

# **Mechanical and Aerospace Engineering at West Virginia University**



**2007-2008  
Annual Report**

[www.mae.wvu.edu](http://www.mae.wvu.edu)

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Undergraduate MAE student, Thilanka Munasinghe, standing alongside Governor Manchin during Undergraduate Research Day at the Capitol

The mission of the College of Engineering and Mineral Resources is to prepare students to practice their profession and to contribute to the well being of society through academic study, research, extension, and service.

# MESSAGE FROM THE CHAIR

## Mechanical and Aerospace Engineering

At a recent student job fair I met a fellow from industry that told me “I need to hire some good Aerospace Engineers.” You must be in the aircraft industry –I said. Not at all, he responded, “I make centrifugal compressors for basic industries like mining.” He explained that his product line is constantly changing due to new markets and new regulations all over the world, and that AE’s work wonders with Computational Fluid Dynamics (CFD), so they are essential on his design team. Go figure. Later that day I meet this guy from one of the software giants vying for dominance of the Web, and he tells me “I need to hire some good Mechanical Engineers”. I was ready now, so I said “I get it, ME’s are great programmers.” Maybe they are –he said, but rather I need their expertise in HVAC and thermal management for the design and operation of our huge server farms that hold the content of the Web. I’ve got to go and re-think my definition of the disciplines –I thought.

Our graduates are so successful in the marketplace because the basic engineering science and liberal studies skills they have upon graduation afford them the flexibility to do anything in the realm of the broadly defined disciplines, AE and ME. The curriculum emphasizes “engineering science;” with “engineering practice” acquired through capstone design, internships, co-op and on-the-job training. Not just the curriculum, but the whole learning experience is by enlarge dominated by the research “themes” that the faculty pursue. In a way, student’s learning experience is largely defined by **Who** (the faculty are) rather than **What** (the curriculum say they must teach). Modern engineering students do undergraduate research, do competition-style student projects, are leaders of student organizations, and much more. There is so much that takes place outside the confines of the well-crafted syllabi that one cannot define the educational programs just by the curriculum. And luckily so, because the qualities most sought after by recruiters are the so-called extra curricular activities.

If the **Who** is so important, it bemoans us to think about how we decide **Who** to hire. We have hired ten new faculty in the last five years, for a total of 27 tenure/tenure-track in the department. We look for brilliant, accomplished people, who have the social skills to



Ever J. Barbero

be good citizens of the department. That’s it. If you wish more specificity, I’d say we look for expertise in broad areas of basic engineering science, say thermal sciences, and experience in any, a priori undetermined area of technology that would not replicate but be synergistic with existing strengths in the department. We also look for people that have the potential to connect with students and be good teachers and mentors, in and out of the classroom. In this way, the faculty in the department constitute a dynamic system whose interests and expertise closely follow those of society as guided by the research needs of the nation.

Our hiring philosophy is very demanding in terms of time and effort on the part of our search committees, who continue to do a marvelous job. It is also very demanding in terms of start-up packages; that is money that new faculty need to set up their labs and become competitive in research right away. It is in this regard that we could use the help of alumni and corporations interested in helping us continue our quest.

# NEW FACULTY MEMBER

## EDWARD M. SABOLSKY



Dr. Edward M. Sabolsky joined West Virginia University (WVU) as an Assistant Professor in August 2008. Before joining WVU, Dr. Sabolsky was a Senior Research Scientist within the Fine Ceramics and Igniter R&D Group within the Saint-Gobain High-Performance R&D Center. In 2001, he joined NexTech Materials, Ltd. (NexTech) as a research scientist. He assumed the

position of Fuel Cell Group Leader at NexTech in 2006, where he managed the solid oxide fuel cell (SOFC) research group. He has been married to Katarzyna (also a materials scientist) since 2004. They have two daughters, Zofia and Natalia.

Dr. Sabolsky's research has focused on the development of piezoelectric/dielectric materials, chemical sensors, reforming catalyst, solid oxide fuel cells (SOFCs), and ceramic separation membranes. This research included the synthesis of complex oxide ceramic powders and nanopowders, fabrication of novel ceramic monolithic structures, and manipulation of grain structure (and grain orientation) to improve performance. His work in ceramic processing and microstructural design has demonstrated novel piezoelectric ceramics, catalytic electrodes, and microstructural architectures for electrolytic cells with enhanced efficiencies. He will continue his work at WVU on advanced ceramic processing and materials for energy-related applications.

Dr. Sabolsky has authored more than twenty papers in technical literature, and has received two patents. He has given more than twenty-five domestic and international presentations on his work. Dr. Sabolsky is an active member of the American Ceramic Society, The Electrochemical Society, and the Materials Research Society, and a literature reviewer for the Journal of the American Ceramics Society, Journal of Electroceramics, Materials Letters, and the Journal of Materials Science.

### *EDUCATION*

- Ph.D. (2001), Pennsylvania State University, USA
- B.S. (1996), The Ohio State University, USA

### *SELECTED PUBLICATIONS*

- E.M. Sabolsky, M.M. Seabaugh, S. Ibanez, K. Sabolsky, and Z. Zhong, "SOFC Cells and Stacks for Complex Fuels", 10<sup>th</sup> International Symposium on Solid Oxide Fuel Cells (SOFC X) Proceedings, April 3-8, 2007, Nara, Japan.
- E.M. Sabolsky, M.M. Seabaugh, L. Maldonado, W. Collins, and S.L. Swartz, "Doped-CeO<sub>2</sub> Thin-Film Ceramic Membranes for Small-Scale Oxygen Generation Systems", AICHE 2005 Conference Proceedings, April 11-14, 2005, Atlanta, GA.
- G.L. Messing, S. Trolier-McKinstry, E.M. Sabolsky, et al., "Templated Grain Growth of Textured Piezoelectric Ceramics," Crit. Rev. Solid State, 29 [2] 45-96 (2004).
- E.M. Sabolsky, S. Trolier-McKinstry, and G.L. Messing, "Dielectric and Piezoelectric Properties of <001>-Textured 0.65 Pb(Mg<sub>1/3</sub>Nb<sub>2/3</sub>)O<sub>3</sub>-0.35PbTiO<sub>3</sub> Ceramics," J. Appl. Phys., 93 [7] 4072-4080 (2003).

### *WORK EXPERIENCE*

- Senior Research Scientist (2007-2008), Saint-Gobain High-Performance Materials R&D Center, Northboro, MA
- Fuel Cell Group Leader (2006-2007), NexTech Materials, Ltd., Lewis Center, OH
- Research Scientist (2001-2006), NexTech Materials, Ltd., Lewis Center, OH

### *SELECTED FUNDED RESEARCH PROJECTS*

- Sulfur-Tolerant Solid Oxide Fuel Cell (SOFC) Anodes, Office of the Secretary of Defense
- Ceramic Oxygen Generator for Carbon Dioxide Electrolysis Systems, NASA
- Low Cost Materials, Designs, and Manufacturing Processes for Robust Tubular Solid Oxide Fuel Cells (SOFC), TACOM-Army
- High Performance Lead-Free Piezoelectric Ceramics, National Science Foundation

# NEW FACULTY MEMBER

## XUEYAN SONG



Dr. Xueyan Song joined West Virginia University as an Assistant Professor in August 2008. Xueyan did her Ph.D. thesis work in the Beijing Laboratory of Electron Microscopy, Chinese Academy of Science. Before joining WVU, Xueyan was working at the University of Wisconsin-Madison for 8 years, first as a Research Associate and then as a Research Scientist.

Xueyan's expertise lies in the field of materials science and transmission electron microscopy. With a productive research record and over 15 years of hands-on experience on state-of-the-art electron microscopy, Xueyan is an unusually skilled microscopist with a deep commitment to conducting comprehensive and in-depth analysis on the materials atomic structure, chemistry using TEM, HREM, STEM and EELS. Her research field spans structural alloys, functional compounds such as hydrogen storage materials, high performance ceramic superconductors and compounds semiconductors. Her high quality research works in the forefront research fields also led to publications in the most prestigious journals including *Nature*, *Nature Materials*, *Physical Review* and *Applied Physics Letters*. Some of those works were really demanding and her strong citation record reflected this. In the field of superconductivity for the 14 papers that she first-authored and co-authored at University of Wisconsin-Madison, Xueyan has over 600 citations since the year 2001.

Xueyan and her husband, Dr. Yun Chen, also a West Virginia University employee, have an adorable baby, Tony, who was born in January 2008 in Madison, WI. Xueyan, Yun and their son, Tony are enjoying their new life and work in Morgantown.

### EDUCATION

- Ph.D., Materials Science and Engineering, Zhejiang University, 1998.
- M.S., Materials Science and Engineering, Yanshan University, 1995.
- B.S., Materials Science and Engineering, Yanshan University, 1992.

### WORK EXPERIENCE

- 2006-2008: Research Scientist, Department of Materials Science and Engineering, University of Wisconsin-Madison.
- 2003-2006: Research Scientist, Applied Superconductivity Center, University of Wisconsin-Madison.
- 2000-2003: Research Associate, Applied Superconductivity Center, University of Wisconsin-Madison.
- 1998-2000: Post Doctoral Fellow, Departamento de Engenharia de Materiais, Instituto Superior Tecnico, Lisboa, Portugal

### SELECTED PUBLICATIONS

- Xueyan Song, George Daniels, Matthew Feldmann, Alex Guriech, David Larbalestier, Electromagnetic, atomic structure and chemistry changes induced by Ca-doping of low-angle YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7- $\delta$</sub>  grain boundaries, *Nature Materials*, 4, 470-475 (2005).
- Xueyan Song, Zhijun Chen, Sang Kim, Matthew Feldmann, David Larbalestier, Jodi Reeves, Yiyuan Xie, Venkat Selvamanickam, Evidence for enhanced flux-pinning by small, dense nanoprecipitates in a Sm-doped YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7- $\delta$</sub>  coated conductor, *Applied Physics Letters* 88, 212508 (2006).
- Xueyan Song, (110) facets and dislocation structure of low-angle grain boundaries in YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7- $\delta$</sub>  and Y<sub>0.7</sub>Ca<sub>0.3</sub>Ba<sub>2</sub>Cu<sub>3</sub>O<sub>7- $\delta$</sub>  thin film bicrystals, *Journal of Materials Research*, 22, 950-957, 2007.
- Xueyan Song, Valeria Braccini, David C. Larbalestier, Inter- and Intra-granular Nanostructure and Possible Spinodal Decomposition in Low Resistivity Bulk MgB<sub>2</sub> with Varying Critical Fields, *Journal of Materials Research*, 19, No. 8, pp. 2245 – 2255 (2004).

# STUDENT PROJECTS – CHALLENGE X AND EcoCAR

In 2007-2008, the WVU Challenge X Team competed in the final year of the DOE/GM sponsored Challenge X Advanced Collegiate Vehicle Design Competition. The final year of Challenge X included a publicity event and road rally in Los Angeles, California in November of 2007. WVU team members showcased the Challenge X Chevrolet Equinox at multiple venues in Los Angeles and Anaheim, California including a Vehicle Ride and Drive at Peterson Automotive Museum and a Vehicle Display at the Electrical Vehicle Symposium (EVS 23). The final Challenge X competition began at the New Jersey Motor Speedway on May 13, 2008, where the WVU team competed in performance events to evaluate the acceleration, ride and handling, fuel economy, and emissions performance of the WVU diesel-hybrid vehicle. The competing university teams then traveled to New York City to kick off a 400-mile Road Rally along the East Coast stopping in Baltimore for a publicity event at the Maryland Science Center and then continuing to Washington DC. The WVU Challenge X vehicle performed admirably on the Road Rally completing the 400-mile journey without any mechanical problems. Activities in Washington DC included visits by WVU team members to the offices of Senator Rockefeller, Senator Byrd, and Congressman Mollohan. Members of the WVU Team took Congresswoman Shelley Moore Capito on a ride around Capitol Hill in the WVU Hybrid Equinox. The Finish Line Ceremony was held in front of the U.S. Department of Energy on L'Enfant Promenade in Washington DC. WVU finished 12th place in the field of 17 universities in the final year of competition.



WVU Team at New Jersey Motor Speedway, May 13, 2008, from left to right: Daniel Fridley, Dustin Whitt, Paul Rocchini, Scott Watterson, Scott Wayne (faculty advisor), Tyler Winkler, Chris Culp, Patrick Mancini, Howard Mearns

With the conclusion of Challenge X, WVU has embarked on a new project, **EcoCAR: The NeXt Challenge**. With gas prices at an all-time high and vehicle emissions a pressing concern, the need for fuel-efficient and environmentally friendly vehicles is critical. West Virginia University engineering students are doing their part to help design cars of the future as they gear up for the next big collegiate competition in alternative vehicle design.

**EcoCAR: The NeXt Challenge**, sponsored by the U.S. Department of Energy, Argon National Labs and General Motors, is a national three-year collegiate competition. Its purpose is to give students hands-on

experience designing vehicles to be more fuel-efficient, with reduced greenhouse gas emissions, while maintaining performance and reliability.

# STUDENT PROJECTS – CHALLENGE X AND EcoCAR

This past spring, the competition's judges accepted proposals from universities around the nation. Of the 65 proposals received, WVU's was among 17 universities selected to participate, and WVU's proposal was ranked fourth in the nation.

Over the next three years, WVU's EcoCAR team, composed mainly of mechanical and aerospace engineering majors along with students from computer science and electrical engineering, will develop and implement a plan to convert a stock 2009 Saturn Vue crossover sport utility vehicle into an advanced technology hybrid vehicle that is more economical to operate and more environmentally friendly.

In the first year of the competition, students will explore different design options with the use of special software. In the second year, the team will receive a vehicle from GM and begin integrating new parts, testing emissions and fuel-efficiency, and making structural changes. The third and final year will be devoted to making additional improvements, working on appeal and marketability, and getting the vehicle ready for production. Each year, EcoCAR officials will judge the team on its progress and how well it has met its goals for that year.

For more information about **EcoCAR: The NeXt Challenge**, please visit <http://www.ecocarchallenge.org/>.



Individuals accepting EcoCar – from left to right, Dr. Scott Wayne, faculty advisor, Jairo Sandoval, Zhenhua Zhu, Russell Buberniak, Howard Mearns

# STUDENT PROJECTS – DESIGN BUILD FLY

The objective of Design/Build/Fly (DBF) is to gain hands-on experience in designing/building and racing an electric motor powered, small Unmanned Aircraft. The American Institute of Aeronautics and Astronautics (AIAA) organizes an annual Design/Build/Fly race. Every other year the race is held at a Cessna Aircraft field in either Wichita or in Tucson. Room G37-ESB is a fully-equipped laboratory/shop, only available to DBF class students. There they build their aircraft out of materials such as plywood, balsa wood, fiberglass and carbon composites. WVU usually averages in the top quarter of the competition. Participation has grown so that in spring 2008, more than sixty teams competed, with several teams coming from overseas universities.

This DBF class is currently a two semester 400 level class, open to all undergraduate Aerospace or Dual-degree engineering majors. Experienced junior and senior students must share their skills with the lower class students. The design team is subdivided into several task groups. The course emphasizes the use of composite materials, both for their increased performance and their likely application in student's future work.

A major focus this past year was on increasing the use of computer modeling and analysis for both the aircraft design and component performance testing. The DBF class students were each provided with software from Solid-Works. This allowed them to do integrated CAD modeling, finite element analysis, and a basic computational fluid dynamics package. Using this method of design, each team could quickly incorporate changes to optimize their designs. This allowed them to design for minimum weight and fly with more than 50% of takeoff weight in payload! In addition, computer design allowed the WVU team to use Brodak's laser cutting system to rapidly create precisely cut-out components.

Each year the race scoring system changes. The final score is always a composite of a "report score", a "flight score", and an "aircraft cost". AIAA changes the "Flight" and "Cost" scoring criteria every year. This forces the teams to optimize their design to take advantage of the current scoring method. It also makes it unlikely that any previous design would perform well in the current year's competition.

The Class Teaching Assistant (TA) is an integral part of the process and probably learns the most. They assist in the designing and the teaching of new construction methods. They also order supplies, grade student papers and arrange travel and accommodations for those participating in the annual race. Since 2006, Master's degree student Shanti Hamburg has been the class TA. He pushed for a much increased use of computer design and analysis. As a result, in April 2008 the team traveled to Wichita, KS where the WVU entry performed spectacularly; unfortunately, only in the first half of the race — a mid-air mechanical propeller-failure caused the aircraft to crash. Still the WVU team scored #14 out of a field of 60. Professor John Loth has been this AIAA sponsored DBF Race Instructor from the beginning — more than a decade.



# STUDENT PROJECTS – ALTERNATE ENERGY

In the Fall 2007 semester, undergraduate students from both the Mechanical and Aerospace Engineering (MAE) Department and the Lane Computer Science and Electrical Engineering (CSEE) Department combined forces in the Alternative Energy Senior Design Course instructed by Dr. Roy Nutter, Professor in Lane CSEE and Dr. James Smith, Professor in MAE. For this course, students work in teams on a project that involves multiple aspects of engineering, e.g. mechanical design, thermal and electrical systems, electronics, fluid dynamics, computer programming, and project management. The mechanical engineering team consisted of Steven Hard, Geoffrey Newlin, Trenton Smith, Blake Waldie, Neil Buzzard, Matthew DeLiso, Lucas McCulla, Andrew Nawrocki, and Patrick Wildfire and the electrical engineering team consisted of James Barnhart, Jonathan Kung, Matt Bays, Ross McGrady, and Michael Board.

The capstone design experience allows students to identify their own problem areas, to focus on the primary problem, and to formulate a solution. Students break the larger problem into a series of smaller ones, formulate and find solutions to each, and then integrate the results back into an overall solution design. In the capstone design course, students are given design experiences in which they are required to make ethical decisions concerning the importance of the design for society, the issues of risk and liability with regard to the design, societal value, and recognition of the regional and global consequences of engineering decisions.

The capstone senior design course is a designated writing course in which the instructor corrects and requires resubmission of reports several times during the semester. In addition, this course requires team and/or individual presentations to the instructor, classmates, and invited audiences to enhance oral communication skills. The capstone design courses offer the students challenging, real-life opportunities to apply and expand not only their technical abilities, but also their recognition of the dynamics of market requirements or expectations along with the dynamics of typical product development cycles.

This year's course focused on the ongoing effort to provide constant, reliable electricity to citizens in remote, rural communities. A high-inertia, low-speed flywheel was selected as the most feasible storage medium for this application due to its simplicity, ease of maintenance, low cost, and reliability.



MAE Students attend Society of Automotive Engineers (SAE) World Congress  
at Cobo Hall in Detroit, MI, April 2008

# STUDENT PROJECTS – MICROGRAVITY RESEARCH TEAM

This year the West Virginia University Microgravity Research Team (MRT) submitted a proposal to NASA to study both capillary and viscous fingering in microgravity. WVU was one of fifty teams invited to participate out of more than 100 proposal submissions to the NASA Reduced Gravity Student Flight Opportunities Program (RGSFOP) from across the country. This was the eighth year of the program at WVU and the seventh WVU team to fly an experiment in microgravity.

This year's team was divided into two groups, the Flyers that consisted of WVU undergraduate students — Emily Calandrelli, Greg Duckett, Charles Andrew Harner, and Corey Snyder, while Gavin Hall, Jesse Phillips, Eileen Reiff, and Alan Talbott served as members of the Ground Crew.

The team's goal was to design an experimental apparatus, which would be capable of studying the phenomenon known as fingering in a narrow, two-dimensional flow channel known as a Hele-Shaw cell. This phenomenon is an instability that often occurs at the interface between two dissimilar fluids, and has important applications in fields such as maximizing oil recovery from nearly depleted oil fields.

Six MRT7 team members traveled to Houston for ten days at NASA's Johnson Space Center (JSC), where the team was able to test their experiment aboard NASA's C-9 "Weightless Wonder" research aircraft, which is capable of producing weightless periods in 25 second durations. After returning to Morgantown, the team analyzed their data that was taken during the flight. The students then submitted their findings to the NASA RGSFOP, in a final report, that also documented their outreach activities including presentations at meetings and to local area school groups.

During their spare time in Houston, team members were hosted by several WVU alumni who work at NASA, on tours of NASA JSC facilities including the Space Shuttle and ISS mission control centers, and the Neutral Buoyancy Laboratory "NBL" where astronauts train for future space missions. They also attended a Houston Dynamo soccer game, tailgating prior to the game and meeting Dynamo President/General Manager and former Mountaineer quarterback, Oliver Luck.

The WVU Mechanical and Aerospace Engineering Department and the NASA West Virginia Space Grant Consortium support the WVU Microgravity Research Team program. The project advisors are professors Dr. John Kuhlman and Dr. Donald Gray.



Flying in the "Weightless Wonder" are WVU team members Corey Snyder and Emily Calandrelli

For more information, please visit the project website: <http://www2.cemr.wvu.edu/~wwwzerog/>

# STUDENT PROJECTS – BALLOON SATELLITES

This year was the sixth year that the “Balloon Satellites” course has been offered at West Virginia University. Using a helium-filled weather balloon each year students design, build, launch, track, and recover small electronics payloads. The payloads rise into the stratosphere when launched and are tracked and recovered via GPS. Course instructors set weight, size, and cost constraints which impact the design of the instrumentation packages. In Spring 2008, five missions were successfully completed during the flight, including: a test of a cut-down system, a Geiger-Muller tube, air temperature and pressure measurement versus altitude, in-air video and still photography, gyroscopic stabilization of a payload, accelerometer data, pressure and temperature data from inside the balloon, and live in-air video feed to ground.

The course is taught by professors Dr. John Kuhlman and Dr. Mike Palmer, and is open to any student with at least a sophomore standing. The funding for the course has been provided by the WVU MAE Department, with some additional funding from the NASA West Virginia Space Grant Consortium.

For this academic year, the course was offered as two separate courses: a beginning 1-credit course consisting of relatively simple projects that were specified by the course instructors (e.g., the video or still photography, and pressure or temperature data), and a second follow-on, 2-credit course where student teams each proposed their own mission and hardware (e.g., the gyroscopic stabilization, accelerometer data, and in-air video feed). This will allow the students to combine the two projects into a three credit hour approved technical elective.

For more information, please visit the course website: <http://www2.cemr.wvu.edu/~satellite.balloon/>



At moment of launch

On the ground



At maximum altitude

# STUDENT PROJECTS – PROJECTS WITH INDUSTRY

The Projects With Industry was very active and helped West Virginia industry to be more energy efficient and productive by the work done by the student teams. Student teams went to Armstrong Flooring in Elkins, Wheeling Corrugated Steel in Wellsburg, Pratt & Whitney in Bridgeport, Crown Industries in Weirton, and Davis Lynch Glass Company in Morgantown. This program is supported by a grant from the West Virginia Division of Energy.

The project at Pratt & Whitney involved the design of a robotic machine to sandblast turbine blades for jet engines in a sealed chamber. Students, Hussein Ammar, Mark Frasier, and James McCormick, were involved in this project. Armstrong Flooring in Elkins is one of the world's largest manufacturers of hardwood flooring. The student team worked on solving humidity problems in the plant that was affecting the quality of the flooring. The team consisted of Scott Jones, David Hartley, Derrick Morgan, and Kevin Shields. Wheeling Corrugated Steel in Wellsburg had an older existing boiler plant which was oversized and in need of efficiency improvements. The student team of Josh Childers, Lance Meeker, Jeff Testerman, and Heather Tomayko designed a new boiler system for the plant. Crown Industries in Weirton makes lids for the food industry. They had the student team of Sean Cross, Kevin Doyle, Tom Davidson, Melissa Hitt, Melanie McBride, and Pat Osborne looking at energy efficiency projects. The projects involved heat transfer from furnaces, plant make-up air imbalances, and compressed air efficiency. Professor Ken Means directed the projects.

The Davis Lynch Glass Company projects were directed by Dr. Larry Banta under a grant from the West Virginia Division of Energy to aid the glass industries in the state. Dr. Banta had two student teams working on energy efficiency projects for the company. Kelly Eustice, Josh Barthlow worked on the design of an economizer system and Drew Willard, Andrew Taylor, and Phil Evans performed optimization studies for the glass furnaces.



The student team at Crown Industries inspects a plant operation.



Student team at Wheeling Corrugated after their final presentation to plant and state energy officials.

# STUDENT PROJECTS – BAJA VEHICLE DESIGN

This year there were two Baja Teams in the MAE senior capstone design course. Both teams were very motivated and worked well above the normal level that could be expected out of a three hour class. They spent many long hours designing and building the cars in the MAE Baja shop.

The first team built an amphibious vehicle that went to Cookville, Tennessee in mid April and finished 8<sup>th</sup> place overall out of 70 entries. The vehicle proved to be an outstanding performer in all the events, and finished first in the power pull event. The Gold Team members were Mike Campbell, Derek Duer, Emily Engel, Ricky Forquer, Justin Friend, Juan Gomez, Brian Graham, Eric Hilty, Paulina Hojos, Pat Knight, Adam Miller, and Tyrell Opel. The car was one of the lightest cars ever built by WVU and was very fast and maneuverable. The photo below shows the car during the endurance race with Ricky Forquer driving.

The second Baja car built went to Peoria, Illinois at the Caterpillar Test Track and Research Center. It too was a very light and maneuverable car that finished 30<sup>th</sup> out of 120 entries from all over the world. Going into the third day of competition it was 9<sup>th</sup> place, but due to some stability problems it did not finish the endurance race and dropped in the standings. The members of this team, called the Blue Team, were Franklin Dailey, Ron Donocoff, Caleb Gill, Robert Jones, Matt Riggleman, and Marissa Schott.



Baja Car in the Endurance Race in Tennessee

The Baja program at WVU is led by Professor Ken Means, with Dr. Tony McKenzie as Technical Advisor, and Josh Sill as a Graduate Student Advisor.

# CENTER FOR BUILDING ENERGY EFFICIENCY

The WV State Energy Plan require the West Virginia Department of Energy to designate two centers of building energy efficiency. One center has been started at West Virginia University in the Mechanical and Aerospace Engineering Department, and the second at the West Virginia University Institute of Technology in Montgomery, WV. The two energy centers will serve the state, with the MAE Department Center responsible for the northern half of the counties in the state. The director of the Building Energy Efficiency Center in the MAE Department is Dr. Ken Means, P.E. assisted by Melissa Morris, MSME. The primary charge of the center is to work with the county school systems to improve the energy efficiency of the school systems. In addition, the center will examine other public buildings to aid in reducing energy bills.

The first county involved was Brooke County in the northern panhandle of the state. As a first step, each school in the county is benchmarked to determine their current energy usage using US Department of Energy software called Portfolio Manager. Then, the two highest energy-using schools are studied using a team of senior mechanical engineering students. In Brooke County last spring, the student team comprised of Jennifer Davis, Shiloh Kestel, Richard Pass, and Brenton Wilburn studied the replacement of old leaky windows in two Brooke County elementary schools. They found that the energy savings of the new windows could pay for themselves in 8-9 years.

In the fall of 2007, the building studied was an old high school in Tyler County that has been turned into a museum. The building built in the early 1900's has very high gas bills that threaten its ability to operate and stay open. A student team of Leslie Davis, Brian Michael, and Melissa Hitt determined several energy-saving options for the old building and its antiquated heating system.

Projects currently underway include Hardy, Hampshire, and Monongalia County school systems.



The WVU Team with the Brooke County Board of Education Official.

# INDUSTRIAL OUTREACH TO MEXICO

The MAE Department has developed the tradition of addressing the “Global Competencies” of engineering graduates and the record is there to prove it. For the last 12 years, MAE has conducted a study abroad program in Mexico, in which junior and senior students team up with Mexican students of similar disciplines to conduct applied engineering work on site, on location in local industry, in a bilingual and bicultural environment. A full cultural immersion in a professional setting abroad provides students with an intense opportunity to apply engineering knowledge and at the same time develop interpersonal skills needed to “get the job well done” while learning about a different culture and social landscape.

A network of industries established in Queretaro, Mexico such as General Electric Aircraft Engines, Case-New Holland, Arvin Meritor, Dana Corporation, MABE Appliances and ConduMex among others provide the framework for meaningful projects that are conducted under the watchful eye of Prof. Victor Mucino and engineering liaisons from each company. Worthy of notice this year is the involvement of WVU students in the “Engineers Without Borders” project on greenhouse technology, which is aimed at helping rural communities develop small production units to support local families.

Queretaro, is a beautiful colonial city in the main industrial corridor between Mexico City and the border with the USA. It is also the site of several national research centers and major Universities; namely, University of Queretaro (UAQ), Monterrey Tech (IESTM), Mexico’s National University (UNAM), Technological Institute of Queretaro (ITQ) and Polytechnic University of Queretaro (UPQ). All these institutions have participated in our program in the past 12 years under the coordination our host, Queretaro’s Council for Science and Technology.

Students find themselves immersed in realistic situations calling for engineering and interpersonal skills in the context of practical industrial applications. Students work with engineers from different backgrounds and disciplines but with common professional interests. At the end, students are required to give a professional presentation in Spanish (Mexican students are required to make their part of the presentation in English) and submit a written report developed by the team.



Engineers without Borders on Greenhouse site

“Global Competencies” in the context of engineering exercises are at the core of this program. Students gain experience, which adds value to their competitiveness in the profession, while gaining better understanding of the impact of engineering profession in a societal international context.

# FACULTY AWARDS

## MAE Faculty Awards

### MAE Academy of Distinguished Alumni Award

**Jacky Prucz** received the 17th Annual Academy of Distinguished Alumni Teaching Award in 2008 for his dedication to undergraduate teaching. The MAE Department is lucky to have an outstanding roster of distinguished alumni in its Academy of Mechanical Engineering and Mechanics and in its Academy of Aerospace Engineering. The two academies jointly sponsor a teaching award to recognize the most notable teachers. The Promotion and Tenure Committee of the Department nominates a candidate every year.

### George W. Weaver Award

**Darran Cairns** was awarded the 2008 George Weaver Award in recognition of his excellent teaching of courses in engineering mechanics. Engineering mechanics includes the subjects of statics, dynamics and mechanics of materials, which are covered in three courses that form the foundation of several engineering disciplines.

## CEMR Faculty Awards

### Outstanding Researchers Award

**Nigel Clark, Xingbo Liu and Marcello Napolitano** received the Outstanding Researchers Award for 2007-2008. The recipients are chosen by a committee of their peers based on their research activities and their mentoring of graduate students for this year as well as the continuity of quality research over a several-year period.



Academy of Distinguished Alumni for 2008 from left to right Eric Loth, Douglas C. Cook, Donald J. Bennett, Robert J. Pokorski, Ever J. Barbero (Dept. Chairman), Lawrence C. Hays, and Steve Lewellen

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We have made every effort to make this list complete and accurate, but please let us know if you spot an error, so that we may correct it.



ASME presentation of Pumpkin Drop check to the Ronald McDonald House, from left to right, Eric Legg, Kim George (Executive Director of Ronald McDonald House), Robert Parsons and Jeff Byerly.

# Featured Research Program:

As one of the most reliable power production devices, internal combustion engines are widely used to power on-road and off-road vehicles. In the last three decades, research activities associated with internal combustion (I.C.) engines have been focused on significantly reducing exhaust emissions of unburned hydrocarbon (UHC), carbon monoxide (CO), oxides of nitrogen (NO<sub>x</sub>) and particulate matter (PM). Benefitting from the development of innovative fuel injection systems, electrical control units (ECU) and complex aftertreatment systems, the exhaust emissions of these pollutants have been reduced by more than 95% for present day automobiles and engines. However, no noticeable improvement has been made on fuel economy. The benefit of innovative I.C. engine technologies has been utilized to satisfy the unique requirements of the aftertreatment system, adding luxury features, improving the performance and drivability, and making the passenger more comfortable.

WVU's Center for Alternative Fuels, Engines and Emissions (CAFEE) is recognized nationally as a research group with extensive experience in characterizing and reducing the exhaust emissions of heavy-duty on-road vehicles. CAFEE has successfully completed a wide range of programs aimed at measuring emissions from off-road engines. With the increasing concerns over global warming, the ever-increasing oil price and energy security, CAFEE faculty have anticipated new research opportunities and have extended their research into exploring the technologies, strategies and policies capable of reducing both fuel consumption and greenhouse gas (GHG) emissions of transportation vehicles. As an example, CAFEE researchers are examining numerous technologies such as hybrid vehicle platforms and environmentally friendly fuels such as low sulfur diesel, bio-diesel, compressed natural gas, (CNG) and hydrogen. Listed below are some of the projects conducted by CAFEE in this extended research area:

- With the support of the U.S. Department of Energy (DOE), National Bio-Diesel Board, State of Texas and numerous industry partners, CAFEE is conducting numerous projects evaluating exhaust emissions, fuel economy and GHG emissions of clean alternative fuels such as bio-diesel, ethanol, CNG and hydrogen, which can significantly reduce GHG emissions due to the low fossil carbon contained in these fuels.
- With the support of DOE, CAFEE developed a unique transportable emission laboratory, which has been widely used to measure exhaust emission, fuel consumption, and GHG emissions. This lab travels throughout the United States to evaluate the effects of different technologies on fuel economy and emissions of heavy-duty semi-tractors, transit buses, refuse trucks, construction trucks, delivery trucks, and other vehicles operated on different fuels.
- Supported by industry sponsors, CAFEE is designing and evaluating the performance and emissions benefits of advanced hybrid drive systems, which have been recognized as one of the promising technologies capable of reducing both fuel consumption and GHG emissions when operated on urban roads.
- With the support of Transportation Research Board, CAFEE is developing an interactive model capable of predicting the life cycle cost, fuel consumption, and CO<sub>2</sub> emissions of transit buses using different technologies such as hybrid bus systems and CNG fuels. The modeling results provide guidelines to transit agencies in purchasing buses.
- Funded by the U.S. Department of Transportation (DOT), CAFEE is developing an on-line Integrated Bus Information System (IBIS) that includes a model capable of predicting the fuel consumption and GHG emissions of transit buses operated on different fuels, routes, load, and emission cycles.

# Road toward Green, More Efficient Transportation Vehicles

- Sponsored by industry partners, CAFEE is evaluating technologies for reducing the exhaust emissions of large bore I.C. engines such as locomotive and marine engines and those used to power compressors for natural gas pipelines.
- The U.S. Department of Energy has supported a study on development enabling technologies, such as novel lubricating oil formulations to advance hydrogen-fueled heavy-duty engines, which produce negligible amounts of CO<sub>2</sub>.
- With support from the U.S. Department of Defense (DOD), CAFEE researchers are examining strategies to improve fuel economy on combat and tactical vehicles.



Locomotive Fuel Consumption and Emission Measurement



Onsite Measurement of the Fuel Consumption, Exhaust Emissions, and GHG Emissions

# EDITORIAL AND PROFESSIONAL SERVICE

## Editorial Boards

**Ever Barbero**, International Journal of Aerospace Engineering.

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**Nick Wu**, Associated Editor, "Journal of Energy Storage and Conversion" since 2008.

## Professional Service

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**Ismail Celik**, Member, ASME Honors and Award Committee.

**Ismail Celik**, Member, Nuclear Engineering CFD Best Practice and Guidelines Committee.

**Wade Huebsch**, Member, AIAA Applied Aerodynamics Technical Committee.

**Hailin Li**, Organizer, one session for ASME ICED 2008 Spring Conference and one session for 2008 SAE International Powertrains, Fuels and Lubricants Congress, Shanghai.

**Xingbo Liu**, Secretary, TMS High Temperature Alloys Committee.

**Xingbo Liu**, Advisor, JOM.

**Xingbo Liu**, Member, TMS Energy Committee.

**Xingbo Liu**, Symposium Secretary, 11th International Symposium on Advanced Superalloys – Production and Application.

**Xingbo Liu**, Co-organizer for the following symposiums: Coating for Thermal & Corrosion Resistance Symposium in 31st International Conference & Exposition on Advanced Ceramics & Composites; and Symposium on Materials in Clean Power Systems: Fuel Cells, Hydrogen-, and Carbon- Based Technologies in TMS '2008 Annual Conference.

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# EDITORIAL AND PROFESSIONAL SERVICE

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**James E. Smith**, New SI Engine and Component Design, Session Organizer and Chairman (Two Sessions), 2008 SAE International Congress Exhibition, April 14-18, 2008, Detroit, Michigan.

**James E. Smith**, Member SAE Board of Directors, SAE International, 2005-08, Warrendale, Pennsylvania.

**James E. Smith**, New Engine and Driveline Design, Session Organizer and Chairman (Two Sessions), 2007 SAE Powertrain and Fluid Systems Conference and Exhibition, October 29-31, 2007, Rosemont, Illinois.

**James E. Smith**, New SI Engine and Component Design, Session Co-Organizer (Two Sessions), the 14th Asia Pacific Automotive Engineering Conference (APAC-14), August 5-8, 2007, Hollywood, California.

**James E. Smith**, The 14th Asia Pacific Automotive Engineering Conference (APAC-14), General Conference Chairman, August 5-8, 2007, Hollywood, California.

**James E. Smith**, Member At Large, SAE Technical Standards Board, SAE International, 2006-09, Warrendale, Pennsylvania.

## SAE Fellows

SAE recognizes its most accomplished members with the grade of Fellow, the highest membership grade available.

**Nigel Clark**, Professor and Berry Chair.

**James E. Smith**, Professor and Director of the Center for Industrial Research Applications.

## ASME Fellows

ASME recognizes its most accomplished members with the grade of Fellow, the highest membership grade available. MAE is fortunate to have 5 faculty who have been recognized by ASME for this prestigious honor.

**Richard “Dick” Bajura**, Professor and Director of the National Research Center for Coal and Energy.

**Ever Barbero**, Professor and Chair.

**Ismail Celik**, Professor.

**John Kuhlman**, Professor.

**James E. Smith**, Professor and Director of the Center for Industrial Research Applications.

## SAMPE Fellows

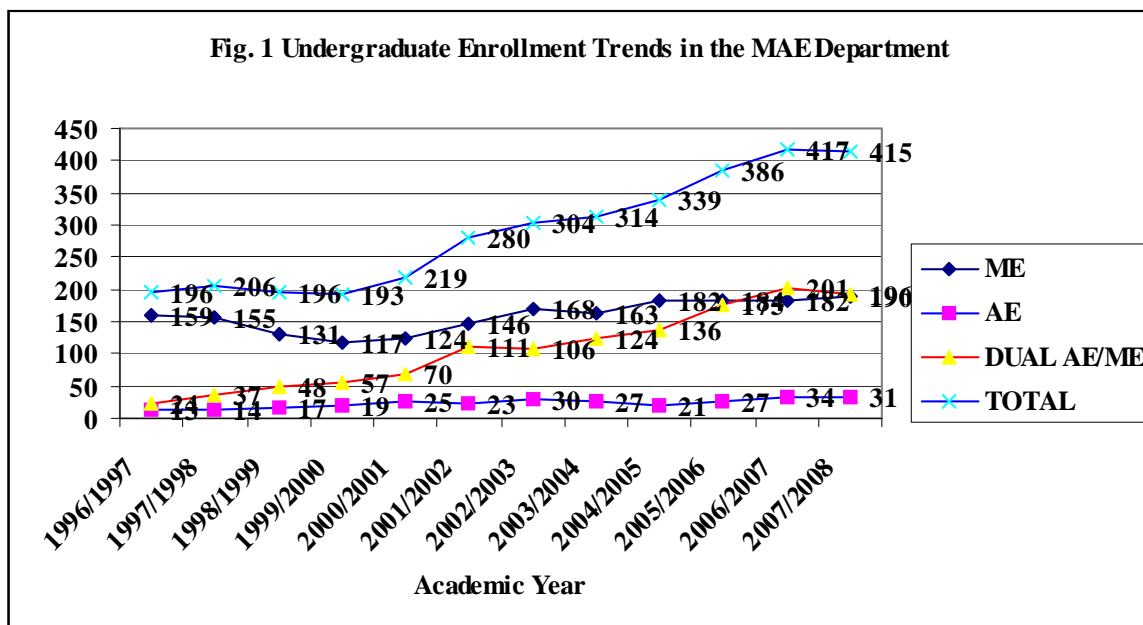
The Society for the Advancement of Material and Process (SAMPE) recognizes its most accomplished members with the grade of Fellow for their distinguished contributions in the fields of materials and process engineering – the technology by which materials are developed or selected and manufacturing processes are chosen that will convert materials into products that meet design, performance, cost effectiveness, and other criteria.

**Ever Barbero**, Professor and Chair.

# UNDERGRADUATE ENROLLMENT AND GRADUATION TRENDS

The undergraduate enrollment in the MAE department has been steadily growing during the 2000-2007 time period, but it has leveled off in the last academic year. This could be the effect of implementing the new requirement of a grade of “C” or better in all Mathematics courses, as part of our continuing efforts to increase the quality of students admitted into our undergraduate programs. While the number of students pursuing the BSAE degree has almost tripled over the last decade and the number of BSME students has increased by about 20%, the number of students enrolled in the dual AE/ME degree program is 8 times higher now than ten years ago, comprising about 47% of the total undergraduate enrollment in the department. Dual majors are not double counted in the data, so the enrollment figures shown represent the actual number of students, currently 415. With 415 undergraduate students, the MAE department has the largest enrollment in CEMR, (18.5% of the number of students pursuing B.S. degrees in engineering at WVU) and is the only department in CEMR whose undergraduate enrollment has increased consistently over the last decade.

The number of B.S. degrees awarded by our department has reached an all-time high of 162 in the last academic year or 38% of the total number of B.S. degrees awarded by CEMR in the 2007-2008 academic year. The steady growth in MAE undergraduate enrollment and graduation rates has occurred because of the excellent reputation enjoyed by our department, our pro-active recruiting efforts and because of the excellent value provided by WVU for both WV resident- and non-resident students alike. Although the demand for engineering graduates in general and mechanical and aerospace engineers in particular is expected to grow in the near future, we do not project continuing increases in our undergraduate enrollment since the department has reached its teaching capacity with 27 faculty members and has decided to enhance the selectivity, rather than the number, of students admitted into our undergraduate programs.

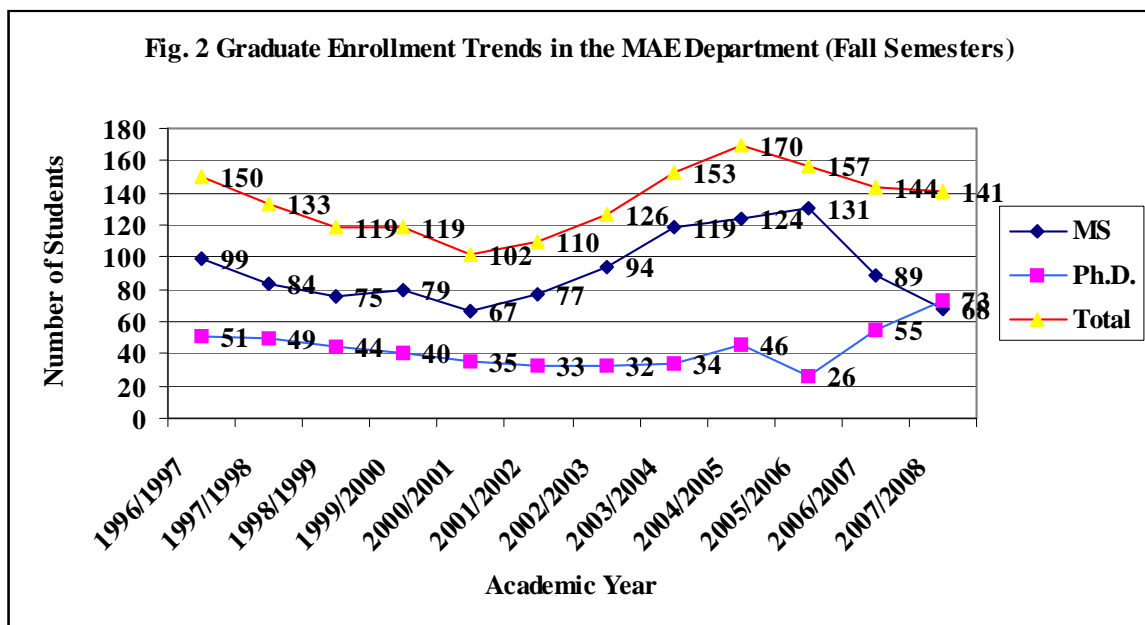


# GRADUATE ENROLLMENT AND GRADUATION TRENDS

The number of applications received over the last five years for admission into the MAE graduate programs has declined, most likely because of the strong employment market for graduating engineers. Despite this trend, the department continues to maintain a viable graduate program whose quality is consistently rising through a pro-active, multi-faceted recruiting strategy of highly qualified applicants. Over 90% of our graduate students are supported financially by the department through either research or teaching assistantships. We have met and even exceeded our goal of reaching a ratio of 1:1 between the numbers of M.S. and Ph.D. students enrolled in the department. The graduate enrollment trends during the last decade are displayed in Fig. 2. Although the total graduate enrollment declined in the last four years by about 17% from the all-time high of 170 students in the 2004/2005 academic year, the Ph.D. enrollment grew by nearly 60% over the same time period, exceeding today the number of M.S. students and reaching 37% of the total number of students pursuing Ph.D. degrees in the College of Engineering and Mineral Resources (CEMR).

The percentage of students who decide to join our graduate programs, out of the total number of students admitted, has been consistently rising over the last five years, from 51% in 2003/2004 to 82% in 2007/2008 at the M.S. level, and from 23% in 2003/2004 to 81% in 2007/2008 at the Ph.D. level. This trend is a result of our pro-active recruiting of high quality students, the strong reputation of our graduate programs and the excellent research and financial opportunities that our department has to offer to prospective graduate students.

In the 2007-2008 academic year, the department awarded 21 M.S. degrees and 7 Ph.D. degrees, a decline of 51% and 42%, respectively, from the previous year, which could be attributed to both the high workload of the MAE faculty who advise graduate students and the inherent uncertainties associated with research projects, either of technical or financial nature. In the coming years, the department is expected to award a significantly higher number of graduate degrees, especially at the Ph.D. level, because of our growing number of Ph.D. students and tenure-track faculty, as well as the growing number of research dollars.



# GRADUATES 2007-2008

## **Bachelor of Science in Aerospace Engineering**

Hussein Hany Ammar  
Chad Michael Amodio  
Joshua Robert Barnett  
Joshua Michael Barthlow  
Patrick Lewis Betoney  
Nicholas Charles Blackman  
Scott David Boas  
Jason Adam Burton  
Caleb Ray Crosby  
Thomas James Davidson, Jr.  
Leslie Marie Davis  
Joseph Andrew Dubusky  
Candice Kay Elliott  
Christopher Nigel Kalani Gee  
Adam Joseph Gibson  
Caleb Joseph Gill  
Jason Nicholas Gross  
Curtis Edward Groves  
Dominic Chad Guerra  
Thomas Arthur Harris  
Shawn Bradley Hefner  
Amy Leigh Hill  
Melissa Lynn Hitt  
Bradley Lee Humbert  
Matthew Bryan Johnson  
Shiloh David Kestel  
Joshua Alan Lantz  
Melanie Dawn McBride  
Lance James Meeker  
Emily Jane Meissner  
Brian Lee Michael  
Sean Michael Moran  
Richard Michael Mulcahy, II  
Steven Richard Mullins  
Kelby Rhett Napolillo  
Zachary Galen Napolillo  
Geoffrey James Newlin  
Kerri Beth Phillips  
Daniel Jake Schulman  
Kristin Michelle Smaltz  
John-Michael Patrick Storton  
Joseph T Strogan

Jeffrey Allen Testerman, Jr.  
Heather Lynn Tomayko  
Blake Woods Waldie

## **Bachelor of Science In Mechanical Engineering**

Daniel William Abbate  
Hussein Hany Ammar  
Kyle Almon Bancroft  
Joshua Robert Barnett  
Joshua Michael Barthlow  
Patrick Lewis Betoney  
Nicholas Charles Blackman  
Scott David Boas  
Colin Scott Boyd  
Frank Stephen Bryan  
Jason Adam Burton  
Neil Andrew Buzzard  
Philip Parshall Casteel  
Brian Lloyd Christopher  
Caleb Ray Crosby  
Kenneth Ray Cummings, Jr.  
Franklin Edward Dailey  
Joshuah Warren Dalton  
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Jennifer N Davis  
Leslie Marie Davis  
Gregory Vincent Dechaine  
Kevin Alan Doyle  
Joseph Andrew Dubusky  
Christopher Thomas Duckworth  
Trampas Jay Efaw  
Candice Kay Elliott  
Emily Lynn Engel  
Shawn L Fike  
Thomas Allen Fish, III  
Eric Guy Fizer  
Mark Richard Fraysier  
Nathan Edward Fuhrman  
Christopher Nigel Kalani Gee  
Adam Joseph Gibson  
Caleb Joseph Gill  
Nicholas Charles Gipson  
Brian Patrick Graham

Kimberly Anne Griffith  
Jason Nicholas Gross  
Curtis Edward Groves  
Jeffrey Scott Halfhill  
Brian Joseph Hannan  
Thomas Arthur Harris  
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Amy Leigh Hill  
Melissa Lynn Hitt  
Bradley Lee Humbert  
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Patrick Wayne Knight  
Paul V. Konrad  
Jeffrey Steven Kubichan  
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Joshua Alan Lantz  
Daniel J Ledebor  
Chet-Mun Liew  
Joseph Thomas Lutz  
Melanie Dawn McBride  
Kevin P. McCrea  
Lucas Wayne McCulla  
Steven Anthony Martin  
Lance James Meeker  
Emily Jane Meissner  
Brian Lee Michael  
Adam Jarrod Miller  
Sean Michael Moran  
Derrick Ramsey Morgan  
Geffrey Dun Moy  
Richard Michael Mulcahy, II  
Kelby Rhett Napolillo  
Andrew James Nawrocki  
Geoffrey James Newlin  
Seth Kaleb Osbourn  
Ryan Poe Oster

# GRADUATES 2007-2008

Harshesh Dinubhai Patel  
Steve G. Patrelakis  
Kerri Beth Phillips  
Ryan Douglas Quinlin  
Matthew Allen Riggelman  
Matthew William Robison  
Clinton Ross Rogers  
Colin Andrew Rojak  
Daniel Jake Schulman  
Balaji Boyce Seward  
Joshua Wade Sheets  
Kevin Thomas Shields  
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Joshua Michael Vecellio  
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David Andrew Walton  
Brandon Lee Ward  
Gregory Scott Watterson  
Brenton Kyle Wilburn  
Patrick Ethan Wildfire  
Robert Lee Wilson, II  
Tyler James Winkler  
Jackson William Wolfe  
Amr Fayez Younes  
Mohammed Zaifullah  
Seiar Ahmad Zia  
William Peter Zivich

## Master of Science in Aerospace Engineering

Joshua Patrick Effland  
John Eric Harman  
Justin Lee Smith



Dr. Ever J. Barbero congratulates Aaron Kessman and Kerri Phillips on receiving the Swiger Graduate Fellowship awarded to students beginning their doctoral study or those in their first year of doctoral study.



## Master of Science

### Mechanical Engineering

Robin Wendell Ames  
Micah A. Arter  
Michael Andrew Fasouletos  
Joshua Wayne Flaugher  
Christopher Douglas Griffin  
Chandima Surangie Jayasinghe  
James Joshua Maybury  
Melissa Lynn Morris  
Abishek Muralidharan  
Rakesh Nandivada  
Matthew Stephen Shafran  
Tyler-Blair Adams Sheppard  
Petr Sindler  
Benjamin Louis Smith  
Arvind Thiruvengadam  
Robert Ray Tincher  
Choo-Siang Jerry Wong  
Victor Choong Yew Chew

## Doctor of Philosophy

Gerald Martin Angle  
Mokhtar Awang  
Richard William Guiler  
Eduardo G. Perez  
Franz Andreas Johannes Pertl  
Alex J. Tsai  
Jing Xu

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Pumpkins Away – 2007 Pumpkin Drop  
– Mylan Park Elementary School  
participant.

## ADVISORY COMMITTEE

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# RESEARCH AWARDS 2007-2008

Argonne National Laboratory, Support for Development of a Heavy-Duty Vehicle Emissions Module for PSAT, Clark, Thompson, Gautam, Wayne, \$72,803

Assoc Liaison Office for University Coop in Development, WVU - UAQ Partnership, Mucino, \$840,933

Augusta Systems, Inc., Sensor Optimization Technology Project, Napolitano, Seanor, \$754,515

Battelle Memorial Institute, Resilient Tunnel System, Huebsch, \$71,608

Battelle Memorial Institute, Resilient Tunnel System – Flood Containment Plug, Banta, Barbero, Means, \$203,680

Boeing Company, Sensitivity on the Evolution of Contrails Behind Aircraft, Huebsch, Lewellen, S., Lewellen D., \$462,867

BP America, Inc., Biodiesel Blend Emissions Effects, Wayne, Gautam, Thompson, Krishnamurthy, Lyons, Clark, \$45,597

Calstart, Inc., Development of a Yard Hostler Activity Cycle, Clark, Lyons, Thompson, Gautam, Wayne, \$46,644

Carnegie Mellon University, Simulation Tools for Solid Oxide Fuel Cell Stacks, Celik, and \$96,003

Coordinating Research Council, Inc., Sixteen Hour Cycle Development, Clark, \$12,834

Ctr Rotorcraft Innovation Inc, Aerodynamic Flow Control of Rotor & Tilt-Rotor Surfaces Using Dynamic Roughness, Huebsch, \$75,097

Dinex Exhausts Inc., Verification of Exhaust After Treatment System for Transport Refrigeration Units by the CARB Procedure, Shade, Clark, Gautam, Lyons, Thompson, Wayne, \$196,968

DOE - METC, Molybdenum Phase of Nano-sized Oxide Dispersions, Kang, \$253,796

Eagle Glass Specialties, Inc, Characterization of Laser-Speckle for Nano & Micro Structured Glass Surfaces & Correlation to Surface Topography, Cairns, \$10,000

Emissions Control System, Analysis of Regulated and Unregulated Exhaust Emissions from Oxidation Catalyst Equipped Transit Buses, Gautam, Krishnamurthy, Wayne, Clark, Shade, Lyons, Thompson, \$132,573

Energy Enterprise Solutions LLC, Quick PEP English to Chinese Translation, Liu, \$6,614

Envirofuels- LP, Investigation of Emissions Benefits of Diesel Fuel Additives in Locomotive Applications, Thompson, Gautam, Lyons, Clark, Wayne, \$17,000

ESW America, Inc., Evaluation of an Engine and Vehicle Emissions Testing Facility, Shade, Thompson, Gautam, Clark, Wayne, \$17,370

ESW America, Inc., Verification of ESW America's Particulate Reactor for California ARB Using a Chassis Dynamometer Phase II, Shade, Krishnamurthy, Clark, Gautam, Thompson, Nix, Lyons, Wayne, \$12,000

Europ Tec USA, Inc, Durable Oleo Phobic and Hydroph, Cairns, \$49,552

Federal Transit Admin, Transit Vehicle Exhaust Emissions IV, Lyons, Clark, Gautam, Thompson, Wayne, \$1,352,691

GIT Locomotive Emissions, Haynes Corporation Locomotive Emissions Project, Wayne, Clark, Gautam, Lyons, Thompson, \$12,876

Gregory Industries, Airknife, Loth, \$65,000

Gregory Industries, WVU Airknife Online Trial Proposal, Loth, \$60,000

Grote Ind & Articulated Tech, Flexible Solid State Lighting, Cairns, \$80,000

Haynes Locomotive Emissions, Haynes Corporation Locomotive Emissions Project, Wayne, Clark, Gautam, Thompson, Lyons, \$12,876

Houston Advanced Research Center, an Optimized Diesel-Electric Bus for Reduction of Nox in Texas Revenue Service, Clark, Thompson, Gautam, Shade, Wayne, \$437,020

# RESEARCH AWARDS 2007-2008

- Houston Advanced Research Ctr, Configuration and Characterization of International Hybrid Drive Vocational Trucks, Clark, Thompson, Gautam, Shade, Wayne, \$511,676
- Hypercat DMG, Characteristics and Loading of Diesel Exhaust Filters, Clark, Li, McKain, Thompson, \$56,622
- Imperial Machine & Tool Company, Robotic Vehicles, Gautam, \$99,999
- IMTS, Development of Novel CFD Tools for Bioengineering Applications, Celik, \$79,998
- IMTS, Evolutionary Optimization of Micro Aerial Vehicles, Smirnov, \$59,994
- Innospec Fuel Specialties, Optimization of Additized Diesel Fuels: Innospec, Clark, Gautam, Lyons, Thompson, Shade, Wayne, \$96,091
- Iron Bay Model Company, CIBAI Engine Development, Loth, \$15,000
- Loc US Dept of Transportation, Transit Vehicle Exhaust Emissions Evaluation II, Lyons, Clark, Gautam, Thompson, Wayne, \$2,323,224
- Loc US DOE - Colorado, IMF - Multifunctional Metallic & Refractory Materials, Kang, Liu, Loth, \$2,178,445
- LOC US DOE - Illinois, Transportable Emissions Laboratories, Lyons, Gautam, Clark, Thompson, Wayne, \$4,191,982
- LOC US DOE - METC, Low Temperature Combustion, Clark, Thompson, Lyons, Gautam, Wayne, \$391,565
- M.J. Bradley & Associates, An Independently Controlled Urea-SCR System for Deep Nox Reduction in Marine Applications, Clark, Thompson, Gautam, Lyons, Wayne, \$155,427
- ManTech International Corporation, Nanoscale Catalysts for Ground Vehicle Fuel Economy Enhancement, Gautam, Clark, Shade, Thompson, Carder, Wayne, \$100,000
- Miami-Dade Transit Agency, Characterization of Exhaust Emissions from Palm Oil-Based and Soybean Oil-Based Biodiesel Fueled Heavy-Duty Transit Buses, Gautam, Shade, Carder, Thompson, Clark, Lyons, Wayne, \$150,000
- Montana State University, Sequestration of CO<sub>2</sub> in Appalachian Coal Deposits, Smirnov, \$89,476
- NASA, Design, Simulation, Validation, and Flight Testing of Adaptive Fault Tolerant Flight Control Systems, Napolitano, \$112,646
- NASA, NASA Cooperative Agreement, Woerner, Ammar, Cukic, Goseva-Popstojanova, Menzies, Napolitano, Yang, Mooney, Woerner, \$62,428
- NASA, Wing Morphing as a Primary Flight Control, Huebsch, \$72,000
- NASA Langley Research Ctr, Integrated System for Immunity-Based Failure Detection, Identification, Perhinschi, \$59,829
- National Academy of Sciences, Assessment of Hybrid-Electric Transit Bus Technology, Clark, Thompson, Gautam, Wayne, \$300,000
- National Biodiesel Board, Optimization and TCEQ Evaluation of Biodiesel Blends, Clark, Thompson, Gautam, Lyons, Shade, Wayne, \$171,282
- National Institute for Occupational Safety and Health (NIOSH), Surfactant Collection System for Nano-Oartucykate Exhaust Products from Heavy-Duty Diesel Engines: Development and Performance Testing, Gautam, Carder, \$275,000
- National Science Foundation, Further Analysis of Near-Surface Tornado Intensification, Lewellen, \$334,000
- Norfolk Southern Railway Company, Norfolk Southern CSC-Special Projects VA-2008-01, Clark, Gautam, Nix, Thompson, Wayne, \$200,020
- ORYXE, Affect of Additive Formulation on Heavy-Duty Diesel Engines Emissions, Thompson, Clark, Gautam, Lyons, Shade, Wayne, \$160,158

# RESEARCH AWARDS 2007-2008

ORYXE, Evaluation of an Additized ULS Bio-Diesel Candidate Fuel Following the Official TCEQ Alternative Fuel Formulation Procedure, Thompson, Clark, Gautam, Lyons, Shade, Wayne, \$216,195

ORYXE, Evaluation of an Additized ULS Diesel Candidate Fuel Following the Official TCEQ Alternative Fuel Formulation Procedure, Thompson, Clark, Gautam, Lyons, Shade, Wayne, \$76,067

ORYXE, Evaluation of CARB Reference and Candidate Fuels for Aldehyde Determination, Thompson, Clark, Gautam, Lyons, Wayne, \$38,383

ORYXE, Evaluation of CARB Reference and Candidate Fuels for SOF Determination, Thompson, Clark, Gautam, Lyons, Wayne, \$100,620

ORYXE, Evaluation of CARB Reference and Candidate Fuels for VOC Determination, Thompson, Clark, Gautam, Lyons, Wayne, \$131,685

ORYXE, Evaluation of CARB Reference and Candidate Fuels for VOC, SOF, and PAH Determination, Thompson, Clark, Gautam, Lyons, Wayne, \$84,798

ORYXE, Evaluation of Fuels for a CARB Certification Program, Thompson, Clark, Gautam, Lyons, Shade, Wayne, \$125,235

ORYXE, ORYXE CARB Certification #33 Phase 1, Thompson, Clark, Gautam, Lyons, Shade, Wayne, \$121,670

ORYXE, ORYXE CARB Certification #33 Phase 2, Thompson, Clark, Gautam, Lyons, Shade, Wayne, \$199,359

ORYXE, ORYXE Energy CARB Cost Reduction Certification Program, Thompson, Clark, Gautam, Lyons, Wayne, \$109,404

ORYXE, Selection of a Bio-Derived Diesel Candidate Fuel for a TCEQ Evaluation, Thompson, Clark, Gautam, Lyons, Wayne, \$57,777

ORYXE, Selection of a Bio-Derived Diesel Fuel Blend for the Texas Market, Thompson, Clark, Gautam, Lyons, Wayne, \$81,459

ORYXE, Selection of a CARB Reference and Candidate Fuels, Thompson, Lyons, Gautam, Clark, Wayne, \$77,868

ORYXE, Selection of a Reference Bio-Diesel TCEQ Fuel, Thompson, Gautam, Lyons, Wayne, Clark, \$71,959

ORYXE, Selection of Candidate Diesel Fuels for California and Texas Markets, Thompson, Clark, Gautam, Lyons, Wayne, \$70,157

ORYXE, Study of Fuel Additives for Fuel Economy Improvement, Thompson, Clark, Gautam, Lyons, Wayne, \$67,943

ORYXE, Study of Fuel Additives for Steady State Particulate Matter Reduction, Thompson, Clark, Gautam, Lyons, Wayne, \$57,390

ORYXE, Study of Fuel Properties Impact on SOF Emissions, Thompson, Clark, Gautam, Lyons, Shade, Wayne, \$58,978

ORYXE, Third CARB Investigation for an Additized Diesel Fuel, Thompson, Clark, Gautam, Lyons, Wayne, \$91,909

ORYXE, Verification of Bio-Diesel Additive Formulation on Heavy-Duty Diesel Engines Emissions, Thompson, Clark, Gautam, Lyons, Shade, Wayne, \$55,875

Progress Rail Service, Emissions Analysis of Locomotive Diesel Engine Overhaul Processes, Nix, Clark, Gautam, Lyons, Thompson, Shade, Wayne, \$97,808

Prologic Inc, Expanded Flexibility Network Centric Small Unit Lethality Study, Gautam, \$20,239

Research & Development, Degradation of Metallic Interconnects in Coal Based SOFC, Barbero, Wu, Liu, \$192,105

Research & Development, Developing Novel Coating Solutions, LLC (RDS), Kang, Barbero, Liu, \$206,000

# RESEARCH AWARDS 2007-2008

Research & Development Solutions (RDS) LLC, Defining the Future Needs for Lubricant Formulations for Hydrogen-Fueled Heavy-Duty Engines: Enabling Technology Development, Gautam, Thompson, Clark, Carder, Lyons, Wayne, \$175,350.

Research & Development Solutions (RDS) LLC, Effect of Fuel Properties on Thermo Acoustic Combustion Instabilities in Gas Turbines, Gautam, \$102,213

Research & Development Solutions, (RDS), LLC, Fundamental Transfer Processes in Solid Oxide Fuel Cells-Experiments & Simulation, Wu, \$46,797

Research & Development Solutions (RDS) LLC, Lube Hydrogen, Gautam, Lyons, Thompson, Clark, Carder, Wayne, \$189,274

Research & Development Solutions (RDS), LLC, Assessment of Turbo-Chemistry Models for Prediction of Fuel Composition Effects on GTC Emissions, Celik, \$159,169

Research & Development Solutions (RDS), LLC, Fundamental Transfer Processes in Solid Oxide Fuel Cells-Experiments & Simulation, Celik, \$278,968

Research & Development Solutions (RDS), LLC, In-Situ Electrochemical on Bit-Rock-Fluid Interaction During UDS Experiments, Liu, \$215,000

Research & Development Solutions (RDS), LLC, Prediction of Emissions from Gas Turbine Combustion via LES, Celik, \$170,100

Research and Development Solutions (RDS), LLC, Development of Advanced Controls for Hyper System, Banta, \$129,000

Research and Development Solutions, LLC (RDS), 3D Reconstruction and Image Enhancement for the NETL UDS X-ray Video System, Loth, Kang, \$171,000

Research and Development Solutions, LLC (RDS), Collaboratory for Multiphase Flow Research, Turton, Kang, Johnson, Clarke, Kuhlman, \$1,125,000

Research and Development Solutions, LLC (RDS), Long Term Reliability Investigation on TBC, Chen, Kang, \$146,272

Research Corp., Program to Stimulate Competitive Research FY08, Clark, \$53,819

Research Corp., PSIR FY06, Clark, \$69,000

Research Corporation, PSIR Prior Jul 05-FY07, Gautam, \$882,414

Rypos, Inc., Rypos Filter Evaluation, Shade, Clark, Gautam, Lyons, Wayne, \$168,000

Sierra Instruments, Additional Research on Full and Partial Flow Sampling Systems, Clark, Shade, McKain, Thompson, \$59,266

Sierra Instruments, Co-Operative Program to Compare Full and Partial Flow Sampling Systems, Clark, McKain, Shade, Thompson, \$114,135

South Coast Air Quality Management, Advanced Diesel Emission Control System in Low-Sulfur Diesel H-Duty Engines, Carder, Gautam, Clark, Thompson, Wayne, Lyons, Shade, \$400,076

South Coast Air Quality Management, Characterization of Exhaust Emissions from Natural Gas-Fueled Refuse Haulers, Gautam, Thompson, Clark, Lyons, Carder, Krishnamurthy, Wayne, \$180,000

South Coast Air Quality Management, Characterization of Nox Emissions from Late Model Year Heavy-Duty Vehicles, Gautam, Clark, Thompson, Lyons, Krishnamurthy, Carder, Wayne, \$740,000

South Coast Air Quality Management, Gautam, Thompson, Wayne, Carder, Lyons, Shade, Clark, \$400,076

Transit Resource Center, Analysis of Tailpipe Emissions from Westchester County Transit Buses, Thompson, Gautam, Lyons, Clark, Wayne, \$217,256

United States Postal Service, Characterization of Emissions and Fuel Efficiency of a Diesel-Powered Step Van, Carder, Krishnamurthy, Gautam, Shade, \$16,297

# RESEARCH AWARDS 2007-2008

- United States Postal Service, Characterization of Emissions and Fuel Efficiency of an Azure Dynamics E-450 Hybrid Step Van, Carder, Gautam, Shade, \$16,239
- United States Postal Service, Characterization of Emissions and Fuel Efficiency of an Eton Hybrid 2 Ton Truck, Carder, Clark, Krishnamurthy, Gautam, Thompson, Shade, Wayne, \$29,958
- US Department of Energy, Direct Utilization of Coal Syngas in High Temperature Fuel Cells, Celik, Condlo, Finklea, Smirnov, Ma, Cooper, Wu, Liu, Kang, \$700,000
- US Department of Energy/NETL, Energy Dense, Lightweight, Durable Systems for Storage and Delivery of Hydrogen, Shoukry, Lyons, Prucz, \$983,558
- US Department of the Air Force, Integration of Microwave Plasma Ignition into a Multi-Fuel Engine, Smith, \$399,800
- US Dept. of DHHS/NIOSH, Real Time PM Measurement from Diesel Engines, Gautam, Clark, Lyons, Thompson, Wayne, \$476,664
- US Dept. of Energy, Integrated Control of Next Generation Power System, Chouldry, Lai, Noore, Reynolds, Saymanski, Schoder, Sneckenberger, \$15,895
- US DHHS/CDC/NIOSH, Enclosing Hood Effectiveness, Guffey, \$354,995
- US DHHS/CDC/NIOSH, Experimental & Theoretical Study of Early Detection & Isolation of Influenza, Celik, \$448,948
- US DOT, Federal Transit Administration, Hybrid Bus Emissions and Certification Working Group, Lyons, Clark, Gautam, Thompson, Wayne, \$300,000
- US DOT, Federal Transit Administration, Transit Vehicle Exhaust Emissions Evaluation - Phase V, Thompson, Gautam, Lyons, Clark, Wayne, \$1,349,964
- USDA Forest Service Wood Education and Resource Center, Dev of an Expert System to Assess the Opportunities to Use Wood Residue as a Commercial and Industrial Fuel Source in the Appalachian Region, Wang, Spong, Gray, Grushecky, \$33,759
- UT-Battle, LLC, Measurement of Regulated Emissions and Torque from a 2005 Volvo Tractor, Krishnamurthy, Clark, Carder, Gautam, Thompson, Wayne, \$49,888
- Virginia Polytechnic Institute and State University, Warm Air Drying of Fine Particles (CAST Round III), Kang, Saus, Johnson, \$216,323
- West Virginia Development Office, Industry Energy Efficiency Program, Means, \$150,000
- WV Department of Commerce/WV Division of Energy, WV Save Energy Now, Banta, Means, \$13,881
- WV Department of Highways, Development of Reinforced LMC and MSC for Crack Resistant Bridge Deck Overlays, Shoukry, Riad, Cairns, William, \$240,697
- WV Department of Highways, Long Term Performance on WV Smart Road, Shoukry, \$186,285
- WV Dept of Highways, Bridge Deck Crack Reduction through Uniform Setting and Curing Procedures, Riad, \$192,248
- WV Dept of Highways, Bridge Decks, Shoukry, \$162,007
- WV Dept of Highways, Early Age Cracking - Evansville Bridge, Shoukry, \$186,062
- WV Dept of Highways, Monitoring the Structural Performance and Bridge Deck Crack Growth - Star City, Riad, William, Prucz, Shoukry, \$282,609
- WV Dept of Highways, Shoukry, \$145,808
- WV Development Office, FY 2008 WVDO IOF-WV, Cairns, \$100,000
- WV Development Office, Glass Industry Assistance Project, Banta, \$90,000
- WV Development Office, Industries of the Future WVDO, Banta, \$10,150

# RESEARCH AWARDS 2007-2008

WV Division of Energy, Center for Building Energy Use,  
Wang, Spong, Gray, Means, \$60,000

WV EPSCoR, EMSE, Barbero, \$499,840

WV EPSCoR, EPSCoR, Feng, \$24,319

WV Higher Education Policy Commission WV EPSCoR,  
High Resolution Biomedical Imaging for Clinical  
Diagnosis, Velan, McGraw, Mukdadi, \$20,838

WVU Department of Highways, Effects of SIP Forms  
on the Performance of RC Bridge Decks, Shoukry,  
\$397,856

WVU Department of Highways, Longitudinal Decking  
of Concrete Bridge Decks: Model Calibration, Shoukry,  
\$547,094



Two members of the WVU "Microgravity Research Team - 7", Emily Calandrelli and Corey Snyder, kneeling on the far right, with other students after their microgravity research flight on June 24, 2008 aboard the NASA C-9 "Weightless Wonder".

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<b>Fiscal Year</b>	<b>2003-2004</b>	<b>2004-2005</b>	<b>2005-2006</b>	<b>2006-2007</b>	<b>2007-2008</b>
No. of Faculty	24	24	28	28	27
Research Awards	\$9,126,475	\$6,470,348	\$10,676,884	\$9,013,481	\$9,474,329
Research Expenditures	\$7,901,476	\$8,894,729	\$9,313,003	\$10,032,752	\$9,945,664
Journal Papers (Jan-Dec)	43	33	38	55	53
Undergrad Enrollment	339	386	401	417	415
MS Enrollment	124	104	89	73	68
Ph.D. Enrollment	46	56	55	66	73
Undergraduate Degrees	125	101	127	126	162
MS Degrees	45	29	31	43	22
Ph.D. Degrees	4	6	11	12	7
Undergrad Student Cr. Hrs.	7,983	8,817	10,036	9,900	10,140
Graduate Student Cr. Hrs.	2,722	2,767	2,827	2,315	3,228
Undergrad Course Cr. Hrs.	220	184	277	236	280
Graduate Course Cr. Hrs.	45	54	45	48	45

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