combustion processes; assessments of cogeneration systems; and fundamental and applied combustion topics.

QUALIFICATIONS

Extensive academic and industrial experience. Expertise in both experimental and analytical investigations on engine, combustion, cogeneration, thermodynamic and emissions topics.

EXPERIENCE

06/07 – present

Texas A&M University

Department of Mechanical Engineering

Position: Gulf Oil/Thomas A. Dietz Professor

Appointed Gulf Oil/Thomas A. Dietz Professor of Mechanical Engineering. Continued research activities in the areas of internal combustion engines, emission reduction technologies, and alternative fuels (with emphasis on bio-fuels). Research programs include topics such as thermodynamic simulations using the second law of thermodynamics for internal combustion engines; detection of mercury emissions; the use of fuels such as hydrogen and vegetable oils; thermal management of fuel cells; and low temperature diesel engine combustion. Continued teaching in the areas of thermodynamics, combustion, engines, heat transfer, and fluids. Continued to serve in leadership roles for the ASME-ICED, and the SAE.

09/06 – present

Texas A&M University

Department of Mechanical Engineering

Position: Professor, Associate Department Head and Research Program Coordinator

Appointed Associate Department Head for the Department of Mechanical Engineering. Responsible for assisting the Department Head with general department operations. Substitute for the Department Head when needed. Specific assignments of establishing and developing departmental research programs, and to interface with industrial partners. Assisted with teaching schedules and departmental budgets. During this period, the department had typically 1150 undergraduate students, 350 graduate students, 60 faculty, and conducted about \$11 million dollars of externally funded research. Continued teaching, research, and professional society duties.

09/91 – present

Texas A&M University

Department of Mechanical Engineering

Position: Professor

Research activities in the areas of internal combustion engines, engine cycle simulations, the use of the second-law of thermodynamics, alternative fuels, novel engines, combustion sensors, catalytic and non-catalytic exhaust gas treatment, and nitric oxide removal. Teaching courses on thermodynamics, combustion, internal combustion engines, and cogeneration. Supervised graduate and undergraduate students on various research projects. Deputy Division Leader (1991-92) and Division Leader (1992-93) for the Thermal/Fluids Division. Director of Graduate Program (9/94-8/98) (see below for more details). Served as

interim department head (7/96–8/97) (see below for more details). Conducted coal-fueled diesel engine research: developed and used a diesel engine injection system to evaluate fuel injection (1980–95). Continued the use of a diesel engine research facility which included instantaneous cylinder pressure and needle lift as a function of crank angle, gaseous emissions, and a mini-dilution tunnel for particulates. Developed an experimental facility for studying selective non-catalytic (SNCR) and catalytic (SCR) removal of nitric oxide. Served as a co-faculty advisor for two “Propane Vehicle Challenge” student competitions during 1995–1997. Served on national research review panels. Organized and chaired technical sessions for meetings of the American Society of Mechanical Engineers. Served as chairman of the internal combustion engine division of the ASME for fiscal 1997–98. Served as associate editor for the *Journal of Turbomachinery* and *Journal of Engineering for Gas Turbines and Power* (1987–93).

06/04 – 08/04

Sandia National Laboratories, Livermore, CA

Engine Combustion Department

Position: Visiting Scientist

Accepted a 3-month summer sabbatical at Sandia’s Combustion Research Facility. Used a two-stage Lagrangian (TSL) model of a nonpremixed, turbulent fuel jet combustion process to simulate diesel engine combustion. The TSL model incorporated detail chemical kinetics for fuels such as heptane and used empirical correlations for entrainment and mixing. Uses of the TSL model included predicting concentrations of soot precursors such as pyrene as functions of oxygen concentration, temperature, and density, and of injection pressure and nozzle orifice diameter. Good agreement was obtained with experimental results.

09/94 – 08/98

Texas A&M University

Department of Mechanical Engineering

Position: Professor and Director of the Graduate Program

Appointed Director of the Graduate Student Program for the Department of Mechanical Engineering. Initiated new activities to strengthen the Graduate Program. Responsible for recruiting and admitting graduate students. Developed an aggressive program for attracting Ph’D students. Conducted on-campus recruitment visits, new student orientations, qualifying examinations; reviewed applications; admitted students; and provided council for new and continuing students. Continued research activities in the areas of novel engines, nitric oxide removal, alternative fuels, and combustion sensors. Continued teaching courses on thermodynamics, combustion, laboratory, internal combustion engines, and cogeneration. Supervised graduate and undergraduate students on various research projects. Co-faculty advisor for two “Propane Vehicle Challenge” student competitions during 1995–1997. Organized and chaired four (4) major technical conferences and symposia of the American Society of Mechanical Engineers. Continued serving on the Executive Committee of the ASME Internal Combustion Engine Division. During this period, served as chairman of the internal combustion engine division of the ASME for fiscal 1997–98.

07/96 – 08/97

Texas A&M University

Department of Mechanical Engineering

Position: Professor and Interim Department Head

Appointed Interim Department Head for the Department of Mechanical Engineering and Division Head for the Mechanical Engineering Division of the Texas Engineering Experiment Station (TEES). Responsible for recruiting and hiring new faculty, developing research opportunities, and enhancing teaching. Responsible for a teaching budget of about \$5,300,000, and a TEES internal research budget of about \$840,000. Oversaw external research of about \$8,000,000 which was managed by the individual faculty. Responsible for developing additional external funding. Responsible for coordinating the activities of 55 faculty, 34 staff, 1140 undergraduate students, and 240 graduate students. Continued teaching, research, graduate program director, and professional society duties. During this period, served as chairman of the internal combustion engine division of the ASME for fiscal 1997–98.

09/93 – 06/94

Sandia National Laboratories, Livermore, CA
Combustion Applications Division
Position: Visiting Scientist

Arranged a 10-month academic leave at Sandia's Combustion Research Facility. Investigated the auto-ignition characteristics of the direct injection of gaseous fuels into a combustion vessel with diesel engine conditions. Numerical calculations use the HCT (Hydrodynamics, Chemistry and Transport) code which solves one-dimensional time-dependent gaseous combustion problems. Predictions of the temporal auto-ignition characteristics as a function of injection and chamber conditions for methane and three different compositions of natural gas were completed. Also, used a two-dimensional, transient, Eulerian hydrodynamics computer code for reactive flows to investigate the fluid mechanics of the injection process.

09/91 – 08/94

Texas A&M University
Department of Mechanical Engineering
Position: Professor

Appointed Division Leader (1992–93) and Deputy Division Leader (1991–92) for the Thermal/Fluids Division. Continued coal-fueled diesel engine research: developed and used a diesel engine injection system to evaluate fuel injection. Continued use of a diesel engine research facility which included instantaneous cylinder pressure and needle lift as a function of crank angle, gaseous emissions, and a mini-dilution tunnel for particulates. Developed an experimental facility for studying selective non-catalytic nitric oxide reduction techniques. Taught courses on thermodynamics, combustion, laboratory, internal combustion engines, and cogeneration. Supervised graduate and undergraduate students on various research projects. Organized and chaired technical sessions for meetings of the American Society of Mechanical Engineers. Associate editor for *Journal of Turbomachinery* and *Journal of Engineering for Gas Turbines and Power* (1987–93).

09/87 – 06/88

Sandia National Laboratories, Livermore, CA
Combustion Applications Division
Position: Visiting Scientist

Arranged a 10-month academic leave at Sandia's Combustion Research Facility. Conducted experiments on the use of cyanuric acid as an additive to engine exhaust gases to reduce nitric oxide (NO) emissions. Included actual diesel engine exhaust and simulated exhaust gases using bottled gases. Extended this work to include the study of ammonia and urea as additives to reduce NO emissions. Completed a series of parametric investigations which resulted in an enhanced understanding of the effect of operating conditions on the NO reduction process. In addition to this major effort, was also involved in other combustion research activities.

09/85 – 08/91

Texas A&M University
Department of Mechanical Engineering
Position: Associate Professor

Appointed group leader of the Combustion and Fuels Research Laboratory (1989–91). Developed an experimental diesel engine research facility which includes instantaneous cylinder pressure and needle lift as a function of crank angle, gaseous emissions, and a mini-dilution tunnel for particulates. Increased emphasis on coal-fueled diesel engine research and on the development and use of engine cycle simulations. Organized and taught technical short courses as part of the continuing education effort. Taught courses on thermodynamics, combustion, laboratory, internal combustion engines, and cogeneration. Supervised graduate and undergraduate students on various research projects. Organized and chaired technical sessions for meetings of the American Society of Mechanical Engineers. Associate editor for *Journal of Turbomachinery* and *Journal of Engineering for Gas Turbines and Power* (1987–93).

09/79 – 08/85

Texas A&M University

Department of Mechanical Engineering

Position: Assistant Professor

Developed an internal-combustion engine research program with emphasis on alternative fuels and modeling engine processes. Principal investigator on research projects to operate engines using solid fuels such as coal and using vegetable oil fuels. Organized and participated in seminars on combustion topics. Taught courses on thermodynamics, heat transfer, fluid mechanics, combustion, internal-combustion engines and laboratories. Supervised graduate and undergraduate students on various research projects. Organized and chaired technical sessions for meetings of the Society of Automotive Engineers.

09/76 – 08/79

Massachusetts Institute of Technology

Department of Mechanical Engineering

Position: Research Assistant

Investigated heat transfer, mixing and hydrocarbon oxidation in exhaust systems of internal combustion engines. Constructed instrumentation to experimentally determine the instantaneous temperature of the exhaust gas of a CFR engine. Formulated a comprehensive exhaust port heat transfer and hydrocarbon oxidation analysis. Thesis advisor: Prof. John B. Heywood.

09/73 – 09/76

General Motors Research Laboratories, Warren, MI

Power Systems Department

Position: Research Engineer

Employed as a research engineer in the combustion group of the Power Systems Department. Responsible for original analytical and experimental research for low emission, continuous combustion devices. Specific assignments included a comprehensive evaluation of heterogeneous catalysis for gas turbine combustor applications. Also, investigated lean flame combustion.

06/72 – 09/73

University of California, Berkeley

Department of Mechanical Engineering

Position: Research Assistant

Designed and implemented a laser aerosol monitor for determining particulate emissions from a CFR engine. By measuring the attenuated laser radiation at two wavelengths, both the concentration and size distribution of an aerosol were determined. Experimentally measured the particulate emissions (by three independent methods) from a CFR engine as a function of fuel additive and engine operating variables.

06/71 – 12/71

Hughes Aircraft Co., Culver City, CA

Physical Design Department

Position: Student Engineer (Co-op)

Responsible for determining airflow characteristics of air plenums used for radar electronics cooling. Designed test apparatus and conducted tests. Determined air flow rates as a function of pressure. Recommended orifice sizes. In addition, was involved with design, testing and manufacturing of complete radar units.

12/69 – 06/70

Shell Oil Co., Martinez, CA

Mechanical Engineering Group

Position: Student Engineer (Co-op)

With other members of the Mechanical Engineering Group, was responsible for the mechanical equipment in the refinery. In particular, assisted in the final stages of a new grease plant start-up.

HIGHLIGHTS OF TECHNICAL CONTRIBUTIONS

Thermodynamic Engine Cycle Simulations

The current research by Professor Caton on thermodynamic cycle simulations has been completed largely since 1998. This work has resulted in original engine simulations for spark-ignition engines that have been used in a large number of investigations. For example, these simulations have been used to study the effect of engine design and operating parameters on performance, efficiency and nitric oxide emissions.

Use of the Second Law of Thermodynamics

A special use of the thermodynamic cycle simulations has been studies of spark-ignition engine performance from the perspective of the second law of thermodynamics. Availability analyses have been completed for a range of engine operating conditions, for a range of engine design variables, and for a range of combustion parameters.

Alternative Fuels

Studies of alternative fuels for engine applications have been conducted since the mid-1980s. The fuels that have been examined have included vegetable oils and coal fuels for diesel engines. For spark-ignition engines, propane (LPG), hydrogen, and natural gas have been examined. Professor Caton was a co-faculty advisor for the two successful "Propane Vehicle Challenge" student competitions that TAMU students entered during 1995–1997. The most recent work includes engine experimentation and modeling to determine the role of biodiesel on nitric oxide emissions.

Advanced Engine Combustion

In collaboration with Professor Timothy Jacobs, research projects have been launched to explore advanced combustion modes for diesel engines. These projects include versions of homogenous charge compression ignition (HCCI) combustion modes for both diesel fueled and natural gas fueled engines. The latter project is in conjunction with colleagues at Texas A&M University at Qatar.

Advanced Laser-Based Pollutant Sensors

The overall objective of these projects is to develop diode-laser-based, optical sensors to determine the concentrations of nitric oxide, carbon monoxide, other pollutant species and ammonia in exhaust streams. The sensors use absorption techniques and consist of state-of-the-art components that are largely only recently available due to developments in the telecommunications industry. The new sensors have the potential for measuring much lower concentrations and for obtaining these measurements much faster than current analysis equipment.

Selective Non-Catalytic Removal (SNCR) of Nitric Oxides

Professor Caton has been completing research in the area of SNCR since 1987. He was one of the pioneers in the development of the SNCR process using cyanuric acid. He has developed a dedicated laboratory for this work which includes the capabilities to simulate exhaust gases from various combustion devices, an electric furnace to achieve gas temperatures up to 1300 K, and an FTIR spectrometer for quantitative measurements of most of the nitrogen species (including NO, NO₂ and N₂O) and products of combustion. He has extended the original studies to include the use of ammonia and urea. He has studied the decomposition of urea for these applications.

Selective Catalytic Removal (SCR) of Nitric Oxides

As an extension of his SNCR research, Professor Caton has completed a series of projects to evaluate the use of new catalysts for use in SCR applications. The catalysts that have been examined have been monolith structures, and have included: (1) a copper ion-exchanged zeolite (Cu-ZSM-5), (2) a vanadium pentoxide, (3) a vanadium oxide tungsten titanium (V₂O₅-WO₃-TiO₂), and (4) a vanadium oxide titanium pillared clay (V₂O₅/Ti PILC). The SCR processes have been studied for a range of oxygen concentrations, gas temperatures, and ammonia-to-nitric oxide ratios.

Cogeneration Systems

Largely for state institutions, Professor Caton has completed a series of cogeneration assessments. He has developed original computer programs to assess the technical and economical performance of proposed cogeneration systems.

Coal-Fueled Diesel Engines

For the years between 1980 and 1995, Professor Caton completed numerous projects on the development of coal-fueled diesel engines. He was one of the first investigators that was awarded a research contract connected to the Department of Energy's program for coal-fueled engines. He developed and used the first engine cycle simulations to investigate coal fueled engines, and he experimentally studied the fuel injection characteristics of coal-water slurry fuels for engine applications.

EDUCATION

Massachusetts Institute of Technology, Cambridge
Ph'D Degree, February 1980
Major: Mechanical Engineering, Thermal Sciences
Minor: Research Management
University of California, Berkeley
MSME Degree (with honors), June 1973
University of California, Berkeley
BSME Degree (with honors), June 1972
Merced Junior College, Merced, CA
AS Degree, June 1969

HONORS AND AWARDS

SAE Excellence in Oral Presentation Award (2009)
Distinguished Achievement Award – Teaching, Association of Former Students and Texas A&M University (2008)
Gulf Oil/Thomas A. Dietz Professorship (2007 – present)
SAE Fellow (2007 – present)
SAE Excellence in Oral Presentation Award (2005)
TAMU – COE: Halliburton Professorship (2005–2006)
TAMU – COE: E. D. Brockett Professorship (2003–2004)
ASME–ICE Division “Richard Woodbury” Award (2003)
SAE, 25–Years of Active Membership Certificate (2003)
TAMU – COE: Marathon Oil/USX Foundation Fellow (2002)
TAMU – MEEN: Peggy L. and Charles L. Brittan ('65) Teaching Award for Outstanding Undergraduate Teaching (2000)
TAMU – COE: Charles W. Crawford Award (1999)
ASME–ICE Division Retiring Chairman Certificate (1998)
ASME, 25–Year Long Term Membership Certificate (1998)
ASME Fellow (1996 – present)
ASME–ICE Division Citation Award (1994)
ETCE–ASME Service Award (1994)
ASME–ICE Meritorious Service Award (1990)
SAE Ralph R. Teetor Educational Award (1990)
Texas Engineering Experiment Station Fellow (9/1/86 – 8/31/87)
Exxon Faculty Development Award (1982, 1983, 1985)
General Motors Fellow (1976–1979)
Pi Tau Sigma, Mechanical Engineering Honor Fraternity (1971 – present)

NATIONAL RESEARCH REVIEW AND ADVISORY PANELS

1. Appointed to Texas Environmental Research Consortium, Environmental Technology Advisory Council, Houston Advanced Research Center, The Woodlands, TX, February 2006 – present.
2. Appointed to Program Guidance and Evaluation Panel, Oak Ridge National Laboratory, National Transportation Research Center, Oak Ridge, TN, 2004 – present.
3. Appointed to Teetor Educational Award Committee, Society of Automotive Engineers, 2001 – 2009.

4. Served as a member of the U. S. Environmental Protection Agency's (EPA's) Peer Review Panel Meeting for Exploratory Environmental Engineering: Air and Pollution Prevention, R1–Panel 1, Silver Spring, MD, 27–28 October 1999.
5. Served as an advisory panel member for the 1999 EPA Fellowships for Graduate Environmental Study – Science to Achieve Results (STAR) Program, Washington, DC, 26–27 January 1999.
6. Served as an advisory panel member for the NSF/EPA Peer Review Sub-Panel, “Measurement, Assessment, and Feedback Techniques for Pollution Prevention,” for the 1996 NSF/EPA Partnership for Environmental Research, Technology for a Sustainable Environment, Washington, DC, 16–17 June 1996.
7. Appointed to Transportation and Related Equipment Technical Advisory Committee at the International Trade Administration, U. S. Department of Commerce, Washington, DC, 1986–1990.

NATIONAL LISTINGS

Who's Who in the South and Southwest, 25th Edition, Marquis Who's Who, New Providence, NJ, 1997–98, January 1997.

Who's Who Among America's Teachers, 4th Edition, Educational Communications, Inc., Lake Forest, IL, 1995–96, October 1996.

American Men and Women of Science, 1995–96, 19th Edition, R. R. Bowker Data Base Publishing Group, pg. 128, 1994.

Who's Who in the South and Southwest, 23rd Edition, Marquis Who's Who, New Providence, NJ, pg. 131, January 1993.

American Men and Women of Science, 1992–93, 18th Edition, R. R. Bowker Data Base Publishing Group, New York, NY, Vol. 2, pg. 109, 1992.

American Men and Women of Science, 1989–90, 17th Edition, R. R. Bowker Data Base Publishing Group, New York, NY, Vol. 2, pg. 104, 1989.

American Men and Women of Science, 16th Edition, Edited by Jaques Cattell Press, R. R. Bowker Data Base Publishing Group, New York, NY, Vol. II, pg. 103, 1986.

CONSULTING

(see complete descriptions in Section XV: Consulting Activities)

Houston Advanced Research Center (HARC), Environmental Technology Advisory Council, 2006 – present.

University of Keimyung, Taegu, Korea, 2005.

EROOM, Inc., Taegu, Korea, 2005.

Amp Capital Partners, Draper, Utah, and Santa Clara, CA, 2005.

Vinson & Elkins, LLP, Houston, TX, 16 December 2003.

Oak Ridge National Laboratory – NTRC, Knoxville, TN, 2003 – 04.

Battelle Memorial Institute, Columbus, OH, 2001 – 2004

Westmoreland Hall, PC, Houston, TX, 2000

Bell, Rosenberg & Hughes, LLP, Oakland, CA, 2000

Battelle Memorial Institute, Columbus, OH, 1999 – 2000

University of Keimyung, Taegu, Korea, 1999

Beirne, Maynard & Parsons, LLP, Houston, TX, 1999

Senco Products, Inc., Cincinnati, OH, 1997

Callery Group, Houston, TX, 1995, 1996

R VEC, Inc., Carpentersville, IL, 1995

Suntec Industries, Inc., Rockford, IL, 1995

West Research, Meridian, TX, 1994–1995

Southwest Research Institute, San Antonio, TX, 1993

Cummins Engine Company, Inc., Columbus, IN, 1993

Cummins Power Generation, Inc., Irvine, CA, 1993

Detroit Diesel Corporation, Detroit, MI, 1991

Fuel Tech, Inc., Sanford, CT, 1991

Technology Business Development, Texas Engineering Experiment Station,

Texas A&M University, 1987, 1990
 Crystal Energy, Thousand Oaks, CA, 1989
 Integral Technologies, Inc., Blackhawk, IL, 1988–1989
 Entherm, Inc., Houston, TX, 1986
 Arthur D. Little, Inc., Cambridge, MA, 1986
 Central Power and Light Company, Corpus Christi, TX, 1985
 Texas Engineering Extension Service, Texas A&M University, 1985.
 Institute for Ventures in New Technology, Texas Engineering Experiment
 Station, Texas A&M University, 1983, 1984
 Texaco, Inc., Houston, TX, 1983
 Cheek Engineering Company, Houston, TX, 1982
 Southwest Research Institute, San Antonio, TX, 1981

EDITORIAL BOARDS

Energy Information Abstracts, Bowker A&I Publishing, 1990–1993.
 Journal of Engineering for Gas Turbines and Power, American Society of Mechanical Engineers, 1987-1993.
 Journal of Turbomachinery, American Society of Mechanical Engineers, 1987–1993.

AFFILIATIONS

American Chemical Society, Member (1989–Present)

American Society of Engineering Education, Member (1982–Present)

American Society of Mechanical Engineers, Member (1973–Present):

National:

Chair, Best Technical Paper Award Committee, ICE Division (2005–present)
 Member, Best Technical Paper Award Committee, ICE Division (1999–present)
 Past Chairman, the Internal Combustion Engine Division (1998–99)
 Chairman, the Internal Combustion Engine Division (1997–98)
 Member of the Executive Committee of the Internal Combustion Engine Division (1992–99)
 Vice-Chairman, Technical Programs, the Internal Combustion Engine Division (1995–97)
 Assistant Vice-Chairman, Technical Programs, the Internal Combustion Engine
 Division (1993–95)
 Chairman of Fuels and Combustion Committee of the Internal Combustion Engine
 Division (1991–92)
 Vice-Chairman of Fuels and Combustion Committee of the Internal Combustion Engine
 Division (1985–91)
 Member of George Westinghouse Medals Committee (1984–88)
 Associate Editor for *Journal of Turbomachinery* and *Journal of Engineering for
 Gas Turbines and Power* (1987–93)
 Member of Committee on Honors (1990–93)
 Member of Associates Committee (1982–Present)

Brazos Valley Section:

Chairman of Technical Activities (1989–90)
 Chairman of Industrial Relations (1986–87)

Combustion Institute, Member (1973–Present)

Program Review Subcommittee, International Symposium on
 Combustion, Member (1991–92, 93–94, 95–96, 1999–2000, 2001–02)
 Board of Advisors, Central States Section (1986–92)
 Treasurer, Central States Section (1988–97)

Division of Fuel Chemistry, American Chemical Society, Member (1984–85)

Society of Automotive Engineers, Member (1979–Present)

Member of Teetor Educational Awards Committee (2001 – 2009)
 Member of Readers Committee (1982–Present)

BOOK, THESES, AND CANDIDATE REVIEWS

Thomson Engineering, 2007
Indian Institute of Technology, Delhi, 2006
Oxford University Press, 2005
Thomson Engineering, 2004
Brooks/Cole Publishing, 2001
McGraw-Hill Book Company, 2000
Oxford University Press, 2000
Kuwait University, 1998
Irwin, Times-Mirror, 1996
Prentice Hall, 1995
Harper Collins Publishers, 1993
R. R. Bowker, 1993
PWS-Kent Publishing Company, 1991
CRC Press, Inc., 1991
MacMillian Publishing Company, 1989
Indian Institute of Technology, 1988
Butterworth Publishers, 1986
McGraw-Hill Book Company, 1986
Harper & Row, Publisher, Inc., 1983

PATENTS

R. P. Lucht, T. N. Anderson, S. F. Hanna, R. Barron-Jimenez, T. Walther, S. Roy, M. S. Brown, J. R. Gord, and J. A. Caton, "Nitric Oxide Sensor and Method," patent no. 6,982,426, application no. 914782, assignee: U. S. A. as represented by the Secretary of the Air Force, assigned on 03 January 2006.

J. R. Gord, R. P. Lucht, T. N. Anderson, R. Barron-Jimenez, T. Walther, S. Roy, M. S. Brown, and J. A. Caton,, "Diode-Laser-Based Mid-Infrared Absorption Sensor for Carbon Monoxide," patent no. H002197, application no. 11/025,827, assignee: U. S. A. as represented by the Secretary of the Air Force, assigned on 07 August 2007.

PERSONAL

Birth date: 03 June 1949
Security Levels: Secret Clearance, DOD (1986)
Security Clearance, DOE, No. CA 58118 (1988)
Registration: Professional Engineer — Texas, No. 47654 (1980 – Present)

I. REVIEWED AND INVITED JOURNAL PUBLICATIONS

1. J. Sun, J. A. Caton, and T. J. Jacobs, "Nitric Oxides Emissions from Biodiesel-Fuelled Diesel Engines," accepted for publication, *Progress in Energy and Combustion Science*, 2010.
2. J. A. Caton, "A Thermodynamic Evaluation of the Use of Alcohol Fuels in a Spark-Ignition Engine," accepted for publication, *Journal of Fuels and Lubricants*, Society of Automotive Engineers, SAE paper no. 2009-01-2621, November 2009.
3. R. G. Shyani, and J. A. Caton, "A Thermodynamic Analysis of the Use of EGR in SI Engines Including the Second Law of Thermodynamics," *Proceedings of the Institution of Mechanical Engineers, Part D, Journal of Automobile Engineering*, vol. 223, no. 1, pp. 131-149, 2009.
4. J. K. Magnuson, T. N. Anderson, R. P. Lucht, U. A. Vijayarathy, H. Oh, K. Annamali, and J. A. Caton, "Application of a Diode-Laser-Based Ultraviolet Absorption Sensor for In Situ Measurements of Atomic Mercury in Coal Combustion Exhaust," *Energy and Fuels*, vol. 22, pp. 3029-3036, 2008.
5. Y. H. (Sam) Park, and J. A. Caton, "An Experimental Investigation of Electro-Osmotic Drag Coefficients in a Polymer Electrolyte Membrane Fuel Cell," *International Journal of Hydrogen Energy*, vol. 33, pp. 7513-7529, 2008.
6. Y. H. (Sam) Park and J. A. Caton, "Monitoring an Electrode Flooding Through the Back Pressure in a Proton Exchange Membrane (PEM) Fuel Cell," *International Journal of Green Energy*, vol. 5, pp. 347-359, 2008.
7. Y. H. (Sam) Park, A. Parulian, and J. A. Caton, "An Experimental Investigation of the Effects of the Environmental Conditions and the Channel Depth for an Air-Breathing Polymer Electrolyte Membrane Fuel Cell (PEMFC)," *Journal of Fuel Cell Science and Technology*, vol. 5, Issue 4, pp. 041016-1 to 041016-1, November 2008.
8. T. C. Huynh, J. K. Kang, K. C. Noh, J. T. Lee, and J. A. Caton, "Controlling Backfire for a Hydrogen-Fueled Engine Using External Mixture Injection," *ASME Transactions — Journal of Engineering for Gas Turbines and Power*, vol. 130, Issue 6, pp. 062804-1 to 062804-8, November 2008.
9. J. A. Caton, "Results from an Engine Cycle Simulation of Compression Ratio and Expansion Ratio Effects on Engine Performance," *ASME Transactions — Journal of Engineering for Gas Turbines and Power*, Vol. 130, pp. 052809-1 to 052809-7, September 2008.
10. H. Sivadas and J. A. Caton, "Effects of Exhaust Gas Recirculation on Exergy Destruction due to Iso-baric Combustion for a Range of Conditions and Fuels," *International Journal of Energy Research*, vol. 32, pp. 896-910, 2008.
11. Y. H. (Sam) Park and J. A. Caton, "Development of a PEM Stack and Performance Analysis Including the Effects of Water Content in the Membrane and Cooling Method," *Journal of Power Sources*, vol. 179, pp. 584-591, 2008.
12. T. N. Anderson, R. P. Lucht, S. Priyadarsan, K. Annamalai, and J. A. Caton, "In-Situ Measurements of Nitric Oxide in Coal-Combustion Exhaust Using a Sensor Based on a Widely-Tunable External Cavity GAN Diode Laser," *Applied Optics*, vol. 46, no. 19, pp. 3946-3957, July 2007.
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V. CONFERENCE PRESENTATIONS

1. “An Evaluation of the Thermodynamic Characteristics of High Efficiency Reciprocating Engines,” at the 2010 Spring Technical Conference, Central States Section of the Combustion Institute, Champaign, IL, 22 March 2010.
2. “First and Second Law Implications of Fuel Selection for an SI Engine,” at the 2010 Spring Technical Conference, Central States Section of the Combustion Institute, Champaign, IL, 23 March 2010.
3. “A Thermodynamic Evaluation of the Use of Alcohol Fuels in a Spark-Ignition Engine,” accepted for publication and presentation at the 2009 SAE Powertrains, Fuels and Lubricants Meeting, Society of Automotive Engineers, SAE paper no. 2009-01-2621, Grand Hyatt San Antonio, San Antonio, TX, 02 November 2009. (received a 2009 *SAE Excellence in Oral Presentation Award*).
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56. "Nitric Oxide Emissions from a Coal-Fueled Engine: Numerical Results," Energy-source Technology Conference and Exhibition, New Orleans, LA, 13 January 1988.
57. "Autoignition Characteristics of Coal-Water Slurry Fuels for Diesel Engine Conditions: Numerical Results," the Second ASME-JSME Thermal Engineering Joint Conference, Honolulu, HI, 25 March 1987.
58. "Coal-Fueled Diesel Engines: Analytical Evaluations of Ignition Options," The Twenty-First International Symposium on Combustion, The Technical University, Munich, West Germany, 7 August 1986.
59. "Discussion of the Paper: Combustion Characteristics of Coal/Water Mixtures in a Simulated Medium-Speed Diesel Engine Environment," Ninth Annual Energy-sources Technology Conference and Exhibition, New Orleans, LA, 25 February 1986.
60. "Cycle Simulation for a Reciprocating, Internal-Combustion Engine Using a Coal Slurry Fuel: The Role of Volatiles," 1984 American Flame Research Committee Fall Symposium, Tulsa, OK, 11 October 1984.
61. "Cycle Simulation for a Coal-Fueled Diesel Engine," First Annual Heat Engines Contractors' Meeting, U. S. Department of Energy, Morgantown Energy Technology Center, Morgantown, WV, 3 May 1984.

62. "Cycle Simulation of a Coal-Particle-Fueled, Reciprocating Locomotive Engine," 7th Annual Energy-sources Technology Conference and Exhibition, New Orleans, LA, 15 February 1984.
63. "An Analysis of Solid Particle Combustion in an IC Engine Environment," Central States Section Spring Meeting of the Combustion Institute, Lexington, KY, 21 March 1983.
64. "Comparisons of Thermocouple, Time-Averaged, and Mass-Averaged Exhaust Gas Temperatures for a Spark-Ignited Engine," 1982 SAE International Congress and Exposition, Cobo Hall, Detroit, MI, 22 February 1982.
65. "A Comparison of Thermocouple, Time-Averaged, and Mass-Averaged Exhaust Gas Temperatures for a Spark-Ignited Engine," Second Annual Texas Engineering Experiment Station Research Conference, Texas A&M University, College Station, TX, 24 September 1983.
66. "Models for Heat Transfer, Mixing and Hydrocarbon Oxidation in an Exhaust Port of a Spark-Ignited Engine," 1980 SAE International Congress and Exposition, Cobo Hall, Detroit, MI, 27 February 1980.
67. "Heterogeneous Catalysis of Lean Ethylene/Air Mixtures by Platinum Coated Wire Screens," 1976 ASME Winter Annual Meeting, New York, NY, December 1976.
68. "Lead Additive Effects on Particulate Emissions from a CFR Engine," Western States Section Fall Meeting of the Combustion Institute, Monterey, CA, October 1972.

VI. POSTER SESSION PRESENTATIONS

1. J. A. Caton, "Improved Engine Design Concepts Using the Second Law of Thermodynamics: Reducing Irreversibilities and Increasing Efficiencies," at the FreedomCAR Program Semi-Mega Review (SMMR), U. S. Department of Energy, Crystal City Marriott Hotel, Arlington, VA, 18–19 June 2007.
2. S. Park, A. Parulian, and J. A. Caton, "A Study of Relative Humidity and Water Transport in a Proton Exchange Membrane Fuel Cell (PEMFC)," at the Hydrogen and Fuel Cells 2007: International Conference & Trade Show, Vancouver, Canada, 29 April to 02 May 2007.
3. S. Park, A. Parulian, and J. A. Caton, "An Experimental Investigation of the Effects of the Environmental Conditions and the Channel Depth for an Air-Breathing PEMFC," at the Hydrogen and Fuel Cells 2007: International Conference & Trade Show, Vancouver, Canada, 29 April to 02 May 2007.
4. Th. Walther, G. Tweedale, G. Ray, R. P. Lucht, and J. A. Caton, "Fiber Amplifier Based Sensors for Combustion Control," at the Conference on Lasers and Electro-Optics (CLEO), The Baltimore Convention Center, Baltimore, Maryland, May 6–11, 2001.
5. G. J. Ray, T. N. Anderson, R. P. Lucht, Th. Walther, and J. A. Caton, "Fiber-Amplified, Diode-Laser-Based Sensor for OH Absorption," at the 2nd Joint Meeting of the United States Sections: The Combustion Institute, Oakland, CA, 25–28 March 2001.
6. K. D. Kihm and J. A. Caton, "On Coal-Water Slurry Diesel Injector Sprays," at the Fifth International Conference on Liquid Atomization and Spray Systems, National Institute of Standards and Technology, Gaithersburg, MD, 16 July 1991.
7. D. L. Siebers and J. A. Caton, "Removal of Nitric Oxide from Exhaust Gas with Cyanuric Acid," at the Twenty-Second International Symposium on Combustion, The University of Washington, Seattle, WA, 19 August 1988.
8. J. A. Caton and K. Annamalai, "Performance and Emissions of Coal-Fueled Engines Using Group Combustion Theory," Annual Heat Engines and Gas Cleanup Systems Contractors Review Meeting, U. S. Department of Energy, Morgantown, WV, 14 June 1988.
9. J. A. Caton, J. Schmidt, J. Roth and K. Annamalai, "Numerical Results for the Nitric Oxide Emissions for a Coal-Fueled Diesel Engine," The Spring Technical Meeting of the Central States Section/Combustion Institute, Argonne, IL, 11 May 1987.
10. J. A. Caton and K. Annamalai, "Performance and Emissions of Coal-Fueled Engines Using Group Combustion Theory," Annual Heat Engines and Gas Cleanup Systems Contractors Review Meeting, U. S. Department of Energy, Morgantown, WV, 21 April 1987.

VII. INVITED LECTURES

1. "The Second Law of Thermodynamics: the Quality as well as the Quantity of Energy," for ENGR 101, Energy: Resources, Utilization, and Importance to Society, College of Engineering, Texas A&M University, College Station, TX, 11 September 2009.
2. "A Review and Update of Results from an Engine Cycle Simulation Including the Second Law of Thermodynamics for Spark-Ignition Engines," for Oak Ridge National Laboratory, National Transportation Research Center, Oak Ridge, TN, 18 August 2009.
3. "Advanced Vehicles: Alternatives to Internal Combustion Engines," for ENGR 101, Energy: Resources, Utilization, and Importance to Society, College of Engineering, Texas A&M University, College Station, TX, 08 September 2008, and 04 February 2009.
4. "A Brief Overview of IC Engines, Emissions and Alternative Fuels," for the King Mongkut's Institute of Technology North Bangkok (KMITNB), and the Pollution Control Department of the Air Quality and Noise Management Division of the Ministry of Science, Technology and Environment, Bangkok, Thailand, 01 September 2005.
5. "A Review and Discussion of the Use of the Second Law of Thermodynamics for Automotive Thermal Systems," for the 2005 SAE International Congress and Exposition, Society of Automotive Engineers, Cobo Hall, Detroit, MI, 12 April 2005.
6. "The Use of Availability Analyses to Understand Combustion Processes in Reciprocating Engines," for Oak Ridge National Laboratories, National Transportation Research Center, Oak Ridge, TN, 10 December 2003.
7. "The Hydrogen Economy: Fact or Fiction," for the Mechanical Engineering Graduate Student Organization (MEGSO), Department of Mechanical Engineering, 20 November 2003.
8. "Coal Combustion and Emissions Research at Texas A&M University," for the Texas Clean Coal technology Council, Austin, TX, 20 August 2003.
9. "An Overview of Selective Non-Catalytic Removal (SNCR) and Selective Catalytic Removal (SCR) of Nitric Oxides," for Southwest Research Institute, San Antonio, TX, 13 January 2000.
10. "An Overview of Engine Cycle Simulations," for the Department of Mechanical Engineering, Center for Advanced Vehicle Technology (CAVT), University of Alabama, Tuscaloosa, AL, 23 July 1999.
11. "The TAMU Entry in the 1996 and 1997 Propane Vehicle Challenges," for the Engineering Awareness Program in Offshore Technology for High Potential High School Students, Texas A&M University, College Station, TX, 11 June 1998.
12. "Combustion and Engines: Capabilities at Texas A&M University," for Radian International, Inc., Research Triangle Park, NC, 19 May 1998.
13. "Connections Between Industry and Mechanical Engineering at Texas A&M University," for Radian Corporation, R&D Luncheon Committee, Austin, TX, 17 April 1998.
14. "The TAMU Entry in the 1996 Propane Vehicle Challenge," for the Engineering Awareness Program in Offshore Technology for High Potential High School Students, Texas A&M University, College Station, TX, 4 June 1997.
15. "Alternative Fuels," for the Young Engineers Forum, at the Energy and Environment Expo, Houston, TX, 29 January 1995.
16. "Research on Selective Non-Catalytic Removal of Nitric Oxides from Exhaust Gases," for Nalco/Fuel Tech, Naperville, IL, 3 June 1994.
17. "Diesel Engine Research at Texas A&M University," for Cummins Engine Company, Inc., Columbus, IN, 13 July 1993.
18. "Research on Selective Non-Catalytic Removal of Nitric Oxides from Exhaust Gases," for Cummins Power Generation, Inc., Irvine, CA, 16 June 1993.

19. "Use of an FTIR Spectrometer for Investigations of Exhaust Gas Reducing Agents for Nitric Oxide Removal," for the Spring Meeting of the Bio-Rad FT/IR User's Group for Southern Texas, Houston, TX, 15 May 1992.
20. "Internal Combustion Engines: Where We've Been and Where We're Going," for the ASME and ASME-Tech Student Sections, Texas A&M University, College Station, TX, 29 October 1991.
21. "Activities of the Engine Laboratory at Texas A&M University," for the University of Texas, Department of Mechanical Engineering, Austin, TX, 20 February 1991.
22. "Evaluation Techniques for Small Packaged Cogeneration Systems," for the Gulf Coast Cogeneration Association and the North Texas Association of Energy Engineers, Dallas, TX, 16 November 1990.
23. "Propulsion Systems for Vehicles," for the Mechanical Engineering Graduate Seminar, MEEN 681, Texas A&M University, College Station, TX, 1 November 1990.
24. "California or Bust: An Academic Leave Experience," for the Mechanical Engineering Graduate Seminar, MEEN 681, Texas A&M University, College Station, TX, 9 March 1989.
25. "Ten Months at Sandia National Laboratory: A 'Fresh-Air' Experience," for the ASME Brazos Valley Section, College Station, TX, 27 February 1989.
26. "Exhaust Gas Treatment Panel," Panel Chair, for "International Workshop on NO_x Control for Off-shore Operations," invited by Arthur D. Little, Inc., at Santa Barbara, CA, 22 and 23 February 1989.
27. "Cogeneration Systems: Technology Overview," for the Texas Cogeneration Council, San Antonio, TX, 7 October 1988.
28. "An Overview of Coal-Fueled Diesel Engine Research," for University of California, Department of Mechanical Engineering, Berkeley, CA, 25 April 1988.
29. "Coal-Fueled Diesel Engines: Past, Present and Future," for the Society of Automotive Engineers — Student Section, Texas A&M University, College Station, TX, 12 February 1986.
30. "Cogeneration Overview," for the Tyler Area Chamber of Commerce, Tyler, TX, 23 January 1986.
31. "Cogeneration Systems: Technology Overview," for Texas Legislature Special Joint Committee on Cogeneration, Austin, TX, 15 November 1985.
32. "Development and Use of Cycle Simulations of Coal-Fueled Diesel Engines," for General Electric Corporate Research and Development Center, Schenectady, NY, 28 March 1985.
33. "Engine Research at Texas A&M University," for Chevron Research, Richmond, CA, 27 May 1983.
34. "Cycle Simulations of Reciprocating, Internal-Combustion Engines Using Solid Fuels," for Lawrence Berkeley Laboratories, Berkeley, CA, 25 May 1983.
35. "A Cycle Simulation of a Coal-Fueled, Reciprocating Engine," for Electro-Motive Division of General Motors Corporation, LaGrange, IL, 5 January 1983.
36. "Engine Research," for the Society of Automotive Engineers — Student Section, Texas A&M University, College Station, TX, 28 April 1981.
37. "Heat Transfer and Hydrocarbon Oxidation in the Exhaust Port of an SI Engine," for Southwest Research Institute, San Antonio, TX, 18 July 1980.

VIII. REVIEWS OF CANDIDATES AND EDUCATIONAL PROGRAMS

1. Review of candidate for promotion to professor, University of Alabama, Tuscaloosa, AL, 28 October 2005.
2. Review of the graduate program of the Department of Mechanical Engineering, University of Alabama, Tuscaloosa, AL, 15–17 February 1998.
3. Review of candidate for promotion to associate professor, Kuwait University, Kuwait, 28 January 1998.

IX. RESEARCH CONTRACTS AND GRANTS

1. Co-Principal Investigator, "Radiation Heat Transfer and Its Effect on NO Formation in Diesel Combustion with Biodiesel Fuel," funded by the Texas Higher Education Coordinating Board, 2007 ARP Norman Hackerman Advanced Research Program, TEES Proposal No. 08-0187, TEES Contract No. C08-0187, TEES Project No. 32174-73480, THECB Grant No. 000512-0026-2007, from 11/09/08 through 05/14/10, \$47,129.
2. Co-Principal Investigator, "Simultaneous and Substantial Reductions in Nitric Oxide and Particulate Matter Emissions via the Development of Low Temperature Combustion in a Diesel Engine," funded by Houston Advanced Research Center (HARC) via the Texas Environmental Research Consortium (TERC) under the New Technology Research and Development (NTRD) Program of the State of Texas, Grant Number N-41, TEES Proposal No. 08-0423, TEES Contract No. C08-00617, TEES Project No. 32525-A3220, from 21 April 2008 through 31 December 2010, \$746,153.
3. Principal Investigator, "Development of Low Emissions, High Efficiency Natural Gas Engine: Implementation of Homogenous Charge Compression Ignition (HCCI) Technologies," funded by Qatar National Research Fund, National Priorities Research Program, proposal number NPRP8-6-7-2, TEES proposal number 07-1021, TEES Contract No. C08-00589, TEES Project No. 32525-A1760, from 12 March 2008 through 11 March 2011, \$747,824.
4. Co-Principal Investigator, "Root Cause Analysis of Changes in NO_x Emissions due to Biodiesel Combustion in Diesel Engines," funded by Houston Advanced Research Center (HARC) via the Texas Environmental Research Consortium (TERC) under the New Technology Research and Development (NTRD) Program of the State of Texas, Grant Number N-30, TEES Proposal No. 07-1005, TEES Contract No. C08-00003, TEES Project No. 32525-A0070, from 01 September 2007 through 31 August 2009, \$600,000.
5. Principal Investigator, "Improved Engine Design Concepts Using the Second Law of Thermodynamics: Reducing Irreversibilities and Increasing Efficiencies," funded by U. S. Department of Energy, National Energy Technology Laboratory, Morgantown, WV, Contract No. DE-FC26-05NT42633, TAMU Contract No. 2006-014477, TAMU Proposal No. 05-0696, TAMU Project No. 411004, from 01 October 2005 through 30 September 2009, \$513,329.
6. Co-Principal Investigator, "Support for the Development of New Optical Sensors for Measurements of Mercury Concentrations, Speciation, and Chemistry," funded by Purdue University as a sub-contract, Purdue University contract funded by the Department of Energy, "Development and Application of New Optical Sensors for Measurements of Mercury Concentrations, Speciation, and Chemistry," prime Contract No. DE-FC26-04NT42311, Subcontract No. 541-0335-01, TEES Proposal No. 04-0748, TEES Contract No. C05-00247, TEES Project No. 32525-23980, from 10/01/04 through 09/28/08, \$135,480.
7. Principal Investigator, "Analysis of Thermodynamic Irreversibilities in Internal Combustion Engines," funded by Oak Ridge National Laboratories (ORNL), U. S. Department of Energy, prime Contract No. DE-AC05-00OR22725, TEES Contract No. C04-00504, TEES Proposal No. 04-0652, TEES Project No. 32525-22260ME, from 14 July 2004 through 31 May 2006, \$89,739.
8. Co-Principal Investigator, "Development of All-Solid-State Sensors for Measurement of Nitric Oxide and Ammonia Concentrations by Optical Absorption in Particle-Laden Combustion Exhaust Streams," funded by the U. S. Department of Energy, National Energy Technology Laboratory, Contract No. DE-FG26-02NT41535, Texas A&M University Research Account No. 425351, from 09/25/02 through 12/31/06, \$199,284.
9. Co-Principal Investigator, "Development of All-Solid-State Sensors for Measurement of Nitric Oxide and Carbon Monoxide Concentration by Optical Absorption," funded by Innovative Scientific Solutions, Inc., SBIR Phase II Subcontract No. 3020 S1, funded from the Wright Patterson Air Force Base, "Combustion Efficiency Measurements for Advanced Propulsion Systems," prime Contract No. F33615-00-C-2020, TEES Proposal No. 00-102, TEES Contract No. C01-00060, TEES Project No. 32525-62770, from 09/18/00 through 08/15/01, \$245,553; and from 08/16/01 through 12/31/02, \$128,478 and \$110,002, and from 01/01/03 through 04/30/04, \$90,000 (total = \$464,033).

10. Co-Principal Investigator, "Homogeneous Charge Compression Ignition Engines," funded by University of Michigan, as Subcontract No. F006633, funded by the Department of Energy, "HCCI Investigations: University Consortia," prime Contract No. DE-FC01-006633, TEES Proposal No. 00-350, TEES Contract No. C02-00312, TEES Project No. 32525-67320, from 10/01/01 through 09/30/04, \$224,000.
11. Principal Investigator, "Development of Advanced, Nanostructured Catalysts to Remove Pollutants from Exhaust Gases," funded by the Texas Higher Education Coordinating Board, Advanced Research Program, TEES Proposal No. 01-P-012, TEES Contract No. C01-012, TEES Project No. 32196-73150, THECB Grant No. 000512-0012-2001, from 1/1/02 through 08/31/04, \$185,710.
12. Co-Principal Investigator, "Application of Diode-Laser-Based Optical Sensors for Nitric Oxide and Carbon Monoxide for Engine Monitoring and Control," funded by Honeywell Engines & Systems, as Subcontract No. 3020 S1, funded by the U. S. Department of Energy, "Fuel-Flexible Ultra-Low Emissions Combustion System for Industrial Gas Turbines," prime Contract No. DE-FC02-00CH11053, TEES Proposal No. 00-191, TEES Contract No. C01-00392, TEES Project No. 32525-65460, from 01/25/01 through 06/30/02, \$175,000.
13. Co-Principal Investigator, "Development of a Diode-Laser-Based Sensor Laboratory," funded by the Permanent University Fund, Texas A&M University, Account No. 32205-9653-3, Project No. 1032, October 2000 \$149,700.
14. Co-Principal Investigator, "Development of All-Solid-State Sensors for Measurement of Nitric Oxide and Carbon Monoxide Concentration by Optical Absorption," funded by the U. S. Environmental Protection Agency, Office of Research and Development, Science to Achieve Results (STAR) Program, Grant No. R-82818001, TEES Proposal No. 99-567, TEES Contract No. C00-00566, TEES Project No. 32525-6220, from 07/01/00 through 12/31/02, \$225,000.
15. Principal Investigator, "Nitric Oxide Removal From Exhaust Gases Using Augmented Gas-Phase and Catalyst Technologies," funded by the Texas Higher Education Coordinating Board, Advanced Research Program, TEES Proposal No. 99-P-191, TEES Contract No. C00-00229, TEES Project No. 32194-72480, THECB Grant No. 000512-0191-1999, from 1/1/00 through 08/31/02, \$141,680.
16. Co-Principal Investigator, "Development of a Laboratory-Scale Combustor and Instrumentation for Fundamental Studies of Issues Associated with Biomass and Coal Co-Firing," a Cooperative Research and Development Agreement No. 99-F031 between the Texas Engineering Experiment Station and the U. S. Department of Energy Federal Energy Technology Center, 6/16/99 through 6/15/01, no funds.
17. Principal Investigator, "An Investigation of Spark Ignition Processes Using High Speed Laser Schlieren Cinematography," funded by the Energy Resources Program, No. 155265, from 4/15/99 through 8/31/00, \$24,900.
18. Co-Principal Investigator, "Graduate Student Researchers Program," funded by National Aeronautics and Space Administration - Lewis Research Center, Cleveland, OH, Award No. NGT3-52321, from 9/1/96 through 8/31/97, \$5,000.
19. Co-Principal Investigator, "1997 Propane Vehicle Challenge," funded by various sponsors including the U. S. Department of Energy, Chrysler-Canada Limited, Natural Resources Canada, the Texas Railroad Commission, and the Texas Engineering Experiment Station, from 9/1/96 through 6/30/97, approximately \$50,000.
20. Co-Principal Investigator, "Performance of Cluster Burners Under Interactions," funded by the Energy Resources Program, No. 155165, from 5/20/96 through 8/31/97, \$22,800.
21. Co-Principal Investigator, "1996 Propane Vehicle Challenge," funded by various sponsors including the U. S. Department of Energy, Chrysler-Canada Limited, Natural Resources Canada, the Texas Railroad Commission (\$10,000), and the Texas Engineering Experiment Station, from 9/1/95 through 6/30/96, approximately \$60,000.
22. Principal Investigator, "Removal of Nitric Oxide Emissions from the Combustion Gases of Natural Gas, Coal, Lignite, and Petroleum Fuels," funded by the Energy Resources Program, No. 155165, from 9/1/95 through 8/31/96, \$21,000.

23. Co-Principal Investigator, "Graduate Student Researchers Program," funded by National Aeronautics and Space Administration, Washington, DC, Award No. NGT-51244, from 9/1/94 through 12/31/97, \$66,000.
24. Principal Investigator, "Combined Numerical/Analytical Perturbation Solutions of the Navier-Stokes Equations with Applications to Aerodynamic and Geophysical Flows," funded by National Aeronautics and Space Administration – Lewis Research Center, Award No. NAG3-1512, Supplement No. 1, from 9/24/93 through 12/23/94, \$42,678.
25. Principal Investigator, "Analysis and Review of Coal-Fueled Diesel Engines to Support GE-TS Activities," funded by General Electric—Transportation Systems Business Office as a sub-contract from the U. S. Department of Energy, Morgantown Energy Technology Center, Contract No. L66-916987-09, from 1/1/93 through 1/31/94, \$30,689.
26. Co-Principal Investigator, "Energy Audit Review and Development," funded by the Texas Governor's Office of Energy Management, from 12/1/92 through 8/31/94, \$349,860 (total), \$60,000 (Caton's portion).
27. Co-Principal Investigator, "Selective Non-Catalytic NO Removal from Coal Combustion Exhaust," funded by the Center for Energy and Mineral Resources, No. 155109, from 9/1/92 through 8/31/93, \$15,800.
28. Co-Principal Investigator, "Technical Assistance Program: Cogeneration Feasibility Studies and Council Support," funded by the Texas Governor's Office of Energy Management, Contract No. 2007, Amendment No. 1, from 9/1/91 through 11/30/92, \$50,000 (Caton's portion).
29. Co-Principal Investigator, "Selective Non-Catalytic NO_x Removal From Combustion Exhaust," funded by the Texas Higher Education Coordinating Board, Advanced Technology Program, Grant No. 999903-145, from 1/1/92 through 8/31/94, \$122,550.
30. Co-Principal Investigator, "Selective Non-Catalytic NO Removal from Coal Combustion Exhaust," funded by the Center for Energy and Mineral Resources, No. 155109, from 9/1/91 through 8/31/92, \$19,500.
31. Co-Principal Investigator, "Technical Assistance Program: Cogeneration Feasibility Studies and Council Support," funded by the Texas Governor's Office of Energy Management, from 9/1/90 through 8/31/91, \$346,418 (total), \$40,000 (Caton's portion).
32. Principal Investigator, "Equipment Request: Fourier Transform Infrared Spectrometer," funded by the Permanent University Fund, Texas A&M University, Account No. 32205-9162, June 1990, \$135,000.
33. Co-Principal Investigator, "Characterization of Coal-Water Slurry Fuel Sprays from Diesel Engine Injectors," funded by General Electric—Transportation Systems Business Office as a sub-contract from the U. S. Department of Energy, Morgantown Energy Technology Center, Contract No. L66-916987-09, from 2/1/90 through 12/31/92, \$289,786.
34. Principal Investigator, "Characterization of Coal-Water Slurry Fuel Sprays from Diesel Engine Injectors," funded by Texas Engineering Experiment Station, Account No. 08-32133-9831-0, from 2/1/90 through 1/31/92, \$6645.
35. Principal Investigator, "Effects of a Fuel Additive on the Performance and Emissions of a Single-Cylinder Research Diesel Engine," funded by Fuel Tech, Inc., Contract No. 42189, from 5/1/89 through 11/30/89, \$86,377 and supplement funding from 12/1/89 through 6/30/90, \$2,000 and supplement funding from 11/1/90 through 5/31/91, \$3,389.
36. Principal Investigator, "Mathematical Model Modifications of Computer Code Delivered to METC Under Contract No. DE-AC21-84MC21176," funded by U. S. Department of Energy, Morgantown Energy Technology Center, Contract No. DE-AH21-87MC05095, from 3/25/87 through 12/31/87, \$22,139.
37. Co-Principal Investigator, "Performance and Emissions of Coal-Fueled Engines Using Group Combustion Theory," funded by the U. S. Department of Energy, Morgantown Energy Technology Center, Contract No. DE-AC21-86MC23256, from 9/24/86 through 5/31/89, \$160,275.

38. Principal Investigator, "The Design and Development of a Constant-Volume Combustion Chamber for Evaluating the Combustion Characteristics of Coal/Lignite Fuels for Diesel Engines," funded by the Center for Energy and Mineral Resources, No. 18785, from 9/1/86 through 8/31/87, \$13,250.
39. Principal Investigator, "Coal-Fueled Engine Cycle Simulation Development and Support," funded by Arthur D. Little, Inc., Contract No. PO559605, from 6/1/86 through 11/30/86, \$30,429.
40. Principal Investigator, "The Development of an Experimental Facility for the Characterization of Coal-Fuel Sprays," funded by Texas Engineering Experiment Station, No. 9012-2, from 1/9/86 through 8/31/86, \$15,400.
41. Principal Investigator, "A Coal-Fueled Diesel: Simulation Study—Modification," funded by the U. S. Department of Energy, Morgantown Energy Technology Center, Contract No. DE-AC21-84MC21175, from 9/1/85 through 12/31/86, \$50,347.
42. Principal Investigator, "Design for an Experimental Impulse Engine Fuel/Combustion System," funded by Boeing Military Airplane Company, Contract No. BMAC-951, from 12/13/84 through 2/28/85, \$9,650.
43. Principal Investigator, "A Coal-Fueled Diesel: Simulation Study," funded by the U. S. Department of Energy, Morgantown Energy Technology Center, Contract No. DE-AC21-84MC21175, from 4/17/84 through 4/16/85, \$56,070 and supplement funding from 4/17/85 through 8/31/85, \$22,722.
44. Principal Investigator, "Coal-Fueled Diesel: Cycle Simulation Study," funded by the Center for Energy and Mineral Resources, No. 18785, from 1/24/84 through 8/31/84, \$4,000, from 9/1/84 through 8/31/85, \$12,000, and from 9/1/85 through 8/31/86, \$14,900.
45. Principal Investigator, "Technical Reviews of Projects," funded by Institute for Ventures in New Technology, Nos. 9012-2 and 9778, from 2/11/83 to 8/31/85, \$2,775.
46. Co-Principal Investigator, "Engineering Analysis of Cottonseed Oil and Animal Fats as Diesel Fuel," funded by the U. S. Department of Energy and administered by the U. S. Department of Agriculture, Science and Education Office, Agriculture Research Service, Grant No. 59-2481-1-6-056-0, from 9/1/81 through 8/31/83, \$125,000.
47. Principal Investigator, "Direct Utilization of Coal/Lignite in Reciprocating Internal-Combustion Engines," funded by the Center for Energy and Mineral Resources and the Texas Engineering Experiment Station, No. 18751, from 9/1/80 through 8/31/81, \$21,500 and funded by the Center for Energy and Mineral Resources from 9/1/81 through 8/31/83, \$11,625.

X. GRADUATE STUDENTS (All students supervised at Texas A&M University)

Ph'D Students:

1. Junnian (Daniel) Zheng, "Use of an Engine Cycle Simulation to Study Low Temperature Combustion Using Natural Gas," Ph.D., expected August 2012.
2. Hyukjin (Jin) Oh, "Reburning Renewable Biomass for Emissions Control and Ash Deposition Effects in Power Generation," Ph.D., August 2008.
3. Yong Hun (Sam) Park, "Investigation of the Performance and Water Transport of a Polymer Electrolyte Membrane (PEM) Fuel Cell," Ph.D., December 2007.
4. Sherif Fayeze Hanna, "Development of a Solid-State, Diode-Laser Based Ultraviolet Sensor for NO and OH Molecules for Pollution Control and Engine Performance Evaluation," Ph.D., August 2005.
5. Rodolfo Barron-Jimenez, "Development of an All-Solid-State Sensor for CO Concentrations by Optical Absorption," Ph.D., December 2004.
6. Ki-Hyun (Cane) Baek, "Selective Non-Catalytic Reduction of Nitric Oxides by Ammonia: Experiments and Model Calculations," Ph.D., May 2003.
7. S. Todd Tillman, "Flame Structure and Flame Stability Characteristics of Interacting 2D and Circular Laminar Jets in a Linear Triple Burner Array," Ph.D., May 2000.

8. Lawrence J. DeChant, "Combined Numerical/Analytical Perturbation Solutions of the Navier-Stokes Equations for Aerodynamic (Ejector/Mixer Nozzle) Flows," Ph.D., May 1997.
9. Tyn S. Smith, "Experiments on the Selective Non-Catalytic Reduction of Nitric Oxide," Ph.D., May 1995.
10. Stuart R. Bell, "Development of a Cycle Simulation for a Coal-Fueled, Direct-Injected, Internal Combustion Engine," Ph.D., December 1986.

M. S. Students:

11. Breen, Jonathan, "Investigation of Low Temperature Combustion for Diesel Engines Using an Engine Cycle Simulation," MSME, expected May 2010.
12. Vaibhav J. Lawand, "Use of a Thermodynamic Engine Cycle Simulation to Study a Turbocharged Spark-Ignition Engine," MSME, expected December 2009.
13. Junnian (Daniel) Zheng, "Use of an Engine Cycle Simulation to Study a Biodiesel Fueled Engine," MSME, August 2009.
14. Rajeshkumar Shyani, "Using a Cycle Simulation to Examine the Use of EGR for a Spark-Ignition Engine Including the Second Law of Thermodynamics," MSME, August 2008.
15. Sushil Oak, "Second Law Analysis of Premixed Compression Ignition Combustion in a Diesel Engine Using a Thermodynamic Engine Cycle Simulation," MSME, August 2008.
16. Hari Sivasdas, "The Effects of EGR, Water/N₂/CO₂ Injection, and Oxygen Enrichment on the Availability Destroyed Due to Combustion for a Range of Conditions and Fuels," MSME, August 2007.
17. Ankur Gupta, "Cogeneration for a Diesel Engine Locomotive Application," MSME, May 2007.
18. Kaushik T. Patrawala, "An Examination of Possible Reversible Combustion at High Temperatures and Pressures for a Reciprocating Engine," MSME, May 2007.
19. Dushyant Pathak, "Use of a Thermodynamic Cycle Simulation to Determine the Difference Between a Propane-Fuelled Engine and an Iso-Octane-Fuelled Engine," MSME, December 2005.
20. Praveen Chavannavar, "Parametric Examination of the Destruction of Availability Due to Combustion for a Range of Conditions and Fuels," MSME, August 2005.
21. Jasmeet Johar, "An Experimental Investigation of the Urea-Water Decomposition and Selective Catalytic Reduction (SCR) of Nitric Oxides With Urea Using V₂O₅-WO₃-TiO₂ Catalyst," MSME, August 2005.
22. Milivoy Villarroel, "Investigation of Cycle-to-Cycle Variations on Nitric Oxide Emissions for a Spark-Ignition Engine," MSME, August 2004.
23. Giriraj Sharma, "Numerical Modeling of the Selective Catalytic Removal (SCR) of Nitric Oxides," MSME, August 2004.
24. Hyukjin (Jin) Oh, "Selective Catalytic Reduction (SCR) of Nitric Oxide (NO) with Ammonia Over Vanadia-Based and Pillared Interlayer Clay-Based Catalysts," MSME, May 2004.
25. Bhagat C. Kota, "Experimental and Theoretical Investigations of Microwave Heating," MSME, December 2003.
26. James Schaefer, "Development of a Simple Simulation (VROOM) for IC Engines," MSME, December 2003.
27. Saurabh Gupta, "Selective Catalytic Reduction (SCR) of Nitric Oxide with Ammonia Using Cu-ZSM-5 and Va-Based Honeycomb Monolith Catalysts: Effect of H₂ Pretreatment, NH₃-to-NO ratio, O₂, and Space Velocity," MSME, August 2003.
28. Yong Hun (Sam) Park, "An Investigation of Urea Decomposition and Selective Non-Catalytic Removal (SNCR) of Nitric Oxides With Urea," MSME, May 2003.
29. Thomas N. Anderson, "Development of a Diode-Laser-Based Ultraviolet Absorption Sensor for Nitric Oxide," MSME, May 2003.

30. Waruna D. Kulatilaka, "Investigation of Polarization Spectroscopy for Detecting Atomic Hydrogen in Flames," MSME, December 2002.
31. Abhijit Law, "Survey of Diesel Engine Cycle Simulations," MSME, December 2002.
32. Michael Chandler, "A Technical Evaluation of the Advantages and Disadvantages of Fuel Cells Relative to IC Engines for Transportation Applications," MSME, August 2002.
33. Alexander Gentemann, "Flow Reactor Experiments on the Selective Non-Catalytic Removal (SNCR) of Nitrogen Oxides," MSME, May 2001.
34. Yogesh J. Khare, "Investigation of Spark Discharge Processes and Ignition Systems for Spark Ignited Internal Combustion Engines," MSME, August 2000.
35. Srinivas Srivatsa, "The Selective Non-Catalytic Reduction of NO_x Using Urea as the Chemical Agent: An Experimental Approach," MSME, May 1998.
36. Geoffrey R. Baxter, "Development and Use of a Model to Assess the Technical and Economic Feasibility of Cogeneration Systems," MSME, August 1997.
37. Steve G. Bailey, "A Thermodynamic Analysis of the Rotary-Vee Internal Combustion Engine," MSME, August 1994.
38. Brad L. Standridge, "The Use of Enhancers for Removal of Nitric Oxides from Exhaust Gases by Selective Non-Catalytic Reduction," MSME, August 1994.
39. Tim T. Turner, "An Evaluation of an Optically-Based, Cylinder Pressure Sensor in a Single-Cylinder, Research, Diesel Engine," MSME, August 1994.
40. Daniel M. Lee, "The Removal of Nitric Oxide With Ammonia for High Oxygen Conditions," MSME, May 1994.
41. Cariappa M. Chenanda, "Kinetic Modeling of Nitric Oxide Removal from Exhaust Gases by Selective Non-Catalytic Reduction," MSME, May 1993.
42. John K. Narney, "Experiments on the Reduction of Nitric Oxide from Exhaust Gases by Selective Non-Catalytic Reactions," MSME, May 1993.
43. Steve E. Payne, "Characterizations of Coal-Water Slurry Sprays Generated by an Electronically-Controlled Accumulator Fuel Injector," MSME, May 1993.
44. Steve R. Fennell, "Technical and Economic Evaluations of Cogeneration Systems Using Computer Simulations," MSME, May 1993.
45. Ajoy Kumar Seshadri, "Characterization of Coal-Water Sprays from Diesel Engine Injectors," MSME, December 1991.
46. Warren P. Ruellemele, "Effects of a Platinum-Based Fuel Additive on the Performance of a Single Cylinder Research Diesel Engine," MSME, December 1990.
47. David P. Branyon, "Development and Use of an Advanced Coal-Fueled Diesel Cycle Simulation with Group Effects," MSME, August 1989.
48. Charles L. Sager, "Diesel Engine Operation Using Vegetable Oil Fuels," MSME, work completed, no thesis, May 1989.
49. John M. Roth, "Cycle Simulation for Coal-Fueled Engines Using Low-Heat-Rejection Concepts," MSME, August 1988.
50. Mark E. Furtado, "Detailed Diesel Engine Cycle Simulations," MSME, work partially completed, quit program, December 1987.
51. Dean Richardson, "An Experimental Study of Intermittent Sprays of Diesel and Coal-Water Slurry Fuels," MSME, work completed, no thesis, December 1987.
52. Sandeep Kishan, "Simulation Study of Two-Stroke Cycle Compression-Ignition Engines," MSME, May 1985.

53. Kenneth H. Rosegay, "A Cycle Simulation of Coal Particle Fueled Reciprocating Internal-Combustion Engines," MSME, December 1982.

Master of Engineering Students (no thesis):

54. Christopher Fournier, ME, May 2008.

Students from Ruhr-Universität Bochum, Germany (supervised at Texas A&M University):

55. Michael Wendland, "Consideration of Different Strategies for the Use of Hydrogen in an Automotive Spark-Ignition Engine," Diplomarbeit, December 2006.
56. Jan Furmaniak, "Consideration of Different Strategies for the Use of Hydrogen in an Automotive Spark-Ignition Engine," Diplomarbeit, December 2006.
57. Thomas Herker, "Engine Performance Maps for Isooctane (C_8H_{18}) and Hydrogen (H_2) for a Spark-Ignition Engine Using a Thermodynamic Cycle Simulation," Diplomarbeit, December 2005.
58. Tobias Fieback, "Numerical Simulation and Analysis of a Power Plant Using Propane as the Working Substance," Diplomarbeit, December 2004.
59. Inga Tschirner, "A Discussion of Global Warming: Possibilities for Decreasing Carbon Dioxide Emissions to the Atmosphere," Diplomarbeit, December 2004.
60. Marc-André Beyer, "Development of Engine Performance Maps Using a Thermodynamic-Based Computer Simulation of the Engine's Operating Cycle," Diplomarbeit, May 2004.
61. Christoph Glasner, "A Technical Assessment of the 'Hydrogen Economy'," Diplomarbeit, May 2004.
62. Daniel Ubnczyk, "Development and Use of a Computational Simulation for Combined Cycle Power Plants: Selection of Steam Pressure," Diplomarbeit, December 2001.
63. Urs Overhoff, "Development and Use of a Thermodynamic Simulation for Combined Cycle Power Plants and Cogeneration Systems," Diplomarbeit, December 2000.
64. Markus P. Mohr, "Development and Use of a Computer Simulation for a Combined Cycle Power Plant," Diplomarbeit, December 1994.
65. Jurgen F. Schmidt, "An Engine Cycle Simulation with Thermal Nitric Oxide Computations for Coal-Fueled Diesel Engines," Diplomarbeit, June 1987.
66. Klaus F. Koncke, "Calculations of Ignition Characteristics of Coal-Water Slurry Fuels for Engine Conditions: Comparison of Numerical Predictions with Existing Experimental Results," Diplomarbeit, June 1986.

XI. UNDERGRADUATE STUDENTS — SPECIAL PROJECTS (All students supervised at Texas A&M University)

1. William Barnett, "Reburn Experiments Using Biomass to Reduce Emissions," Undergraduate Summer Research Fellow, Summer 2005.
2. Scott Dyas, "Analysis of Design Parameters for an Electro-Hydraulic Valve-Train," MEEN 485, August 2000.
3. Brett Bunger, "Temperature Analysis of the Gas Flow Reactor for Use in Nitric Oxide Reduction Experiments," MEEN 485, August 2000.
4. John Mangan, "The Calibration and Use of Mass Flow Controllers for Use in NO_x Reduction Experiments," MEEN 485, May 2000.
5. Jason Rhodes, "Performance and Emissions for a Dedicated LPG-Fueled Dakota Truck Engine," MEEN 485, May 1997.
6. Greg Suter, "Use of Computer Modeling to Optimize the Design of an LPG-Fueled Engine," MEEN 485, May 1997.

7. James Storey, "Heat Transfer Modeling of the Fuel Delivery System for a 5.2 L Chrysler V-8 Engine," MEEN 485, May 1997.
8. (Robert) Duane Edmonds, "Performance and Emissions for a Dedicated LPG-Fueled Engine," MEEN 485, August 1996.
9. Jeremy Eubanks, "Optimal Ignition Timing for Modified LPG Engine," MEEN 485H, May 1996.
10. Michael R. Billetdeaux, "Documentation and Evaluation of Modifications to a Chrysler V-6 Engine for the 1996 Propane Vehicle Challenge," MEEN 485, May 1996.
11. Jennings Goodman, "A Thermodynamic Framework for the Measurement of Stability in the International Political System," MEEN 485H, May 1996.
12. Christopher M. Vasiliotis, "Performance, Efficiency, and Emissions Comparison of a 1996 Chrysler 3.3 Liter V-6 Engine Operating on Gasoline and Liquefied Petroleum Gas," 95-96 University Undergraduate Fellows Program, MEEN 485H, May 1996.
13. Jamil A. Wakil, "A Technical Assessment and Preliminary Thermodynamic Evaluation of the Parsons Engine," MEEN 485H, August 1995.
14. Ronald A. Bartsch, "Development of a Two-Zone Thermodynamic Model of an Engine Cycle to Study Knock," MEEN 485, May 1995.
15. Frank Pyrtle, III, "Preparation for the Examination of Data Collected Using a Piezoelectric Transducer," MEEN 485, August 1993.
16. Stephen Pierce, "Diesel Engine Cycle Simulation and Cylinder Pressure Measurements," MEEN 485, December 1992.
17. Paul Deignan, "Further Development of an Electro-Magnetically Based Diesel Particulate Collection System," 91-92 University Undergraduate Fellows Program, MEEN 485H, May 1992.
18. Stephen Pierce, "Diesel Engine Cylinder Pressure Measurements," MEEN 485, May 1992.
19. Byron Bunker, "Development and Implementation of an Engine Cycle Simulation," 91-92 University Undergraduate Fellows Program, MEEN 485H, May 1992.
20. Hans Mathews, "Development of an After-Burner for a Ducted Fan Model Aircraft Propulsion System," MEEN 485, December 1991.
21. Ken Peterson, "Development of an After-Burner for a Ducted Fan Model Aircraft Propulsion System," MEEN 485, December 1991.
22. Shean R. Dalton, "Settling Properties of a Coal-Water Slurry Fuel: Effects of Containers," MEEN 485, incomplete, August 1991.
23. Paul Deignan, "Development of an Electro-Magnetically Based Diesel Particulate Collection System," Undergraduate Summer Research Grant, August 1991.
24. Jeff Kofahl, "Design and Testing of an Afterburner for a Small Ducted Fan," MEEN 485, August 1991.
25. Hans Mathews, "Design and Testing of an Afterburner for a Small Ducted Fan," MEEN 485, August 1991.
26. (Dwayne) Allan Daggs, "The Development and Validation of a Thermodynamic Model for Spark-Ignition and Compression-Ignition Reciprocating Engines," MEEN 485, May 1991.
27. Scott Going, "Characterization of Fuel Sprays: Data Reduction and Analyses," MEEN 485, May 1991.
28. Donny Torres, "Development of a Simple Fuel Injection System Model," MEEN 485, May 1991.
29. Blake E. Dickinson, "Settling Properties of Coal-Water Slurries," MEEN 485, December 1990.
30. Michael J. Smith, "The Detection of Platinum and Other Trace Elements Present in Diesel Exhaust Particulate," MEEN 485, August 1990.

31. Michael L. Macek, "Parametric Study of a Diesel Fuel Injection System," Undergraduate Summer Research Grant, August 1990.
32. Brian E. Parks, "Effects of a Platinum-Based Additive on Diesel Engine Exhaust Particulate Matter," Undergraduate Summer Research Grant, August 1990.
33. Brad L. Standridge, "Viscosity Measurement of Coal-Water Slurry Fuel," Undergraduate Summer Research Grant, August 1990.
34. David A. Rogers, "Cycle Simulation to Determine Cylinder and Gas Temperatures in an Air-Cooled Engine," MEEN 485, December 1984.
35. Douglas W. Grant, "Development and Use of an Engine Cycle Simulation," Undergraduate Summer Research Grant, August 1984.
36. James L. Krenek, "The Effects of Induction and Exhaust Processes on the Performance of an SI Engine," MEEN 485, August 1983.
37. Tom J. Blalock, "Engine Cycle Simulation with Equilibrium Properties," MEEN 485, August 1983.
38. Jerry L. Morris, "Coal Particle Combustion with Carbon Monoxide Reactions," Undergraduate Summer Research Grant, August 1982.
39. Saleem Karimjee, "An Analysis of the Fuel-Air Mixture Distribution Within a Cylinder of a Direct Injection Diesel Engine," 81–82 University Undergraduate Fellows Program, MEEN 485H, May 1982.
40. Jerry L. Morris, "Numeric Solution for the Combustion of Graphitic Particles," Undergraduate Summer Research Grant, August 1981.
41. Michael S. Hanley, "Heat Transfer in Induction Systems of Engines," MEEN 485, August 1980.
42. Larry L. Earles, "Jet Mixing in Engines," MEEN 485, December 1980.

XII. CONTINUING EDUCATION

1. Co-taught a short course entitled, "Performance Development of Internal Combustion Engines," for the University of Wisconsin – Madison, College of Engineering, in cooperation with the University of Wisconsin Engine Research Center and the Department of Engineering Professional Development, conducted in Madison, WI, 26–28 September 2006.
2. Co-taught a short course entitled, "Performance Development of Internal Combustion Engines," for the University of Wisconsin – Madison, College of Engineering, in cooperation with the University of Wisconsin Engine Research Center and the Department of Engineering Professional Development, conducted in Madison, WI, 08–10 November 2005.
3. Co-taught a short course entitled, "Performance Development of Internal Combustion Engines," for the University of Wisconsin – Madison, College of Engineering, in cooperation with the University of Wisconsin Engine Research Center and the Department of Engineering Professional Development, conducted in San Diego, CA, WI, 24–26 May 2005.
4. Co-taught a short course entitled, "Performance Development of Internal Combustion Engines," for the University of Wisconsin – Madison, College of Engineering, in cooperation with the University of Wisconsin Engine Research Center and the Department of Engineering Professional Development, conducted in Madison, WI, 07–09 October 2003.
5. Co-taught a short course entitled, "Performance Development of Internal Combustion Engines," for the University of Wisconsin – Madison, College of Engineering, in cooperation with the University of Wisconsin Engine Research Center and the Department of Engineering Professional Development, conducted in South Folly, SC, 01–03 October 2002.
6. Co-taught a short course entitled, "Performance Development of Internal Combustion Engines," for the University of Wisconsin – Madison, College of Engineering, in cooperation with the University of Wisconsin Engine Research Center and the Department of Engineering Professional Development, conducted in Madison, WI, 7–9 May 2002.

7. Organized, directed and co-taught a short course entitled, "Fuel Nozzle Design and Applications," for Suntec Industries, Inc., Rockford, IL, 2 June 1995.
8. Organized, directed and co-taught a short course entitled, "Technology and Economics of Cogeneration," for the American Society of Mechanical Engineers, Professional Development Program, at the McCormick Center Hotel, Chicago, IL, 27–28 April 1989.
9. Organized, directed and co-taught a short course entitled, "Cogeneration Systems," at the Adams Mark Hotel, Houston, TX, 15 September 1987.
10. Co-taught a short course entitled, "Introduction to Cogeneration Systems," for the Texas Public Utility Commission, Austin, TX, 7 and 14 July 1987.
11. Organized, directed and co-taught a short course entitled, "Cogeneration Systems," at the Sheraton Centre Park Hotel, Arlington, TX, 17 November 1986.
12. Directed and taught a short course entitled, "Prime Movers," for Central Power and Light Company, Corpus Christi, TX, 13 November 1985.
13. Organized, directed and co-taught a short course entitled, "Cogeneration Systems," at the College Station Hilton and Conference Center, 23 September 1985.
14. Co-taught a workshop entitled, "Boiler and Steam Systems," sponsored by Texas Engineering Extension Service, at the Dallas/Ft. Worth Airport, 5–6 September 1985.
15. Co-taught a workshop entitled, "Efficient Boiler Combustion and Operation," sponsored by Texas Engineering Extension Service, at the Dallas/Ft. Worth Airport, 20 September 1984.
16. Organized, directed and co-taught a short course entitled, "Cogeneration Systems," Texas A&M University, 16 August 1984.
17. Organized, directed and co-taught a short course entitled, "Efficient Boiler Combustion and Operation," Texas A&M University, 13 August 1984.

XIII. TESTIMONIES FOR THE TEXAS STATE COGENERATION COUNCIL

1. "Consideration of Cogeneration Application for Texas A&M University at College Station — Back-Pressure Steam Turbine and Chiller Station Installation," Texas State Capital, John H. Reagan Building, Austin, Texas, 25 September 1992.
2. "Reconsideration of Cogeneration Application for University of Texas for the Medical Branch at Galveston," Public Utility Commission, Austin, Texas, 7 February 1992.
3. "Consideration of Cogeneration Application for University of Texas for the Medical Branch at Galveston," Central Services Building, Austin, Texas, 22 March 1991.
4. "Consideration of Cogeneration Application for University of Texas at Dallas," University of Texas at Dallas, Richardson, Texas, 23 March 1990.

XIV. DEPARTMENT AND UNIVERSITY SERVICE

1. Member, Advisory Committee, Department of Mechanical Engineering, January 2010 – December 2012.
2. Member, Tenure and Promotion Committee, Department of Mechanical Engineering, 2010-11.
3. Chair, Faculty Search Committee, Department Wide Search, Department of Mechanical Engineering, September 2009 – June 2010.
4. Member, Advisory Committee, Department of Mechanical Engineering, January 2009 – December 2010.
5. Chair, Faculty Search Committee, Candidate in Fluid Mechanics, Department of Mechanical Engineering, January 2009 – May 2009.
6. Chair, Faculty Search Committee, Candidate in Thermal Fluid Sciences Division, Department of Mechanical Engineering, June – July 2009.

7. Member, Faculty Search Committee, Candidate in Design, Department of Mechanical Engineering, September 2008 – May 2009.
8. Associate Department Head and Coordinator of Research Programs, Department of Mechanical Engineering, Fall 2006 – present.
9. Member, Tenure and Promotion Committee, Department of Mechanical Engineering, 2006 – 08.
10. Chairman, Thermodynamics Qualifying Exam Committee, Department of Mechanical Engineering, Spring 2008.
11. Co-Chair, Faculty Search Committee, Department Wide Search for Chair/Professorship Candidates, Department of Mechanical Engineering, August 2006 – May 2007.
12. Member, Faculty Search Committee, Thermal Fluid Sciences Division, Biological Heat Transfer/Fluids, Department of Mechanical Engineering, August 2006 – May 2007.
13. Member, Faculty Search Committee, Mechanics Division, Experimental Mechanics, Department of Mechanical Engineering, August 2006 – May 2007.
14. Member, Thermodynamics (MEEN 227) Textbook Selection Committee, Department of Mechanical Engineering, Spring 2006.
15. Chairman, Thermodynamics Qualifying Exam Committee, Department of Mechanical Engineering, Spring 2006.
16. Member, TEES Homeland Security Advisory Board, Texas Engineering Experiment Station, 2005–06.
17. Member, Graduate Studies Committee, Department of Mechanical Engineering, 2005–06.
18. Member, Thermodynamics Course Development, Department of Mechanical Engineering, 2005.
19. Chairman, Faculty Search Committee, Thermal Fluid Sciences Division, Combustion/Environment, Department of Mechanical Engineering, June 2005 – May 2006.
20. Member, Departmental Advisory Committee, Department of Mechanical Engineering, 2004–05.
21. Member, Mentor Committee for Dr. Timothy J. Jacobs, 2005 – present.
22. Member, Mentor Committee for Dr. Xin-Lin Gao, 2005 – present.
23. Member, Mentor Committee for Dr. Deb Banerjee, 2005 – present.
24. Chairman, Safety Committee, Department of Mechanical Engineering, 2004–05.
25. Member, Tenure and Promotion Committee, Department of Mechanical Engineering, 2004.
26. Member, Departmental Advisory Committee, Department of Mechanical Engineering, 2003–05.
27. Member, Departmental Post Tenure Committee, Department of Mechanical Engineering, 2003–05.
28. Chairman, Uniform Procedures for Centers Committee, Department of Mechanical Engineering, Fall 2003.
29. Member, Faculty Search Committee, Materials and Manufacturing Division, Department of Mechanical Engineering, 2003–04.
30. Chairman, Thermodynamics Qualifying Exam Committee, Department of Mechanical Engineering, Spring and Fall 2003.
31. Member, Departmental Advisory Committee, Department of Mechanical Engineering, 2001–03
32. Member, Departmental Post Tenure Committee, Department of Mechanical Engineering, 2001–03.
33. Member, Departmental Honors and Awards Committee, Department of Mechanical Engineering, 2001–02.
34. Member, College of Engineering Tenure and Promotion Review Committee, Dwight Look College of Engineering, 2001 and 2002.
35. Chairman, Issues (Long-Range Planning) Committee, Department of Mechanical Engineering, 2001–02

36. Member, Mechanical Engineering Department Head Search Advisory Committee, 2001–02.
37. Chairman, Tenure and Promotion Committee, Department of Mechanical Engineering, 2001.
38. Chairman, Faculty Search Committee, Thermal Fluid Sciences Division, Department of Mechanical Engineering, 2000–01.
39. Member, Sub-Committee to Explore a New Course, Thermal/Fluids Sciences Division, Department of Mechanical Engineering, 2000–01.
40. Member, College Committee on Establishing an Environmental Masters Degree, Look College of Engineering, 2000–01.
41. Graduate Council Representative, for Mr. Ernesto Perusquia, Doctor of Philosophy Candidate, Department of Agricultural Economics, 2000–present.
42. Member, College of Engineering Awards Committee, Look College of Engineering, 2000–01.
43. Member, Undergraduate Studies and Curriculum Committee, Department of Mechanical Engineering, 2000–02.
44. Member, Tenure and Promotion Committee, Department of Mechanical Engineering, 2000–03.
45. Chairman, Selection Committee for the Western Coal Transportation — Tom Mayo Fellowship Award, 1999–present.
46. Member, Faculty Search Committee, Thermal Fluid Sciences Division, Department of Mechanical Engineering, 1999–2000.
47. Alternate Member, Graduate Appeals Panel, University Committee reporting to the President, 1999–2001.
48. Member, Thermodynamics Qualifying Exam Committee, Department of Mechanical Engineering, 1999–2001.
49. Member, Departmental Post Tenure Committee, Department of Mechanical Engineering, 1999–2001.
50. Proctor, Fundamentals of Engineering Examination, TAMU, 31 October 1998.
51. Member, Departmental Honors and Awards Committee, Department of Mechanical Engineering, 1998–2000.
52. Graduate Council Representative, for Mr. Jacqueliën Hoervers, Doctor of Philosophy Candidate, Department of Veterinary Pathobiology, 1998–2001.
53. Member, Departmental Post Tenure Committee, Department of Mechanical Engineering, 1998–99.
54. Member, Departmental Advisory Committee, Department of Mechanical Engineering, 1997–98.
55. Chairman, Graduate Studies Committee, Department of Mechanical Engineering, 1997–98.
56. Chairman, Faculty Search Committee, Department of Mechanical Engineering, 1997–98.
57. Interim Department Head, Department of Mechanical Engineering, 15 July 1996 – 31 August 1997.
58. Graduate Council Representative, for Mr. Robert Otey, Doctor of Philosophy Candidate, Department of Educational Administration, 1996–99.
59. Faculty Advisor, “1997 Propane Vehicle Challenge,” Department of Mechanical Engineering, September 1996 through June 1997.
60. Faculty Advisor, “1996 Propane Vehicle Challenge,” Department of Mechanical Engineering, September 1995 through June 1996.
61. Chairman, Tenure and Promotion Committee, Department of Mechanical Engineering, 1995–96.
62. Member, Graduate Appeals Panel, University Committee reporting to the President, 1995–98.
63. Member, Graduate Advisory Committee, for Ms. Christene M. (Lohse) Minor, Master of Science Candidate, Department of Chemistry, 1995–Present.
64. Director, Graduate Program, Department of Mechanical Engineering, 1994–1998.

65. Chairman, Graduate Advisory Committee, Department of Mechanical Engineering, 1994–1998.
66. Member, Graduate Instruction Committee, College of Engineering Committee, 1994–1998.
67. Faculty Advisor, Mechanical Engineering Graduate Student Organization (MEGSO), Department of Mechanical Engineering, 1994–98.
68. Graduate Council Representative, for Mr. Kurt W. McWilliams, Doctor of Philosophy Candidate, Department of Chemistry, 1994–96.
69. Member, Tenure and Promotion Committee, Department of Mechanical Engineering, 1994–96.
70. Lecturer, Thermodynamics Review Session, EIT, Fundamentals of Engineering Examination, 23 March 1993.
71. Chairman, Faculty Search Committee, Thermal Fluids Division, Department of Mechanical Engineering, 1992–93.
72. Division Head, Thermal/Fluids Sciences Division, 1992–93.
73. Committee Member, Academic Executive Committee, Department of Mechanical Engineering, 1992–93.
74. Member, Mechanical Engineering Department Head Search Advisory Committee, 1992–93.
75. Chairman, Focus Group: Future Research Directions, Department of Mechanical Engineering, May 1992 – September 1992.
76. Deputy Division Head, Thermal/Fluids Sciences Division, 1991–92.
77. Member, Thermodynamics Book Review Committee, Department of Mechanical Engineering, February 1992.
78. Graduate Council Representative, for Ms. Chia-Lai Wang, Doctor of Philosophy Candidate, Department of Physics, 1992–Present.
79. Representative, Engineering Faculty Advisory Council, for Department of Mechanical Engineering, 1991–94.
80. Lecturer, Thermodynamics Review Session, EIT, Fundamentals of Engineering Examination, 14 October 1991.
81. Committee Member, Special Event for Potential Graduate Students, for Thermal & Fluids Division, Department of Mechanical Engineering, 1990–94.
82. Member, Faculty Search Committee, Thermal Fluids Division, Department of Mechanical Engineering, 1990–91.
83. Committee Member, Research Executive Committee, Department of Mechanical Engineering, 1989–92.
84. Leader, Combustion and Fuels Research Laboratory, Department of Mechanical Engineering, 1989–92.
85. Proctor, EIT Examination, 28 October 1989.
86. Graduate Council Representative, for Mr. William John Berger, Doctor of Engineering Candidate, Department of Agricultural Engineering, 1989–90.
87. Faculty Advisor, Sigma Delta Chapter of Pi Tau Sigma, Department of Mechanical Engineering, 1986–90.
88. Representative, Council of Principal Investigators, Sub-committee of the Faculty Senate Research Committee, for College of Engineering, 1985–90.
89. Member, Thompson-Caddess-Simmang Awards Committee, Department of Mechanical Engineering, 1985–86.
90. Member, Graduate Affairs Committee, Department of Mechanical Engineering, 1985–94.
91. Member, Appeal Review Board, College of Engineering, Fall 1985.

92. Coordinator, Undergraduate Summer Research Fellows' Proposals, Department of Mechanical Engineering, Spring 1985.
93. Member, Thermal Science Laboratory Committee, Department of Mechanical Engineering, April 1985.
94. Member, Thermodynamics Book Review Committee, Department of Mechanical Engineering, February 1985.
95. Member, Selection Committee for the Western Coal Transportation — Tom Mayo Fellowship Award, 1984–97.
96. Member, Thermodynamics Book Review Committee, Department of Mechanical Engineering, Fall 1983.
97. Graduate Council Representative, for Ms. Millie Klein Doctor of Education, Department of Educational Administration, 1983–88.
98. Member, Self-Study Committee, Department of Mechanical Engineering, 1981–82.
99. Member, Graduate Program Committee, Department of Mechanical Engineering, 1980–81.
100. Member, Thermodynamics Book Review Committee, Department of Mechanical Engineering, Spring 1980.

XV. CONSULTING ACTIVITIES

1. "Technical Support for Texas Environmental Research Consortium," Environmental Technology Advisory Council (ETAC), Houston Advanced Research Center (HARC), The Woodlands, TX, 2006 – present.
2. "Technical Support for Activities Concerning Internal Combustion Engines," for University of Keimyung, and EROOM, Inc., Taegu, Korea, 2005.
3. "Development and Use of a Thermodynamic Simulation to Evaluate the IRIS Engine," for AMP Capital Partners, Draper, UT, and Santa Clara, CA, 5 June 2005 through 28 August 2005.
4. "Studies of Mixing Machines," for Vinson & Elkins LLP, Houston, TX, 16 December 2003.
5. "Formation of Research Programs on Reversible Combustion for Engines," for Oakridge National Laboratory, National Transportation Research Center (NTRC), Knoxville, TN, 10 December 2003.
6. "Assistance for the Development of a Combatant Craft High Performance Diesel Engine (CCHPDE)," for Battelle Memorial Institute, 23 January 2001 to 31 December 2004.
7. "An Assessment of Claims of Excessive Combustion Temperatures in a Gas Turbine," for Westmoreland Hall, PC, 27 October 2000 through 31 December 2000.
8. "Cogeneration Power Plant: Contract Deficiencies," for Bell, Rosenberg & Hughes, LLP, 1 August 2000 through 30 June 2001.
9. "Combatant Craft Alternative Fuel Propulsion Engine," for Battelle Memorial Institute, 27 October 1999 to 1 April 2000.
10. "Design of a LPG Fuel Injection System," for University of Keimyung, Taegu, Korea, 20 July to 31 August 1999.
11. "Evaluation of a Boiler Failure," Beirne, Maynard & Parsons, LLP, 16 August 1999.
12. "Technical Evaluation of a Combustion Powered Tool," for Senco Products, Inc., Cincinnati, OH, 11 February 1997.
13. "Development of a Research Proposal and Technical Paper for the West Engine," for the Callery Group, Houston, TX, 2 August 1995 through 31 May 1996.
14. "Technical Evaluation of the Rotary-Vee IC Engine," for R VEC, Inc., Carpentersville, IL, 8 July 1995 through 9 August 1995.
15. "Fuel Nozzle Design and Applications," for Suntec Industries, Inc., Rockford, IL, 2 June 1995.

16. "Technical Assessment, Evaluation, and Analysis of the West Engine," for West Research, Meridian, TX, 5 September 1994 through 28 February 1995.
17. "A Review of Modeling for Coal-Fueled Engines," for Southwest Research Institute, San Antonio, TX, 1 June 1993 through 31 August 1993.
18. "Diesel Engine Research at Texas A&M University," for Cummins Engine Company, Inc., Columbus, IN, 13 July 1993.
19. "Research on Selective Non-Catalytic Removal of Nitric Oxides from Exhaust Gases," for Cummins Power Generation, Inc., Irvine, CA, 16 June 1993.
20. "Review and Use of Models for Coal-Fueled Engines," for Detroit Diesel Corporation, Detroit, MI, 1 May 1991 through 30 June 1991.
21. "Review of Research on a Platinum Fuel Additive for Diesel Engines," and "Conference Presentation," for Fuel Tech, Inc., Sanford, CT, 2 February 1991 through 20 December 1991.
22. Technical Evaluations of: "Vaporizer for Cold Starting SI Engines with Reduced Volatility Fuels," and "The Wilks Two-Stroke Engine," for the Technology Business Development, Texas Engineering Experiment Station, Texas A&M University, 1 May 1990 through 31 August 1990.
23. "Technical Assessment and Evaluation of Fuel Additives for Furnace Combustion," for Crystal Energy, Thousand Oaks, CA, 1 January 1989 through 31 December 1989.
24. "Cycle Simulation Development for Coal-Fueled Engines," for Integral Technologies, Inc., Blackhawk, IL, 1 August 1988 through 30 June 1989.
25. Technical Evaluations of: "The Harness Rotary Motor," for the Technology Business Development, Texas Engineering Experiment Station, Texas A&M University, 1 February 1987 through 21 February 1987.
26. "Thermodynamic Analysis of Proposed Cogeneration Systems," for Entherm, Inc., Houston, TX, 1986.
27. "The Use and Implementation of Models for Coal Combustion in Engines," for Arthur D. Little, Inc., Cambridge, MA, 15 April 1986 through 30 June 1986.
28. "Prime Movers," a one-day short course for Central Power and Light Company, Corpus Christi, TX, 1 October 1985 through 30 November 1985.
29. "Technical Evaluations," for Texas Engineering Extension Service, Texas A&M University, 1985.
30. Technical Evaluations of: "Variable Stroke Engine," and "Variable Timing Rotary Valve," for the Institute for Ventures in New Technology, Texas Engineering Experiment Station, Texas A&M University, 6 July 1984 through 30 November 1984.
31. Technical Evaluation of: "The Lyle Rotary Valve Cylinder Head," for the Institute for Ventures in New Technology, Texas Engineering Experiment Station, Texas A&M University, 19 January 1983 through 10 June 1983.
32. "Heat Transfer Through Soil," for Texaco, Inc., Houston, TX, 1983.
33. "Refractory Designs for Furnaces," for Cheek Engineering Company, Houston, TX, 1982.
34. "Heat Transfer and Hydrocarbon Oxidation in the Exhaust Port of an SI Engine," for Southwest Research Institute, San Antonio, TX, 1980.

XVI. SPONSOR/HOST OF VISITING FACULTY

1. Professor Jong Tai Lee, Sungkyunkwan University, School of Mechanical Engineering, Jangan-gu, Suwon, Korea, at TAMU from 01 September 2006 to 31 August 2007.
2. Professor Gyeong Ho Choi, Keimyung University, Department of Mechanical and Automotive Engineering, Daegu, Korea, at TAMU from 01 January 2005 to 31 December 2007.
3. Professor Jong Tai Lee, Sungkyunkwan University, School of Mechanical Engineering, Jangan-gu, Suwon, Korea, at TAMU from 15 January 1999 to 28 February 2000.

XVII. CHAIRMAN OF MAJOR CONFERENCES AND SYMPOSIA

1. 1996 Fall Technical Conference, Internal Combustion Engine Division, the American Society of Mechanical Engineers, Fairborn (Dayton), OH, 20–23 October 1996.
2. 1995 Fall Technical Conference, Internal Combustion Engine Division, the American Society of Mechanical Engineers, Milwaukee, WI, 24–27 September 1995.
3. 1995 Spring Technical Conference, Internal Combustion Engine Division, the American Society of Mechanical Engineers, Marietta, OH, 23–26 April 1995.
4. 1994 Internal Combustion Engines Symposium, at the 1994 Energy-sources Technology Conference & Exhibition, New Orleans, LA, 23–26 January 1994.

XVIII. ATTENDANCE AT TEACHING ENHANCEMENT WORKSHOPS

1. “2000 National Effective Teaching Institute (NETI),” by Profs. Rebecca Brent, Richard M. Felder, and James E. Stice, St. Louis, MO, 15–17 June 2000.
2. “Teams and Group Learning,” Dwight Look College of Engineering, Texas A&M University, College Station, TX, 26 May 1999.
3. “Teaming and Collaborative Learning,” by Profs. Cesar Malave and P. K. Imbrie, Dwight Look College of Engineering, Texas A&M University, College Station, TX, 27–28 July 1998.
4. “ENGR 11x and 21x Workshop,” Dwight Look College of Engineering, Texas A&M University, College Station, TX, 7 May 1998.
5. “Foundation Coalition Summer 1997 Workshop,” Dwight Look College of Engineering, Texas A&M University, College Station, TX, 14–15 August 1997.
6. “Cooperative Learning Introductory Session and Workshop,” by Prof. Karl A. Smith, Texas A&M University, College Station, TX, 13 January 1993.
7. “Annual Enhancing College Teaching Workshop for Faculty: Topics on Writing,” Texas A&M University, College Station, TX, 17 January 1986.
8. “Enhancing College Teaching,” Texas A&M University, College Station, TX, 27 August 1979.

XIX. CLASSES TAUGHT

SEMESTER	COURSE TITLE	COURSE NUMBER	NUMBER OF STUDENTS
FALL 1979	THERMODYNAMICS I	MEEN 327	35
FALL 1979	THERMODYNAMICS I	MEEN 327	61
FALL 1979	THERMODYNAMICS I	MEEN 327	25
SPRING 1980	THERMODYNAMICS I	MEEN 327	24
SPRING 1980	THERMODYNAMICS I	MEEN 327	27
SPRING 1980	I. C. ENGINES	MEEN 410	22
SUMMER 1980	HEAT TRANSFER	MEEN 461	34
FALL 1980	HEAT TRANSFER	MEEN 461	25
FALL 1980	COMBUSTION	MEEN 489	11
SPRING 1981	THERMODYNAMICS II	MEEN 328	23
SPRING 1981	THERMODYNAMICS II	MEEN 328	20
SPRING 1981	SEMINAR	MEEN 481	18
FALL 1981	ADVANCED THERMO	MEEN 615	16
FALL 1981	COMBUSTION	MEEN 489	10
FALL 1981	SEMINAR	MEEN 481	16
SPRING 1982	THERMODYNAMICS I	MEEN 327	25
SPRING 1982	THERMODYNAMICS I	MEEN 327	26
SPRING 1982	I. C. ENGINES	MEEN 410	10
SUMMER 1982	FLUID MECHANICS	MEEN 344	22
FALL 1982	THERMODYNAMICS II	MEEN 328	35
FALL 1982	ADVANCED THERMO	MEEN 615	15
FALL 1982	SEMINAR	MEEN 481	20
SPRING 1983	THERMODYNAMICS II	MEEN 328	30
SPRING 1983	I. C. ENGINES	MEEN 410	25
SPRING 1983	HEAT TRANSFER	MEEN 461	30
SUMMER 1983	THERMODYNAMICS I	MEEN 327	30
FALL 1983	THERMODYNAMICS I	MEEN 327	30
FALL 1983	THERMODYNAMICS I	MEEN 327	35
FALL 1983	ENGINEERING LAB	MEEN 404	20
SPRING 1984	THERMODYNAMICS I	MEEN 327	31
SPRING 1984	THERMODYNAMICS I	MEEN 327	35
SPRING 1984	I. C. ENGINES	MEEN 410	15
FALL 1984	THERMODYNAMICS II	MEEN 328	23
FALL 1984	THERMODYNAMICS II	MEEN 328	24
SPRING 1985	THERMODYNAMICS I	MEEN 327	30
SPRING 1985	I. C. ENGINES	MEEN 410	27
FALL 1985	THERMODYNAMICS II	MEEN 328	31
FALL 1985	COMBUSTION	MEEN 405	15
SPRING 1986	ENGINEERING LAB	MEEN 404	19
SPRING 1986	I. C. ENGINES	MEEN 410	19
FALL 1986	COGENERATION	MEEN 689	9
SPRING 1987	I. C. ENGINES	MEEN 410	19
FALL 1987		SABBATICAL	
SPRING 1988		SABBATICAL	
FALL 1988	COMBUSTION	MEEN 405	11
FALL 1988	COGENERATION	MEEN 689	9

XVIII. CLASSES TAUGHT (Continued)

SPRING 1989	I. C. ENGINES	MEEN 410	12
SPRING 1989	ADVANCED THERMO	MEEN 615	19
FALL 1989	ADVANCED THERMO	MEEN 615	17
SPRING 1990	THERMODYNAMICS II	MEEN 328	30
SPRING 1990	THERMODYNAMICS II	MEEN 328	32
SPRING 1990	THERMODYNAMICS II	MEEN 328	28
FALL 1990	I. C. ENGINES	MEEN 410	24
FALL 1990	COGENERATION	MEEN 689	7
SPRING 1991	THERMODYNAMICS II	MEEN 328	30
SPRING 1991	THERMODYNAMICS II	MEEN 328	22
SPRING 1991	I. C. ENGINES	MEEN 410	11
FALL 1991	THERMODYNAMICS I	MEEN 327	116
SPRING 1992	I. C. ENGINES	MEEN 410	17
FALL 1992	THERMODYNAMICS I	MEEN 327	116
SPRING 1993	I. C. ENGINES	MEEN 410	15
FALL 1993		SABBATICAL	
SPRING 1994		SABBATICAL	
FALL 1994	I. C. ENGINES	MEEN 410	18
SPRING 1995	THERMODYNAMICS II	MEEN 328	38
FALL 1995	COGENERATION	MEEN 663	12
FALL 1995	DESIGN (II)	MEEN 445*	18
SPRING 1996	DESIGN (III)	MEEN 446*	18
FALL 1996	I. C. ENGINES	MEEN 410	15
FALL 1996	DESIGN (II)	MEEN 445*	18
SPRING 1997	DESIGN (III)	MEEN 446*	20
FALL 1997	I. C. ENGINES	MEEN 410	11
SPRING 1998	THERMODYNAMICS II	MEEN 328	49
SPRING 1998	DESIGN (III)	MEEN 446*	10
FALL 1998	I. C. ENGINES	MEEN 410	24
SPRING 1999	THERMODYNAMICS II	MEEN 328	52
SPRING 1999	THERMODYNAMICS I	ENGR 212	64
SUMMER 1999	THERMODYNAMICS I	ENGR 212	95
FALL 1999	THERMODYNAMICS II	MEEN 328	56
SPRING 2000	THERMODYNAMICS II	MEEN 328	56
SPRING 2000	THERMODYNAMICS I	ENGR 212	76
SUMMER 2000	THERMODYNAMICS I	ENGR 212	86
FALL 2000	COGENERATION	MEEN 663	12
SPRING 2001	I. C. ENGINES	MEEN 410	22
SPRING 2001	THERMODYNAMICS I	ENGR 212	76
FALL 2001	THERMODYNAMICS I	ENGR 212	81
SPRING 2002	COGENERATION	MEEN 663	10
SPRING 2002	I. C. ENGINES	MEEN 410	20
FALL 2002	THERMAL FLUIDS	MEEN 421	63
SPRING 2003	I. C. ENGINES	MEEN 410	27
SPRING 2003	THERMAL FLUIDS	MEEN 421	46
SUMMER 2003	THERMODYNAMICS I	ENGR 212	86
FALL 2003	COGENERATION	MEEN 663	18

*Co-taught

XVIII. CLASSES TAUGHT (continued)

SPRING 2004	I. C. ENGINES	MEEN 410	33
SPRING 2004	THERMAL FLUIDS	MEEN 421	30
FALL 2004	ADVANCED THERMO	MEEN 615	30
SPRING 2005	THERMAL FLUIDS	MEEN 421	41
SPRING 2005	ADVANCED THERMO	MEEN 615	17
FALL 2005	COGENERATION	MEEN 663	22
FALL 2005	THERMAL FLUIDS	MEEN 421	43
SPRING 2006	THERMAL FLUIDS	MEEN 421	87
FALL 2006	THERMAL FLUIDS	MEEN 421	35
SPRING 2007	I. C. ENGINES	MEEN 410	36
FALL 2007	THERMAL FLUIDS	MEEN 421	40
FALL 2007	GRADUATE SEMINAR	MEEN 681	68
SPRING 2008	I. C. ENGINES	MEEN 410	32
FALL 2008	THERMAL FLUIDS	MEEN 421	42
SPRING 2009	COGENERATION	MEEN 663	29
FALL 2009	ENGINEERING LAB	MEEN 404	20
SPRING 2010	ENGINEERING LAB	MEEN 404	25
		Total Students:	3365