



METRICS

MECHANICAL ENGINEERING

A newsletter for
alumni and friends of
the Department of
Mechanical Engineering

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Robert E. Fischell Named Professor of Practice

In October 2002, Robert E. Fischell was named Professor of Practice in the Department of Mechanical Engineering. The noted engineer, physicist, innovator, philanthropist, and most recent inductee into the A. James Clark School of Engineering's Innovation Hall of Fame has built his career by developing lifesaving medical devices and systems.

A PROLIFIC INVENTOR WITH NEARLY 200 U.S. and international patents in his name, Fischell's work has resulted in a large variety of medical device improvements and new technologies including the first implantable insulin pump, the rechargeable pacemaker, and highly flexible stents for placement in coronary arteries.

Currently, he is developing an implantable medical device that can detect within 60 seconds the occurrence of a heart attack caused by a blood clot. The device will then immediately release medication to dissolve the clot. Called the *Angel Med Guardian*, this device is still in the experimental stage, Fischell says, but he hopes for a commercial release within two years. This newest business venture features Fischell working with his three sons under the company

name of Angel Medical Systems Inc. Fischell also is working with one of his sons on new technology that creates alternating electric currents in the brain to help ease migraine headaches. The third new startup venture for Fischell involves a device that can help eliminate scar tissue and adhesions after abdominal surgery.

While Robert Fischell continues to improve healthcare with new technologies and medical devices, he also will have an impact on developing the next generation of bioengineering and biomedical professionals. Last fall, Fischell donated \$1.25 million to the Clark School of Engineering to establish a fellowship program that gives graduate students the opportunity to create and design new medical devices or systems.

In addition, the University of Maryland recently honored Fischell with its 2001 Major F. Riddick, Jr. Entrepreneurship Award and the 2000 Outstanding Alumnus Award. He was awarded an honorary doctor of science degree from the University during the 1996 commencement proceedings.



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2001-2002 Annual Report
A special insert to this issue of METRICS following page 8



Newsmakers
Advanced Thermal is Incubator of the Year
page 13



A Solar Decathlon Photo Album
From planning to building to the competition on the Mall
page 14



Message From the Chair

AS THIS ISSUE OF *METRICS* will illustrate, the Department of Mechanical Engineering has fully embraced the University's *Zoom* campaign, designed to illustrate the speed at which Maryland has grown into a world-class university. With 46 professional society fellows and six national academy members on our faculty, freshmen who enter our program with an average GPA of 3.96, and graduate students who come to us from around the globe as well as from around the Beltway, Mechanical Engineering is helping to lead the way. *U.S. News and World Report* now ranks Maryland 18th among national public universities, and ranks our graduate engineering program 19th among all doctorate granting engineering schools. *Black Issues in Higher Education* ranked Maryland 3rd in granting engineering doctoral degrees, 3rd in granting engineering masters degrees, and 11th in granting engineering baccalaureate degrees to African Americans. While the numbers only tell part of the story, the accomplishments of our faculty, students, and alumni, highlighted in this issue of *Metrics*, tell the rest of it.

Along with the many accomplishments of our faculty and alumni, it were student achievements that took mainstage this year. We welcomed our first RISE class this summer, with great acclaim.

Prof. Linda Schmidt and her colleagues are to be commended for helping to spearhead such an innovative program for women on our campus. (You can find out more about RISE at www.enme.umd.edu/news/September01/rise.html.) While academics are always our first priority, it was competition that stole some of our attention over the last several months. The Solar Decathlon, sponsored by the Department of Energy, had us Metro-ing downtown to the National Mall to cheer on our team and surfing over to our team's website (www.enme.umd.edu/solartech) to check on the latest scores and rankings among the 14 teams. To help commemorate this huge undertaking we've put together a photo album at the end of this newsletter. However, not to be "outshined" by our solar decathletes, our 2003 FutureTruck team is "gearing up" for their June competition—this year's vehicle is a Ford Explorer—as well as the human-powered submarine team, who are also "diving in" to their project. And, just for fun, we polled our undergraduates to see what they did in their spare time—their responses, listed on page 11, surprised and amazed us with their passionate involvement in their activities. I think you'll agree we have quite unique and diverse mechanical engineering students at Maryland.

Also included in this issue of *Metrics* is our newly designed departmental Annual Report. We hope that you will find that this more compact format highlights the facts and figures of the Department in a more succinct manner than in the past. If you are interested in greater detail, however, please visit our website, www.enme.umd.edu, or email me at abc@umd.edu.

It is with great pleasure that we announce the arrival of Dr. Robert Fischell as Professor of Practice, and Dr. Jaime Cardenas-Garcia as Associate Research Professor. Dr. Fischell, who is profiled in this issue, will bring a wealth of skills and talents to our Department in the area of biomechanics and entrepreneurship. Dr. Cardenas-Garcia, a three-time Maryland alumnus (BSME '71, MSME '75, PhD '83) who comes back to us from Texas Tech University, brings us his expertise in optical methods in experimental solid mechanics and wave propagation.

Sadly, we were all shocked to learn of the sudden death of our colleague Lung-Wen Tsai. I was fortunate to have had the opportunity to meet Dr. Tsai earlier this year, and was impressed by his enormous achievements in the profession, and his warm nature and congeniality. He will be sorely missed by all who knew him.

In Memoriam



Dr. Lung-Wen Tsai, Former Professor

The Department of Mechanical Engineering extends its condolences to the family of former faculty member Dr. Lung-Wen Tsai, who passed away suddenly November 29, 2002. He is survived by his wife, Betty; son, David; and daughter, Julie.

Dr. Tsai joined the University of Maryland's Mechanical Engineering faculty in 1986 and was promoted to full professor in 1990. He conducted research into mechanisms and machine theory, design methodology, and micro electro-mechanical systems, establishing a nationally

recognized research and education program in mechanisms and machine design, automotive engineering, robot manipulators, and walking machines at the University. In 2000 he moved from the University of Maryland to the University of California, Riverside, where he was a professor in their mechanical engineering department. Dr. Tsai was the chief editor of the *ASME Journal of Mechanical Design*, chaired the ASME Mechanisms Committee, held three patents, and was an ASME Fellow. Dr. Tsai had also been elected a fellow of the American Association for the Advancement of Science (AAAS) shortly before his death.

S.K. Gupta Selected to Attend NAE'S Frontiers of Engineering Symposium



Gupta

Associate Professor **Satyandra K. Gupta** was selected among 84 of the nation's top young engineers to participate in the National Academy of Engineering's (NAE) eighth annual Frontiers of Engineering symposium. The three-day event brought together engineers ages 30 to 45 who are performing leading-edge engineering research and technical work. The participants—from industry, academia, and government—were nominated by fellow engineers or organizations and were chosen from a field of nearly 150 applicants.

"Frontiers of Engineering is a unique opportunity for outstanding young engineers from a variety of disciplines to meet one another and discuss cutting-edge topics in the field," said NAE President Wm. A. Wulf. "This symposium brings together talented individuals who represent the future leaders in engineering."

To read more about Frontiers of Engineering, visit the NAE Web site at www.nae.edu/frontiers.

New Fellows



Barker

Professor **Donald B. Barker** has been elected to the grade of Fellow in ASME International, a worldwide engineering society focused on technical, educational and research issues in mechanical engineering.

In a letter from ASME International's President, Susan H. Skemp, describing this honor, she writes:

"ASME International's Constitution describes this esteemed recognition as; 'a Fellow, a membership grade of distinction...' I can assure you that the selection criteria are rigorous. Nominations must document the individual's significant engineering achievements, as well as contributions to the Society and the profession, authoring or contributing to technical publications or reports, and developing patents and inventions. Dr. Barker's recognition truly places him in a distinguished and a very small segment of ASME's membership."

Dr. Barker is also head of the PWB and Modules Laboratory, a member lab of the CALCE Electronic Products & Systems Center. He has published extensively in the general area of experimental

mechanics, fracture, fatigue, dynamic material response, and electronic packaging.



Piomelli

Professor **Ugo Piomelli** has been named a Fellow in the American Physical Society (APS).

In a letter to Dr. Piomelli, Associate Executive Officer Alan Chodos wrote:

"As you may know, election to Fellowship in the American Physical Society is limited to no more than one half of one percent of the membership. Election to APS Fellowship is recognition by your peers of your outstanding contributions to physics.

"The citation, which will appear on your Fellowship Certificate, will read as follows:

"For important and insightful contributions to the development of large eddy simulation techniques and to the understanding of wall-bounded turbulent flows."

Dr. Piomelli also serves the Department as Director of Graduate Studies and Associate Chair.

Sreenivasan Named New Director at ICTP



Sreenivasan

Distinguished University Professor and Glenn L. Martin Professor of Engineering **Katepalli R. Sreenivasan** has been appointed as the new director of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy. The ICTP was founded in 1964 by Abdus Salam with the aim of fostering the growth of science and research in developing countries.

Sreenivasan is an experimentalist and is a professor of mechanical engineering and professor of physics at the University of Maryland, where he also Director of the Institute for Physical Science and Technology. He received his doctorate in aerospace engineering at the Indian Institute of Science in Bangalore and

spent two years as a post-doctoral research fellow in Australia and as a research associate and lecturer at The Johns Hopkins University in Baltimore. He then moved to Yale University, where he was a tenured professor for 22 years and where he served in several different roles, including chair of the department of mechanical engineering and acting chair of the Council of Engineering. He came to Maryland last January.

Sreenivasan has published over 150 papers in the fields of complex fluids, turbulence, combustion, cryogenic helium and nonlinear dynamics, and is a member of the National Academy of Engineering. He will begin his tenure at the ICTP in March 2003.

In Brief



Baz

Professor **Amr Baz** and the Virtual Reality Lab are described in a *Science News* article entitled, "Deep Vision: When Walls Become Doors into Virtual Worlds." In the article, the author describes a demonstration of the Lab's 3D simulation of a torpedo's casing's vibrations as the weapon travels through water. The goal of this Navy-funded work is to find ways to dampen the vibrations and thereby make the weapons stealthier. To read the entire article, go to www.sciencenews.org/20020601/bob8.asp.



Buckley

Assistant Professor **Steven Buckley** has been named Chair of the Environmental Engineering Division of ASME. The division, which has approximately 1400 primary members and over 8000 associate members, has technical divisions working in environmental technology, risk management, and policy. Working with other areas of ASME and other technical societies, the division sponsors or co-sponsors conferences related to radioactive and non-radioactive waste management, environmental technologies, risk assessment, and emerging issues in air pollution, water pollution, and the environment. His term is for one year.



Dasgupta

Professor of Mechanical Engineering **Abhijit Dasgupta** was recently honored by his graduate alma mater, Villanova University. He is the recipient of the Carl Humphrey Memorial Award, which was named after the first engineering Dean at Villanova. This annual award is given by the College of Engineering to an alumnus of their graduate program whom they consider has brought Villanova good visibility through their own career successes. Dr. Dasgupta received his M.S. at Villanova, and then went on to the University of Illinois to receive his Ph.D.



Duncan

Professor **James Duncan** has been named Director of the Science, Technology and Society (STS) Program of College Park Scholars, taking the reins from Professor James Wallace, who was the program's previous director.

The STS Certificate Program offers students an opportunity to expand their understanding of the relationships between science, technology, and society and to augment their general scientific and technological literacy. Similar to a college "minor," the certificate program enables students to focus some of their CORE course requirements and upper-level electives in areas of particular interest outside their chosen major(s).

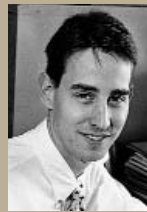
For more information on the STS Program, visit <http://scholars.umd.edu/sts/cps.html>.



Gupta

A brief interview with Associate Professor **Satyandra K. Gupta** was featured in the on-line magazine *Spatial Dimensions*, discussing Dr. Gupta's experience with ACIS over the years, as well as his thoughts on the future trends of CAD/CAM. Dr. Gupta has been using the 3D ACIS Modeler for his research, which deals with developing new algorithms and representations for creating next-generation computer-aided design and manufacturing systems that can reduce time-to-market, enable cost effective small batch manufacturing, and facilitate manufacturing of geometrically complex heterogeneous objects.

To read the article, visit www.spatial.com/news_events/spatial_dimensions/index_html#Gupta.



Herrmann

Associate Professor **Jeffrey Herrmann** has been selected to receive the Society of Manufacturing Engineers' Jiri Tlustý Outstanding Young Manufacturing Engineer Award. This award is being conferred in recognition of his significant achievements and leadership in the field of manufacturing engineering as a young engineer. He is one of twelve recipients selected to receive this award in 2003. Dr. Herrmann will receive this award at one of the Society's major events in May. The award was recently named for Dr. Jiri Tlustý, an SME Fellow and founding member of the North American Manufacturing Research Institute (NAMRI) of SME, who died earlier this year.



Mote

University President and Professor of Mechanical Engineering **C.D. "Dan" Mote, Jr.** was selected as one of the 40 most influential people in the greater Washington, DC area, according to *Washington Business Forward* magazine. For the first time in the four years of running this survey, the "Forward Forty" have been ranked. Dr. Mote was ranked 20th. To see the rankings and read the full article, go to www.bizforward.com/wdc/issues/2002-07/forward40/



Nau

Affiliate Professor of Mechanical Engineering **Dana Nau** received the Best Research Paper Award at the 6th European Conference on Case-Based Reasoning, for "On the Complexity of Plan Adaptation by Derivational Analogy in a Universal Classical Planning Framework." The Conference was held in September 2002 in Aberdeen, Scotland.

Wallace Appointed to U.S. National Committee



Wallace

Professor **James Wallace** has been appointed Member-at-Large of the U.S. National Committee for Theoretical and Applied Mechanics (USNC/TAM) of the National Academy of Sciences.

The USNC/TAM was established in 1949 by the National Academy of Sciences (NAS) to represent the United States in international scientific activities relating to the field of mechanics. It is the focal point for the U.S. engineering, scientific, and mathematical communities that have common interests in mechanics. The committee serves as the national forum for defining major issues in mechanics research, technology, and edu-

cation, suggesting strategies in areas of mutual concern, and stimulating appropriate actions. This committee operates under the auspices of the Board on International Scientific Organizations of the Policy and Global Affairs Division of the NRC.

The USNC/TAM also represents the NAS as the U.S. adhering organization to the International Union of Theoretical and Applied Mechanics (IUTAM), a member union of the International Council for Science (ICSU). The IUTAM was formed in 1946 with the objective of creating a link between persons and national or international organizations engaged in scientific work (theoretical or experimental) in mechanics or in related sciences. The United States is one of 49 countries

that presently adheres to IUTAM, one of 26 member unions of the ICSU.

As part of several U.S. national committees within the Board on International Scientific Organizations, the USNC/TAM is encouraged to consider issues not only specifically relevant to mechanics, but also relevant across several disciplines. New activities and initiatives include, for example, using modern communication networks to improve information flow between researchers in different parts of the world; improving the public's understanding of science and engineering through visiting lecture programs, interactive web sites, town meetings, and other events; and fostering opportunities for younger scientists to become engaged in collaborative research.

ME Department Hosts NSF Program Directors

On Monday, October 7, 2002, the Department of Mechanical Engineering hosted Janet Twomey and Ron Rardin of the National Science Foundation Directorate for Engineering, Division of Design, Manufacture and Industrial Innovation.

Dr. Twomey is Program Director of the NSF's Manufacturing Enterprise Systems (MES) program. The MES program addresses focused research on design, planning and control of operations in manufacturing enterprises, from shop floors to the associated procurement and distribution supply chains.

Dr. Rardin is Program Director of the Service Enterprise Engineering (SEE) program. This program addresses focused research on design, planning and control of operations and processes in commercial service enterprises.

They each gave a talk on their respective programs (Operations Research, Service Enterprise Engineering, and Manufacturing Enterprise Systems), the results from past DMII initiatives, and new focus areas for DMII (health care, green manufacturing, sensing systems). They also met with faculty and researchers from various departments on campus.

Fischell

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Fischell's professional career began at the Naval Ordnance Laboratory and Emerson Research Laboratory, working several years there before he began a 38-year career at the Johns Hopkins University Applied Physics Laboratory (APL), becoming the chief engineer of the Space Department. He retired from the APL in 1997 and is currently chairman of Fischell Biomedical, LLC, and Angel Medical Systems, Inc.

Fischell serves as a director of the University of Maryland Foundation, and on the University of Maryland Foundation Trustees Board, as well as on the Clark School of Engineering Board of Visitors, and the Board of Visitors for the College of Mathematics & Physical Sciences. He is also a member of the National Academy of Engineering.

CALCE to be Modeled in Korea

by Kyoungye Moon
Korean Business Journal

The Secretary of the Ministry of Commerce, Industry, and Energy (Kukwhan Shin) is planning to build a professional research center like that of CALCE EPSC at the University of Maryland in order to improve the reliability of Korean microelectronics components and to develop value added products. The research center will be in universities to include master



Pecht

and doctorate development. CALCE is a desirable model for university research center and industry and university collaborated research.

This year, about US\$3 million will be invested and totally US\$20 million until 2005. About 2000 reliability experts are expected to be created through this project.

More experts and research will help to release the pressure from high technology development in microelectronics.

To learn more about CALCE and Director Michael Pecht, go to www.calce.umd.edu.

Peter Sandborn and CALCE Featured in EDN Access

by Graham Prophet
Editor, EDN

Excerpted from the on-line article:

“The problem of component obsolescence has been around for as long as the electronics industry... Design refreshes or complete redesigns are progressively more costly options, and those with a need to quantify exactly how costly should look at the models that University of Maryland,



Sandborn

College Park Associate Professor Peter Sandborn has developed. This work explores the field in minute detail, including such aspects as life-cycle modeling and part-obsolescence forecasting. It also attempts to quantify a matter that has more often been treated as a matter of intuition or necessity: how to optimize the interval between design revisions and redesigns over the life of a long program. In the space available here, it is impossible to do any more than mention the name of this program—the CALCE Center’s MOCA (Computer Aided Life Cycle Engineering Center’s Mitigation of Obsolescence Cost Analysis) program at the University of Maryland.”

To read the full article, go to www.e-insite.net/ednmag/index.asp?layout=article&articleid=CA257048&pubdate=11/14/2002.

Smart and Small Thermal Systems Lab Presents Workshop

On Monday, October 7, 2002, the Department of Mechanical Engineering’s Smart and Small Thermal Systems Laboratory hosted a workshop on Thermal Packaging of High Flux Military and Commercial Electronics.

This highly successful workshop’s main charge was to identify the next round of emerging technologies in thermal management of high flux electronics. Attendance was by invitation only, was



Ohadi

capped at 55 participants, and included authorities and technical experts from various electronics and computer manufacturers and aerospace industry. Government organizations such as NASA, the Naval Research Lab, and the Office of Naval Research were also present.



Bar-Cohen

The various topics presented were broken down into three categories: Navy Systems: Needs, and Technology; Advanced

Thermal Management for Aerospace Systems; and Recent Developments and Advances in Thermal Technology. An overview of the day was the culminating event.

The workshop included 12 invited speakers from academics, industry, and government, including Laboratory Director Michael Ohadi and Department of Mechanical Engineering Chair Avram Bar-Cohen. The proceedings are being edited and will be available at a nominal fee to the public.

For more information on the Smart and Small Thermal Systems Lab, visit www.enme.umd.edu/s2ts/.

ME Department Co-Sponsors Biosensor Symposium

On October 7, 2002, the Department of Mechanical Engineering co-sponsored a Symposium on Biosensor Technologies and Microbial Diagnostics, along with the U.S. Food and Drug Administration (FDA) and The Joint Institute for Food Safety and Nutrition (JIFSAN). The Symposium, held at the FDA in College Park brought together local biosensor researchers for exchange of information and ideas.



Herold

The speakers, many of whom are active in biosensor development, included scientists from FDA, Naval Research Laboratory, University of Washington, University of Maryland, University of Kansas, Ben-Gurion University, Israel, and Intrinsic Bioprobes, Inc.

Overviews on microbial food borne pathogens and the CDC/NIOSH's view of microbial detection were offered, as well as a presentation by **Avram Bar-Cohen**, Professor and Chair of Mechanical Engineering, on the engineering of bio-MEMS systems. Topics of discussion included fluorescence labeled biosensors, multi-analyte array sensors, electrochemical sensors, surface plasmon resonance (SPR), SPR-mass spectrometry, PCR, and DNA microarray analysis.

More than 120 scientists from FDA, UMD, USDA, Naval Research Laboratory and other organizations attended the meeting, which was organized by Associate Professor **Keith Herold**.

College Faculty Win Prestigious NASA Award

IN JUNE NASA ANNOUNCED THAT A GROUP of faculty from the Clark School of Engineering will be the recipient of a major award from NASA for the establishment of one of the seven NASA University Research, Engineering and Technology Institutes (URETI). The URETI's are a major step taken by NASA toward forging a stronger and expanded relationship with academia. These institutes are being established in areas of long-term strategic interest to NASA and the nation. Each URETI will have an initial life of five years and a maximum possible duration of 10 years. The budget for each URETI is approximately \$3M per year.

The University of Maryland URETI, which is in the area of 3rd Generation Reusable Launch Vehicles, is led by Professor Mark Lewis from the Department of Aerospace Engineering. Other participating faculty are: Profs. Wereley, Pines, Yu, Cadou, and Akin from Aerospace Engineering; **Ashwani Gupta** and **Steven Buckley** from Mechanical Engineering; Smidts from Materials and Nuclear Engineering; and Marshall from Fire Protection Engineering. The University of Maryland is the lead institution on this URETI; other participating academic institutions are the University of Michigan, University of Washington, North Carolina A&T and Johns Hopkins Applied Physics Lab. The other six winning proposals are from UCLA, Georgia Tech, Princeton, Texas A&M, University of Florida, and Purdue.



Buckley



Gupta

Herrmann, Sandborn, and Schmidt Awarded NSF PREMISE Grant

Associate Professors Jeffrey Herrmann, Peter Sandborn, and Linda Schmidt are the principal investigators for a new NSF Product Realization and Environmental Manufacturing Innovative Systems (PREMISE) grant, "Applying Decision Production Systems to Improve Environmentally Responsible Product Development." The project begins January 1, 2003, and runs until June 30, 2004.

ENVIRONMENTALLY RESPONSIBLE product development (ERPD), also known as environmentally benign manufacturing, considers both environmental impacts and economic objectives during the numerous and diverse activities that accompany product development.

There are many ways to minimize the environmental impacts that products generate throughout their life cycle. The greatest opportunity for ERPD occurs during the product design phases, when designers and others make the decisions that determine most of the product's environmental impact.

Numerous tools have been developed to help designers create environmentally benign products. The two major classes of tools are life cycle assessment (LCA) and design for environment (DFE).

The most significant obstacles to using LCA and DFE tools effectively are the difficulties acquiring the needed data and the challenges developing realistic, appropriate metrics of environmental impact. That is, there exists a real conflict between the information flow and decision making that exists in a product development organization and the information flow and decision making that LCA and DFE tools require to be effective. Consequently, these tools are, generally, not integrated with the other activities of the product development process, and the

tools' ability to improve ERPD is limited.

A product development organization includes the engineers, managers, and other personnel who make process and product engineering decisions while trying to satisfy a variety of constraints and managing tradeoffs between multiple competing objectives, including environmental concerns. This research views product development as an information flow governed by decision-makers who make decisions under time and budget constraints. From this perspective, a product development organization is a decision production system.



Herrmann



Sandborn



Schmidt

This research seeks to understand how product development organizations use environmental information in their decision-making. It will consist of two tasks:

1. Constructing a long-term collaborative research agenda that guides a research program using the decision production system perspective to improve ERPD, particularly by integrating LCA and DFE tools into other product development activities.

2. Conducting an exploratory study to describe the flow of information related to LCA and DFE in the product development activities of an electronics manufacturing company.

The research will explore a novel, systems-level paradigm to develop new insights into the behavior of product development organizations. The decision production system perspective results from the principal investigators' experience creating design decision support tools and the careful study of product development. Unlike many existing approaches, this per-

spective examines the entire organization, not just individual product development projects.

Applying the decision production system perspective to ERPD will yield novel methods that guide the development of powerful LCA and DFE tools (for specific decision-makers) and the rational and systematic deployment of these tools across the entire product development organization. Ultimately, this will reduce the time and cost of ERPD by using effective LCA and DFE tools in a coordinated manner. Successfully completing the research will contribute fresh insights into ERPD and will begin an innovative research program that has academic and commercial importance and will make significant theoretical and practical contributions to ERPD across a range of industrial sectors.

The research will integrate research and education by using the research results to enhance and create courses. In addition to graduate research assistants, undergraduate students will participate on the research team. Research projects are exciting, effective learning experiences for undergraduates, and participation in such projects increases the number and diversity of American students who conduct research and earn advanced degrees in science and engineering.

The research will enhance the research and education infrastructure by establishing collaborations between organizations working to improve ERPD and developing a long-term research plan for the participants. The research results will be disseminated broadly through scholarly publications and conferences, as online document collections, in undergraduate and graduate engineering courses, in projects with collaborating manufacturers, and in short courses offered to engineers working in industry. In addition, the research will benefit society by helping manufacturing companies develop energy-efficient and environmentally benign products.



Department of Mechanical Engineering Annual Report 2001-2002

A special pull-out section to the Fall 2002 issue of *Metrics*

The Year in Review

Avram Bar-Cohen
Professor and Chair



**Dear Friends, Alumni, Faculty,
and Students,**

The 2001-2002 academic year has been an extraordinary one in the life of the Department of Mechanical Engineering—filled with successes, accomplishments, and new beginnings. I could not have hoped for a better start as Department Chair, and it is my distinct honor and pleasure to highlight for you the events of this past year.

AS BEFITS A DEPARTMENT POISED FOR ascension to the upper echelons of academia, and despite the economic slowdown, research expenditures again reached nearly \$15 million, bringing our overall department expenditures in 2001-2002 to more than \$19 million. These funds have come from federal agencies and laboratories (36%), corporate sponsors (33%), the State of Maryland and the University (29%), and the endowment (2%). These grants have helped to launch a cutting-edge NASA University Research, Engineering and Technology Institute (URETI) on 3rd Generation Reusable Launch Vehicles (Profs. **A.K. Gupta** and **Steven Buckley**), underpinned NSF's support of the innovative, team-based educational program RISE, which provides women undergraduates with summer research internships (Prof. **Linda Schmidt**), facilitated the acquisition of advanced instrumentation and laboratory equipment (Profs. **Elisabeth Smela** and **Jaime Cardenas**), and initiated a major fuel cell development program (Prof. **Gregory Jackson**).

Our faculty continues to shine, winning recognition from their peers in academia and industry, as well as from their colleagues and students here at Maryland. Profs. **Donald Barker** and **Ugo Piomelli** were promoted to the rank of Fellow in ASME International and the American Physical Society, respectively, increasing the number of Fellows in the Department to 46. Prof. **Reinhard Radermacher** was the recipient of ASHRAE's Distinguished Service Award, while Prof. **Arthur Bergles** was the recipient of ASHRAE's Louise and Bill Holladay Distinguished Fellow Award. Prof. **Abhijit Dasgupta** was honored by his graduate alma mater, Villanova, with the Carl Humphrey Memorial Award,

continued next page

Department at a Glance — 2001-2002

43	Faculty
46	Professional Society Fellows
6	National Academy of Engineering Members
6	Professional Journal & Book Series Editors
23	Professional Journal Associate & Other Editors
5	Published Books—2001
19	Published Chapters in Books—2001
85	Published Refereed Journal Articles—2001
192	Conference and Seminar Presentations—2001
17	Invited Conference Lectures—2001
555	Undergraduate Students—Fall 2002
1260/1390	SAT 25/75 Percentiles of Entering Freshmen
3.96/4.0	Average GPA of Entering Freshmen
27	Percentage of Women/Minority Entering Freshmen
31	Percentage of Undergraduates in Honors Programs
225	Graduate Students—Fall 2002
2061	Average GRE of Entering Graduate Students
3.55/4.0	Average GPA of Entering Graduate Students
93	B.S. Degrees Awarded
40	M.S. Degrees Awarded
14	Ph.D. Degrees Awarded
\$15M	External Research Support
\$19.5M	Total Expenditures

The Year in Review

continued from page AR1

named for Villanova's first engineering dean. Prof. **Michael Ohadi's** company, Advanced Thermal and Environmental Concepts, won the Incubator of the Year Award from Maryland's Technology Advancement Program. And, to underscore Maryland's "Zoom," *Washington Business Forward* magazine named University President and Professor of Mechanical Engineering **C.D. Mote, Jr.** number 20 of the 40 most influential people in greater Washington, DC. Finally, in the "tooting my own horn" category, I received the Outstanding Sustained Technical Contribution Award from the Components, Packaging, and Manufacturing Society of the IEEE.

At the May 2002 Commencement ceremony Prof. **David Bigio** was given the Poole & Kent Outstanding Teaching Award and Prof. **David Holloway** received the A. James Clark School of Engineering Faculty Service Award. Earlier in May it had been announced that Prof. **Donald Robbins, Jr.** was named Outstanding Professor of a Graduate Course by the Graduate Student Government Association. Prof. **Linda Schmidt**, Pi Tau Sigma's advisor, was the winner of the 2002 Outstanding Advisor for a Student Organization Award by the Office of Campus Programs.

Promotions, directorates, and additions were also key changes to our faculty. Drs. **Don DeVoe**, **Satyandra K. Gupta**, and **F. Patrick McCluskey** were promoted to Associate Professor with tenure; Professor **Amr Baz** was named Director of the newly formed Center for Small Smart Systems; Professor **James Wallace** was named Director of the University's Gemstone Program, and Professor **James Duncan** was named Director of the Science, Technology, and Society Program under the University's College Park Scholars Program. In addition, we were delighted

to welcome **Katepalli Sreenivasan**, the newly appointed Director of the Institute for Physical Science and Technology, as a professor of mechanical engineering. Dr. Sreenivasan was also named Distinguished University Professor and Glenn L. Martin Professor of Engineering. Dr. Sreenivasan came to Maryland from Yale University, where he was the Harold W. Cheel Professor of Mechanical Engineering, a professor of physics and professor of applied physics. He also served as Yale's mechanical engineering department chairman from 1987-1992. Dr. **Jaime Cardenas-Garcia**, a three-time Maryland alumnus (BSME '71, MSME '75, PhD '83), and formerly an associate professor of mechanical engineering at Texas Tech University, returned to his alma mater as Associate Research Professor in our Department.

Inspired and guided by the faculty, ME students are following their own path to excellence. **Gaurav Shah** was awarded one of 50 inaugural Jack Kent Cooke Foundation Graduate Scholarships, valued at up to \$300,000 (he also delivered the student commencement speech at the December 2002 Clark School Commencement). Ph.D. student **Rajath Mudalamane** was the recipient of the Lew Erwin Memorial Scholarship Award and was honored by the Society of Plastics Engineers at a ceremony at the SPE Annual Technical Conference (ANTEC) in San Francisco. As many of you are aware, the Maryland team, competing in the Department of Energy's Solar Decathlon, dominated the media's attention in the summer and fall months. Advised by Prof. **Jungho Kim** and led by student project managers **Alex Yasbek**, **Catherine Buxton**, and **Andrew Hunt**, a team of some 30 ME undergraduates worked diligently for over two years to plan, design, and build a solar house on the National Mall in Washington, DC.

Fourteen teams from around the U.S. and Puerto Rico competed in ten contests, from livability to public relations to energy consumption. The Maryland team placed first in Energy Balance and Hot Water Competitions, fourth overall, and first in the hearts of all Terrapins everywhere.

Our alumni continue to prove that a Maryland mechanical engineering degree is just a starting point to a wonderful career in engineering. Alumna **Mary Lacey** (BSME '78) was recently named technical director for the Naval Surface Warfare Center, Indian Head, the highest civilian job within the center. Dr. **Richard Stamper** (PhD '97), assistant professor of mechanical engineering at Rose-Hulman Institute of Technology, received the ASEE's Ferdinand Beer and E. Russell Johnston Outstanding New Mechanics Educator Award. Dr. **Richard Link** (BSME '87) was named a Fellow of ASTM and received the 2002 ASTM Award of Merit. And, beginning in July 2003, alumna **Nilüfer Egriçan** (PhD '77), professor and former dean of the School of Mechanical and Textile Engineering at Istanbul Technical University, Turkey, will assume the ASME Region XIII (international region) vice presidency.

Clearly this Department—your Department—of Mechanical Engineering is a department on the move. We are proud of the many accomplishments of the faculty, students, and alumni, and are working to have an even greater impact in the year ahead. Thank you for your support and for the joy of leading the department along its journey.

Zoom, baby.

Graduate and Undergraduate Programs



Dr. Ugo Piomelli
Director of Graduate Studies
and Associate Chair



Dr. Sami Ainane
Director of the
Undergraduate Program

Enrollment

In the 2001-2002 academic year the Department of Mechanical Engineering had 280 graduate students enrolled. Of these 130 were Master of Science students and 150 were Doctoral students.

Degrees

The Department granted 40 M.S. degrees and 14 Doctorates in 2001-2002. Dissertation titles and the names of Doctoral student's advisors are listed later in the report.

Recruitment

As of November 1, 2002, 734 students applied to the graduate program for entrance in 2002-2003. This represented a 17% increase over the number applying in the previous year. This increase is no doubt due to the growing reputation of the Department and our efforts in publicizing our departmental accomplishments. Of these applicants, 76 were accepted and 50 enrolled, most with financial assistance in the form of a graduate teaching assistantship, graduate research assistantship, or graduate fellowship.

Research and Fellowships

During the 2002-2003 academic year the Department is supporting 39 students through teaching assistantships and 171 students through research assistantships. The Department can boast of providing its assistants with the third highest base stipend of any university in the country, the highest of any public university. In addition, 25 of our students have been awarded fellowships for the 2002-2003 academic year.

Student Credentials

The students who enrolled in our program in 2002-2003 had an average GRE total of 2051 and an average GPA of 3.40.

Enrollment

Enrollment in the undergraduate program has increased by over 40% in the past three years. Currently, 570 students have declared Mechanical Engineering as their major. 126 of these students are in the University Honors Program. The freshmen class of 2002 had an average SAT score of 1333 and an average high school GPA of 3.96. Last year, we awarded nearly 100 Bachelor's degrees. Our program features design throughout the undergraduate curriculum and unique teaching methods, including teaming studio experience and the use of Undergraduate Teaching Fellows.

Career Paths

A wide choice of Career Paths is available to the student in the senior year. These optional Career Paths, which include Computer and Information Technology, Computer Aided Design and Manufacturing, Controls, Sensors and Electronic Packaging, Energy and the Environment, Engineering Management, and General Mechanical Engineering, enable students to study in depth their areas of interest and to better prepare themselves for careers of their choice.

Honors Program

The departmental Honors Program, now in its fourth year, offers high-quality education to a group of especially talented ME students. The ME Honors program currently has about 90 participants and has been highly successful in attracting talented students to the Department.

B.S./M.S. Program

Our department offers a combined B.S./M.S. Program, which is available to the top students in the department. This program provides these students with the opportunity to earn both a B.S.M.E. and an M.S.M.E. following five years of study.

continued on following page

Undergraduate Awards & Honors

American Society of Mechanical Engineers Senior Award

Presented to the senior member who has contributed most to the student chapter
Heather Elaine Kroshl

Society of Automotive Engineers Senior Award

Presented to the senior member who has contributed most to the student chapter
Sarabpreet Singh Bumra

Pi Tau Sigma Outstanding Service Award

Presented to a student for outstanding service and contributions to the chapter
Rebecca Mae Lynch

Pi Tau Sigma Memorial Award

Presented to the senior in mechanical engineering who has made the most outstanding contributions to the University
Robert Michael Baden

Pi Tau Sigma Outstanding Sophomore Award

Presented to the most outstanding sophomore in mechanical engineering on the basis of scholastic average
Dan Feng

Department of Mechanical Engineering Academic Achievement Award

Presented to the junior in mechanical engineering who has attained the highest overall academic average
Gaurav Jaydeep Shah

Department of Mechanical Engineering Chair's Award

Presented for excellence in academics, outstanding service to the Department, or leadership in the Department
Anita Maria Currano

The Kim A. Borsavage and Pamela J. Stone Student Award for Outstanding Service

Presented for outstanding service and dedication to the A. James Clark School of Engineering
Rebecca Mae Lynch

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Undergraduate Program

continued from page AR 3

Student Organizations and Projects

The number of student chapters of national professional societies continues to grow. This growth is an indication of the increasing variety of interests among our students and our faculty. Currently, there are student chapters of the American Society of Mechanical Engineers, Society of Automotive Engineers, the American Society of Heating, Refrigeration and Air Conditioning Engineers, Society of Experimental Mechanics, and the Society of Manufacturing Engineers.

Over the past decade, the department has established an enviable record in intercollegiate student competitions. Regional, national, and international competitions in Mini-Baja vehicles, solar cars, methanol cars, liquefied natural gas powered vehicles, hybrid-electric cars, future cars, walking robots, super-mileage vehicles, human powered vehicles, human powered submarines, the Solar Decathlon, and others have resulted in numerous prizes and honors for our students and faculty. This success has provided many of our graduates with opportunities to receive employment offers in a wide variety of industries.

Probably the largest student project undertaken in the history of the University, The Solar Decathlon, saw 14 university teams compete for 10 days on the National Mall in Washington, DC. A group of 30 ME undergraduates, advised by ME Prof. Jungho Kim, took part in this two-year planning and building contest, sponsored by the Department of Energy. Our Maryland team placed first in the Hot Water and Energy Balance competitions, and fourth overall.

Ph.D. Graduates & Dissertation Titles

Fall 2001

Mustafa Arafa

Advisor: Amr Baz

Vibration and Noise Control Using Active Piezoelectric Damping Composites

Caleb Belai

Advisor: Bruce Berger

Cutting State Identification

Jun Huang

Advisor: Satyandra K. Gupta

Accessibility-Driven Spatial Partitioning: A Step Towards Automated Design of Multi-Piece Molds

Sameer Anand

Advisors: Yogendra Joshi and Satyandra K. Gupta

A Comparative Study of Two Classes of 3-DOF Parallel Manipulators

Chunhui Pan

Advisor: Kenneth Kiger

Development of Two-Phase PIV and its Applications to Sedimentation within a Particle-Laden Turbulent Channel Flow

Weijie Zhao

Advisor: Yu Wang

Modeling and Analysis of Gear Rattle in Automotive Transmissions

Spring 2002

Keita Broadwater

Advisor: Donald Barker

Characterization and Health Monitoring of Epoxy-Cured Fiber Optic Connectors Via Fiber Optic Sensing

Richard Ciocci

Advisor: Michael Pecht

Assessing the Migration to Lead-Free Electronic Products

Peter L. Haswell

Advisor: Abhijit Dasgupta

Durability Assessment and Microstructural Observations of Selected Solder Alloys

Weifeng Liu

Advisor: Michael Pecht

Reliability Assessment of Metal Particle-in-Elastomer Sockets

Ion Pelinescu

Advisor: Balakumar Balachandran

Active Control of Wave Transmission Through Cylindrical Struts

Yuan Zhao

Advisor: Michael Ohadi

Flow Boiling Characteristics of Carbon Dioxide in Microchannels

Huayang Zhu

Advisor: Gregory Jackson

Numerical Modeling of Combustion on Palladium Catalysts for Gas Turbine Applications

AR 5

Graduate Awards & Honors

Graduate School Fellows

Vytenis Benetis

Antonio Cardone

Lorenzo Cremaschi

Amr Gado

Mohammad Reza Keimasi

Kyle Kratzsch

Martin Linck

Gregg Lithgow

Cheng Shao

Zhen Shi

Pameet Singh

Bretton Swope

Travis Temple

Xuezheng Wang

Shenglan Xuan

Jianming Yang

Xiabo Yao

Zihua Yue

Krista Zaniewski

Lei Zhang

Yuxun Zhou

Bin Zhu

Likun Zhu

Litton Industry Fellow

Ali Farhang-Mehr

SRC Fellow

Deborah Pollack

Summer 2002

Zhiyang Yao

Advisors: Satyandra K. Gupta and Dana Nau

Geometric Algorithms for Operation Planning of Geometrically Complex Milling Features

Contracts, Grants, and Awards

PI	Agency	Title
Anand	Advanced Thermal & Environmental Concepts, Inc.	EHD-Enhanced Air-to Liquid Heat Exchanger
Anand	Advanced Thermal & Environmental Concepts, Inc.	Chip Integrated EHD Cryogenic Cooling System Phase II
Anand	DOD-Navy.NSWC	Center for Energetic Concepts Development
Anand	DOD-Navy.NSWC	International Shock Wave/ Dynam...
Anand/Allen	NIST	Research on Web-Enabled Collab...
Azarm	NSF	Robust Product Design Selection Under Uncertainty
Azarm	State/Black and Decker	MIPS Optimization of Power Tool Design
Azarm	DOD-Navy.ONR	Concurrent Design Optimization
Azarm	NSF	Entropy Based Multiobjective Genetic Algorithm
Azarm/McCluskey/Pecht	DOD-Navy.ONR	Decision Support of Design of Hig...
Azarm-CoPI	DOD-Navy.NSWC	Center for Energetic Concepts Development
Balachandran	NSF	Novel Fiber Optic Acoustic Sensor System
Balachandran	NSF	High-Speed Milling Dynamics
Balachandran/Baz	DOD-Navy.ONR	Virtual Platform for Des and Control of Struct. AC
Baz	Business Performance Group	Integrated Simulation-Based Design Environment
Baz	Catholic University	Active & Passive Control of Smart...
Baz	DOD-Army.ARO	Active & Reactive Shells
Baz	DOD-Army.ARO	Multi Input/Multi-output Active Control & ...
Baz	DOD-Navy.ONR	Active & Passive Vibration & Noise ...
Baz	DOD-Navy.ONR	Virtual Design of Quiet Underwater ...
Baz	Qortek, Inc.	Semi-Passive Shock and Vibration Mounts
Baz	Qortek, Inc.	Qortek Isolator Proof of Concept Vibration Tests
Baz and Davis	Qortek, Inc.	Multifunctional Integrated Piezo-Fiber Modulation System
Bernard	VorCat, Inc.	Gridfree Compressible Turbulent Flow Modeling
Bigio	Intelligent Automation	Polypropylene-based AVI Guard Products
Bigio	MULTI COMP	Polymer Mixing Program (PMP#2)
Bigio	NSF	Modeling & Control of Extruders &...
Bigio	State/Intelligent Corporation	Polypropylene-based AVI Guard Products
Bruck	DOD-Navy.ONR	Fabrication & Design of a Functionally...
Bruck	DOD-Navy.NSWC	Center for Energetic Concepts Development
Buckley	Carnegie Mellon	LIBs for Real-Time Ambient Particle Analysis
Buckley	DOD-Navy.ONR	Particle Diagnostics for Navy Vehicles and Operations
Buckley	NSF	RET Supplement for NSF Award
Buckley	Systems Planning & Analysis	Ship Structural Health Monitoring Using Fiber Optic Sensing
Buckley	DOD-Navy.NSWC	Center for Energetic Concepts Development
Buckley/Balachandran	Systems Planning & Analysis	Structural Health Monitoring Using...
Buckley/Balachandran	Systems Planning & Analysis	Towed Array Shape Mgmt.
Buckley	NIST	Assessment of Accuracy in Singly...
Buckley	NSF	Investigation of Laser-Induced Bre...
Dasgupta	Hitachi	Development of Nested Finite Ele...
Dasgupta/DeVoe	NSF	A MEMS-based Stiffness/Energy Sensor for Structural...
DeVoe	DOD-ARPA	Parallel Fabrication of 3D Micros...
DeVoe	DOD-MD. Procurement of	III-V MEMS for Optical Microsystems
DeVoe	DOD-Navy.ONR	A Deep Reactive Ion Etcher
DeVoe	NIST	MEMS Test Structures for Materials Characterization
DeVoe	NIST	Integrated Silicon/Plastic Microfluidic Gas Sensors
DeVoe	NSF	PECASE: Mechanically Robust Macrome
DeVoe	NIST	MEMS Test Structures for Material
DeVoe	DOD- Navy.NSWC	Center for Energetic Concepts Dev
DeVoe/Balachandran	DOD-ARPA	High-Q Piezoelectric Nanomechanical Filter Arrays
di Marzo	DOD-Navy.ONR	Fire Protective Clothing Model
di Marzo	NIST	Fire Safety Engineering
Duncan	DOD-Navy.ONR	The Effects of Salinity and Wind on the Surface Profile...
Duncan	DOD-Navy.ONR	The 3D Structure of Spilling Breakers
Duncan	DOD-Navy.ONR	An Experimental 2D+T Investigation of Breaking Bow Waves
Duncan	NSF	The Dynamics of Short Wavelength
Duncan	DOD-Navy.ONR	Equip. for the Study of Breaking...
Duncan/Kiger	NSF	Air Entrainment by Translating Plu...
Gupta, A.K.	DOD-Navy.ONR	Control Flame Structure in Spray
Gupta, A.K.	DOD-Navy.ONR	Phase Doppler Interferometer/Refr...
Gupta, A.K.	Japan Science & Tech. Corp	Thermogravimetry Analysis Coal & Wastes

PI	Agency	Title
Gupta, A.K.	NASA - Glenn (Lewis)	Studies on the Behavior of Highly...
Gupta, A.K.	NASA - Glenn (Lewis)	Data-Base on Fuel Air Mixing & C...
Gupta, A.K.	NSF	Experimental & Theoretical Studies
Gupta, A.K.	NSF	Experimental & Theoretical Studies
Gupta, A.K.	Teledyne Energy Systems	Burner Development for TP Systems
Gupta, S.K.	DOD-Navy.ONR	Automated Mold Design and Fabrication for Rapid...
Gupta, S.K.	NSF	Generating Shared-Setups for Ena...
Gupta, S.K.	NSF	REU Supplement for NSF Grant #...
Gupta, S.K.	Carnegie Mellon	Automated Extraction for Structured MEMS Design
Gupta, S.K.	NSF	PECASE: Automated Design of Multi-Piece Molds (Career)
Gupta, S.K.	NSF	REU Career Supplement
Han	Intel	Development of High Resolution R...
Han	Intel Technology	Practical Approach of Microscopi...
Han	Semiconductor Research	SRC National Semiconductor Scholarship
Han	Semiconductor Research	Development of Displacement Me...
Hillman	Boeing	Reliability Assessment of Super-FET Component
Holloway	DOE - CHICAGO	Gate Fellowship Application
Holloway	General Dynamics	Hybrid Electric Design for a Unmanned Grad Combat Vehicles
Holloway	General Dynamics	Hybrid Electric Drivetrain
Holloway	MD Grain Prod. Utl Board	Development of and Ethanol Fueled...
Jackson	California Energy Comm.	Integral Catalytic Combustion/Fuel
Jackson	DOD-Navy.ONR	Development of Design Models for Hydrogen Catalytic...
Jackson	NSF	Development & Validation of Surface...
Jackson/Kiger	NSF	Impact of H2 and CO on Lean Premi...
Joshi	DOD-Navy.NSWC	Microfabrication Alliance for Innovat...
Joshi/Sandborn	Georgia Tech	Internet Based Modules for Natio...
Kiger	NSF	Acquisition of a Phase Doppler An...
Kiger/Modarres	NRC	High-Resolution Experimental Measurement of Turbulent...
Kiger/Kim	DOD-MD. Procurement of	Heat Transfer Measurements on...
Kim J.	NASA - Glenn (Lewis)	Investigation of Pod Boiling Heat T...
Kim J.	NASA - Other	Pool Heat Transfer Mechanisms in...
Kim J.	National Renewable Energy Lab	U of Maryland Solar Decathlon Proposal
Kim J.	NIST	Fabrication of Data Acquisition & ...
Kim J.	NSF	Transition Pool Boiling Heat Trans...
Kim J.	NSF	Transition Pool Boiling Heat Trans...
Kim J.	University of Denver	Time & Space resolved Heat Tra...
Kim/Jackson	NIST	Development of a High Temperature Absorption Coefficient
McCluskey	Applied Data Systems	Upgrading a RISC-based Single Board Computer System
McCluskey	Georgia Tech	Web-based Graduate Course on Mechanical Design
McCluskey	Silcon Power	Reliability Testing of the Size 6 thi...
McCluskey	Virginia Polytechnic Institute	Characterization of Large Area Solder Die Attach Fatigue
Natishan	EPRI (Electrical Pwr. Res.)	Establishing a Physical Basis for t...
Ohadi	Air Conditioning & Ref. Tech Inst.	MicroChannel Heat Exchanger
Ohadi/Kiger	TEDCO	Development of a Micro-condenser for Source-Integrated...
Pecht	DOD-MD. Procurement of	Manufacturability and Durability Analysis of Single...
Pecht/Das	MD Robotics-Canada	End Effector Electronics Unit Life Investigation
Piomelli	DOD-Navy.ONR	Large-eddy Simulation of Complex...
Piomelli	DOD-Navy.ONR	Comparison of Wall-Layering Modeling Techniques for...
Piomelli	NIST	Evaluation of MEMs Ultrasonic Transducer Arrays
Piomelli	NASA-Langley	Interaction of Boundary Layer With...
Radermacher	ARTI	CO2 Expander-Compressor Analysis
Radermacher	Battelle	Operation of CHP Systems, Measurement and Data Evaluation
Radermacher	DOD-Army.ARO	Modeling & Testing of Commercial Prototype Carbon dios...
Radermacher	EPA	Systematic Analysis of the Performance Potential of ...
Radermacher	EPRI Solutions	Installation of Capstone Micro-turbine
Radermacher	Excel Water Technologies	Testing an Analysis of Atmospheric Water Generator
Radermacher	Lockheed Martin, (now Battelle)	Natural Gas Buildings: Demonstration
Radermacher	United Nations	Intensive Refrigeration Design Training
Sandborn	Frontier Technology Inc	EPOI Life Cycle Cost Development for AFRL and ASC
Sandborn	Lockheed Martin	Part Obsolescence Forecasting
Sandborn	Northrup-Grumman	Electronic Parts Obsolescence Initiative

PI	Agency	Title
Sandborn	Nu Therna Systems, Inc.	Advanced Embedded Passives
Sandborn	University of Texas	IEEE/CMPT Internet Based Education
Sandborn - CoPI	DOD- Navy.NSWC	Center for Energetic Concepts Development
Sandborn/Ramahi	Applied Data Systems	Design of Embedded Computer Systems for Automotive...
Sandborn/McCluskey/Pecht	AF-AFMC-Wright Patterson	Life Cycle Cons Reduction Throng
Schmidt	NIST	Research on Uncertainty Measurement for CMM Software
Schmidt	NSF	A Carrer in Generative Designer A...
Schmidt	NSF	REU Sup to Carrer: Generative D...
Schmidt	NSF	Research Internships in Science and Engineering
Schmidt	NSF	E-volving the Open Workshop on Decision Based Design
Schmidt	Research Foundation of SUNY	A Subcontract to Expansion of De...
Schmidt/Bigio	NSF	BESTEAMS Model of Team Development
Smela	Advanced Thermal & Environmental Concepts	MIPS Source - Integrated Micro Co..
Smela	Intraurethal Biomedical Technologies Corp.	Intraurethal Continent Prosthesis (ICNCOPRO)
Wallace	DOE - Dept. of Energy	Fundamental Thermal Fluid Phys...
Wallace	NSF	Experimental & Numerical Studies
Wallace	NSF	Concentration Flux Measurements
Walsh G	NSF	Design & Simulation tools for Net...
Zhang G	U. MED. & DENT/NIH	Machining Ceramic Materials with...
Zhang G	U. MED. & DENT/NIH	Minority Graduate Assistant Supplement

Research Sponsors

3COM	CORVIS Corporation	GEC-Marconi (BAE Systems Electronics)	Lockheed Martin	Philips	Tecumseh Products Company
ACSS	CPI	General Dynamics	Lockheed Martin Vought Systems	Praxair	Teledyne Energy Systems
AEDS, France	Dakin	General Dynamics Robotics	Lucent	Propane Education QorTek	Teradyne
American Society for Engineering Education (ASEE)	Datum	General Motors Corp.	MacDermid	QSS	ThermaSys
Applied Data Systems	Delphi Delco Electronics Systems	Georgia Tech	Maryland Grain Producers Utility Board	Raytheon Systems Company	Thermo King
ARTI	Electronics Systems	Governors' Ethanol Coalition	Matrics Tech	Rockey Research	TRW, England
ASCO	DENSO Corp	Grundfos Management, Germany	Matsushita	Rockwell Collins, Inc.	U.K. Ministry of Defense
ATEC	DERA Aquila, QintetiQ	Halla Climate	MD Robotics	Samsung Electronics	U.S. Air Force
Avici	DOD - Maryland Procurement Office	Hamilton Sunstrands	Merix	Sandien	U.S. AMSAA - AMXSY
AWA	DOE - Chicago	Harris	Michelin	Sandia	U.S. Army
BAE	DuPont	Heatcrat	MTI	Schlumberger	U.S. Army Research Office
Black & Decker	Eaton	Hitachi	NASA	Schlumberger Oil Drilling Services	Unistar Group
Boeing	Education Alliance	Honeywell	National Semiconductor Corp.	Schlumberger Well Services	University of Alabama
Brazeway	Embraco	Idirect	NIST	Seagate	University of Denver
Bryant-Berry, Inc.	Energy Concepts Co.	Iltam	Nokia Research Center	Selas Fluid Processing Corporation	UT Batelle
Business Performance Group	Environmental Protection Agency	Ind Tech	Northrop Grumman	Semiconductor Research Corp	Virginia Tech
Capstone	EPRIsolutions	Infinite Biomedical Technologies, LLC	Northstar Photonics	Siemens	VorCat, Inc.
Carnegie Mellon University	Ericsson and Phillips	Jackson & Tull Chartered Engineers	NSF	Silicon Power	VPAA
Carrier	Ericsson Radio Systems AB	Japan Science & Technology Corp.	NSWC	Smiths Industries	Washington Gas
CASCADE	ERS	LeCroy	Nuclear Regulatory Commission	St. Jude Medical	Wieland - Werke
Cessna	Ethel Sorrentino	LG Electronics	ONR	Systems Planning and Analysis	York International Co.
CIENA Corporation	ExxonMobil	Liebert	Pepsi	Tatung, China	
Clark Construction	Ford Motor Company	Litton	PerkinElmer	Technobit	
Copelan	Frostburg State University		Phenix Software Technologies		
Copeland					
Copper Development					

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Incubator of the Year: Heat is on at Advanced Thermal

By Will Wingfield

Originally published in the *Potomac Tech Journal*, June 25, 2002

Advanced Thermal and Environmental Concepts Inc. was born when its chief executive officer, Michael Ohadi, decided to go beyond his research into cooling and refrigeration and apply it to a business model. This Best New Incubator Company joined the University of Maryland College Park's Technology Advancement Program, TAP, in 2001.

LOCATED ON THE UNIVERSITY CAMPUS, ATEC develops cooling and heat exchange and transfer products for use in electronics, refrigeration and automotive applications.

"Essentially, all of our projects we subcontract back to the University to help develop or obtain fundamental data we use in our projects or concepts," said John Lawler, the company's president and technical director. "It's nice to be right here in terms of meeting with the researchers and graduate students."



Ohadi

Two of ATEC's recent hires came from the University's graduate student body, and Lawler said the firm also makes use of the testing facilities available on campus. In addition, Ohadi, a University of Maryland professor of mechanical engineering, is never more than a few hundred yards

from the office.

"The faculty can't give their full time to run a company ... but he's still a technical leader in the company and maintains a high level of interest," explained Ed Sybert, director of the TAP incubator program. "He can look in on the company on his lunch break or before and after class."

Sybert said Lawler, who has had significant experience in chemical engineering at the Massachusetts Institute of Technology, devotes his full attention to being president of the company.

"The partnership is a good one," Sybert said.

When looking at applicants for the TAP incubator, "we look for innovative technologies that can capture either a niche market

or significant marketshare of an overall market. This is a very novel technology that has brought applicability in a couple of niche markets," he said.

Company officials believe their technology has many different applications. As high-powered computer workstations and servers become increasingly miniaturized, for instance, they generate extra heat, which the company hopes to combat. The company's products can also control frost accumulation in grocery store freezers.

"The basic technology that most of our concepts start from is the application of electric fields to a fluid, and therefore getting it to move in some way," Lawler said. "The basic concept is a miniature pump, getting fluid to mix better than otherwise or getting two fluids to separate better than they would otherwise."

"The elements of heat transfer haven't changed in many years," he said. "With very little additional power input, we can improve the heat transfer rate, allowing things to be smaller and more efficient in terms of their size."

While ATEC has been successful in getting government research and development contracts, Lawler said the company is also looking to bring product into the marketplace, and recently began seeking outside venture capital to make that happen.

"They have developed a diverse staff in order to cover the breadth of their technology. They have equipped the laboratory to conduct the small-scale experiments necessary to support their product design," Sybert said. "[They need to] continue to solidify relationship with university resource people as well as commercial technological partners."

TAP receives a 1-percent equity stake in the company in exchange for every year ATEC remains in the incubator.

"Since we've only physically been here eight or nine months, at some point they like for you to graduate and move out. I assume in two years we'll consider that," Lawler said. "If we're successful with fund raising, we could grow out of this space."

On the Drawing Board: Cutting Costs, and Circuit Boards, Down to Size

by Tom Ventsias, University Media Relations

New software developed by Associate Professor of Mechanical Engineering Peter Sandborn can help electronics manufacturers redesign printed circuit boards to improve performance, save space, and decrease overall weight.

THE SOFTWARE TOOL OFFERS A detailed cost-analysis of embedded passives, an emerging technology that integrates passive components like resistors and capacitors into the interior layers of a printed circuit board, as opposed to the traditional method of soldering them to the board's exterior.



Sandborn

“Embedded passives are on the threshold of becoming mainstream in the electronics industry,” says Sandborn, and that most handheld telecommunications applications and other devices that have size and weight considerations “will undoubtedly go to embedded passives in the next few years.”

The cost-analysis tool allows R&D specialists to digitally describe a traditional electronics system using discrete passives—the term used for resistors and capacitors soldered onto a circuit board—and then redesign the system by converting some or all of the discreet passives to embedded passives. The software provides detailed cost estimations that include both current and projected costs of electronic components, Sandborn says, and also gives size and weight projections to help design engineers maximize space considerations.

The software was developed in partnership with the National Center for Manufacturing Sciences' Advanced Embedded Passives Consortium, a collaborative R&D effort co-funded by industry and the National Institute of Standards and Technology, or NIST. The consortium includes major telecommunications and electronics manufacturers such as DuPont, Nortel, and Merix, with industry and the NIST Advanced Technology Program providing funding for developing the software.

Part of making the software functional and user-friendly, Sandborn says, was working with the embedded passives consortium. “The biggest challenge was in getting realistic [cost] numbers,” he says. “By partnering with research and development experts from companies such as DuPont and Nortel, I was able to get very accurate input on what is being used in industry right now, and what the needs for the future are.”

This story first appeared in Maryland Research Magazine.

Pi Tau Sigma Award Presented to DeVoe

The University of Maryland's Tau Mu Chapter of Pi Tau Sigma, the National Honorary Mechanical Engineering Society, has presented Associate Professor **Don DeVoe** with its annual Appreciation Award.

Dr. DeVoe was chosen to be the recipient of this award in recognition of his dedication toward the passion for his students to learn. In a letter to Dr. DeVoe, Pi Tau Sigma President Robyn Hladish stated that he was “one of the few teachers that really showed an enthusiasm for every student to grasp the understanding of Vibrations, Controls, and Optimization II (ENME 462). We appreciate your work and your dedication towards your students' education. We want you to know that your actions were recognized as both outstanding and exemplary.”

Pi Tau Sigma began this award in 2001 to recognize professors that they feel have performed above and beyond the already high expectations placed up them.

ME Baby Boom!



Congratulations to the following ME faculty and staff who have welcomed new additions to their families in 2002:

Megan Augusta McCluskey, born March 7, to Associate Professor Patrick McCluskey and his wife, Monica

Liam Orion DeVoe, born May 4, to Associate Professor Don DeVoe and his wife, Cassandra Michaud

Annika Grace Jackson, born June 11, to Assistant Professor Greg Jackson and his wife, Karin

Ian Alexander Picard, born October 23, to Assistant to the Director, CALCE, Ania Picard and her husband, Charles

What do you do with your free time?

About a month into the Fall 2002 semester we sent an email to our undergraduate majors, asking them what they like to do with their free time. Knowing that free time is a precious commodity for our students, we were eager to know what their interests were outside of mechanical engineering.

The two dozen responses received to date amazed and delighted us with the many activities, organizations, and hobbies our students take part in. Below are excerpts from some of the responses that we got. Clearly, our mechanical engineering majors are a busy group!

My school-related activities include being an active member of both the UM Linux User Group (UM-LUG) and the UM Electronic Dance Music Club (UM-EDMC). Non school-related activities include running a weekly drum 'n' bass netcast (it's a type of Electronic Music for those who aren't familiar), and DJ'ing here and there. I also take part in a couple Audi/Volkswagen groups around the area.
— William Jackson Allen

I am a sophomore, and I have bought several electric/gas vehicles to test. The campus is large so I really enjoy running around at high speed with an electric bike or scooter. I personally spend free playing computer games, console games, eating food, hanging out, talking to random people, going to seminars, watching movies, going to performances at the Clarisse Smith Performing Arts Center, and MOST importantly, working out at the gym.
— Michael Armani

I play baseball for the varsity team.
— Chris Davis

I play clarinet in the Marching Band, where I am a squad leader, and also play clarinet in the Basketball Pep Band.
— Anthony J. Downs

I am a third year mechanical engineering student. I am in Delta Gamma sorority. In addition I take night classes in pottery at the art and learning center.
— Michelle Flanagan

I am a junior/senior status ME. I am also an amateur artist. I take painting classes here at UMCP and I also spend some time outside of school in arts. I am part of Society of Hispanic Professional Engineers and serve as their publicist. I also am part of ACLA and ASME.
— Carlos E. Garcia

I am a senior here and am currently president of the Engineering Student Council and webmaster for ASME. I have been part of Gymkana, although not for long, and am a member of the Hillel on campus, and SAE. I also work part-time at the gym.
— Elisabeth Goldwasser

ROTC; fraternity; I work; and play intramural football.
— Marques Jackson

In addition to my second-year undergrad ME course load, I am an active member in the Hinman CEO's program, doing research with Dr. Gil Blankenship as part of the ASPIRE program, am a novice member of the University Men's Crew Team, and play viola in a student-run extracurricular chamber orchestra called Philharmonia, in addition to private lessons.
— Eric Jones

I devote a good portion of my time to my fraternity Alpha Tau Omega.
— Ben Kahane



I'm currently on the Advisory board for my College Park Scholars Group: Science, Technology, and Society (STS). I also TA a class for freshmen in STS. When I have free time, I work at the Institute for Research in Electronics and Applied Physics doing mechanical drawings with AutoCAD.
— David Ian Katz

I am a fourth year mechanical engineering major. For the last 2 years, I have been involved on campus as a Resident Assistant in Cumberland Hall with the College Park Scholars Program. I am also a member of the Asian American Navigators, a Christian fellowship on campus.
— Christina Kim

I am the treasurer of the Beta Omicron chapter of Phi Kappa Tau fraternity, I play intramural soccer with the team Demolition, I play the piano (jazz and classical), and in my free time I have traveled to 4 Spanish speaking countries (South America and Europe) to take classes and am now nearly fluent in Spanish.
— Eric Christopher Love

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Semiconductor Research Corp. Makes 3 Student Awards

Semiconductor Research Corporation has awarded three undergraduate students \$6,000 each as part of their Undergraduate Research Assistant Program. These three students, who are students of Associate Professor **Bongtae Han**, are **Pulak Datt**, **Elisabeth Goldwasser**, and **Anita Currano**.

In a letter to Dr. Han, SRC's Student Relations Manger Ginny Wiggins congratulated them on this award, stating that "We are very pleased that Anita, Pulak, and Elisabeth will continue in this program and look forward to exciting results during the upcoming academic year."

Ph.D. Student Mudalamane Honored

Mechanical Engineering Ph.D. student **Rajath Mudalamane** was recently honored by the Society of Plastics Engineers. At a ceremony at the May 2002 SPE Annual Technical Conference (ANTEC) in San Francisco, he was the recipient of the Lew Erwin Memorial Scholarship Award from the Extrusion Division of the SPE.

The Lew Erwin Scholarship was established by the Extrusion Division of the SPE in honor of the memory of Lew Erwin to support undergraduate and graduate research in the field of polymer extrusion. The 2002 award is for \$2500. In order to be considered for the award, students must be a member of SPE and submit an application that includes a CV, official academic transcripts, a brief essay on what enticed the candidate to enter the polymer field, and what are his/her current thoughts about a career in plastics; a succinct description in no more than 500 words of the Senior project, M.S. or Ph.D. project which this Scholarship will help support; and a recommendation and brief summary of capabilities with respect to polymer engineering by the candidate's research advisor.

Free Time

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I'm currently the Ellicott Community Legislator for the SGA; I serve on my hall council and on the board for religious Jews on campus. I'm also involved in Jewish outreach on campus. I'm in Quest, Gemstone and Honors.
— Isaac Pollack

I am a member of "The Punkin Chunkin Terps" and I am a bike mechanic at the Outdoor Rec Center, and a member of Phi Sigma Theta National Honor Society.
— Peter Protopappas

I am a senior ME. Besides spending a lot of time on the program's Future Truck, I am involved in the following:

1. Playing music in a progressive rock band.
2. Advocating peace and mobilizing against war in the campus' Peace Forum organization.
3. Studying, selling newspapers, and discussing internationalism, globalization, and oppression with the International Socialist Organization, which has a campus branch.
— Michael J. Scott

My main activity is volunteering at HELP Center. It is a peer counseling service on this campus.

HELP Center is an on campus peer counseling and crisis intervention hotline (301-314-HELP). We also accept walk-ins and provide free and confidential pregnancy tests. Basically it is trained students helping other students in any situation. These issues arise from being stressed about a final, to a relationship, to sexual assault and suicide. We are there to listen to the student, discuss options and give resources. Also, HELP Center provides a vast amount of resources including information and contacts. It is a student organization recognized by SGA, but is directed by the counseling center.

I met a lot of people my freshman year, but never felt part of an organization. I joined HELP Center thinking I would

be able to volunteer my time and help others, because I have been fortunate enough to have the help of others in times of distress and crisis. I had no clue what I really got into. I soon realized that I would be in a position to prevent suicides, aide students with decisions that would affect the rest of their lives, and be there for someone when they had no one to turn to. I was also part of an 80-member club that seems almost closer than a fraternity.

Seven semesters later I am now the President of HELP Center. I spend about 30 hours a week spending my time with administrative duties, taking phone calls and walk-ins, and visiting different shifts.

Don't get me wrong, its not all work. We have dinners, parties, and a heck of a lot of fun. I have made some of my closest friends there, and I will miss them dearly when I graduate.

Being a mechanical engineering major, I am certainly glad that a group like this exists especially during stressful times. Being part of this organization has allowed me to develop my people skills and leadership skills.
— Michael Sihvola

I'm the assistant captain of the club hockey team.
— Paul Sylvester

Club lacrosse; club waterpolo last year also.
— Brett Taylor

The only extracurricular that I do through school is intramural sports, most recently basketball in spring '02. I also work 30 hours a week as a waiter during the school year. This semester I'm on exchange at the University of Hawaii.
— Jonathan Urban

alumniNOTES

Link Receives ASTM Award

The ASTM (formerly known as the American Society for Testing and Materials) has awarded Dr. Richard E. Link their 2002 ASTM Award of Merit and named him a Fellow, which is the highest Society recognition for individual contributions to standards activities. Link, an associate professor of mechanical engineering at the United States Naval Academy and a resident of Arnold, Md., will receive the award for his “distinguished and sustained technical contributions to Committee E08 on Fatigue and Fracture, in particular his leadership of standards development and his role in establishing the experimental procedures most appropriate for elastic-plastic fracture mechanics test methods.”

An ASTM member since 1985, Link currently serves on the ASTM Committee on Publications and as an associate editor of the *Journal of Testing and Evaluation*, which is published by ASTM International. A contributor to numerous fracture mechanics papers published in ASTM special technical publications, Link has also made presentations about his work at E08 meetings.

On the standards development front,

Link has made significant contributions to E08 work through efforts to improve experimental procedures and approaches for interpreting measured quantities for standards measuring elastic-plastic fracture toughness. He has provided technical leadership resulting in the adoption of a common fracture toughness standard, and is an important contributor to standards related to elastic-plastic fracture mechanics theories.

In his current position, Link teaches courses in strength of materials, and computer-aided design and manufacturing. Before joining the faculty at the Naval Academy, Link worked as a research engineer at the Naval Surface Warfare Center, where he conducted basic and applied research programs in material characterization and the fatigue and fracture performance of metallic materials for naval and nuclear materials.

Link holds a B.S., an M.S., and a Ph.D. in mechanical engineering from the University of Maryland, College Park. He is, in addition to ASTM, a member of the American Society of Mechanical Engineers.

from the University of Maryland, she has been active with ASME, serving as Vice Chair (1997-1999) and Chair (1999-2001) of the Turkey Section. She has also served as General Secretary of the University-Industry Council, and currently serves as General Secretary of the International Center for Applied Thermodynamics, which publishes the quarterly *International Journal of Applied Thermodynamics*. She has been a member of Pi Tau Sigma, the mechanical engineering honor society, since 1977, and of the honor society Phi Kappa Phi since 1974. She has been the organizer and chair of several conferences, and in July 2002 served as Conference Chair of the ASME International's 6th Biennial Conference on Engineering Systems Design and Analysis in Istanbul, Turkey.

Stephen M. Graham, Ph.D. '78, joined the faculty at the United States Naval Academy as an Assistant Professor in August 2002. A student of Professor Emeritus R.J. Sanford, his areas of study were fracture mechanics and optical mechanics.

Craig Barker, B.S. '91, joined Wooden & Benson in June of 1997. As a Supervisor, his areas of expertise include audits of local governments, non-profit organizations, financial institutions and construction entities. Prior to joining Wooden & Benson, Barker was employed by the U.S. Department of Defense as a mechanical engineer for five years. Upon successful completion of the CPA exam in May of 1996, Barker was employed with a local public accounting firm where he specialized in audits of low-income housing projects. In January of 2000, Barker obtained the Certified Fraud Examiner (CFE) designation and has been approved by the Association of Certified Fraud Examiners Board of Regents for full membership and use of the designation. He is a member of the Maryland Associa-

tion of Certified Public Accountants, American Institute of Certified Public Accountants, and the Association of Certified Fraud Examiners.



Nilüfer Egrican Ph.D. '77, of Istanbul, Turkey, was elected as the next ASME Region XIII vice president at the Summer Annual Meeting in Minneapolis. Her term will begin in July 2003. ASME Region XIII encompasses those sections and members outside of North America.

Dr. Egrican is Professor and former Dean of the School of Mechanical and Textile Engineering at Istanbul Technical University, Turkey. The first female recipient of a Ph.D. in mechanical engineering

Mary E. Lacey, B.S. '78, former executive director of the Indian Head Division of the Naval Surface Warfare Center, was appointed to the highest civilian job within the center. Lacey is the center's technical director in charge of network installations in Indian Head, Carderock and Dahlgren, Virginia as well as in Indiana and California.

In November, Lacey gave a talk in conjunction with the Clark School's Women in Engineering Program on career paths in engineering for women.

Donald L. Muschlitz, B.S. '73, was named the Gilbane Building Company's 2001 Builder of the Year in the Central Region for his work as project manager, coordinating \$11.4 million in renovations to the 95-year-old Memorial Hall Building in Columbus, Ohio.

A Solar Decathlon Photo Album

From the initial planning stages and calculating maximum heating and power efficiencies, to pouring the foundation and raising the walls and roof, a group of Maryland undergraduates undertook what was probably the largest student project in the history of the University: The Solar Decathlon. This two-year undertaking, sponsored by the Department of Energy, culminated with 10 days of competition between 14 university teams on the National Mall in Washington, DC.

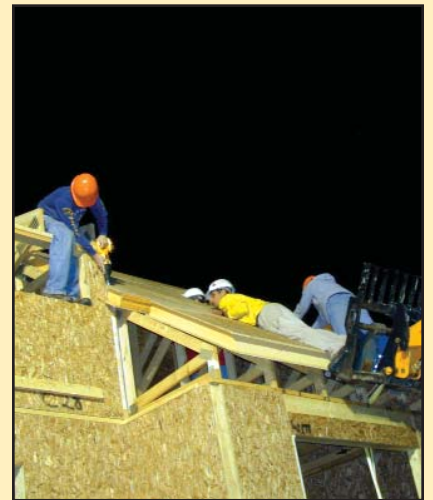
The team of 30 students, consisting primarily of Mechanical Engineering majors and advised by ME Associate Professor Jungho Kim, was thrilled to place fourth overall in the competition held from September 26 – October 6. In addition, the Maryland team placed first in the Hot Water and Energy Balance competitions.

For more information about the Solar Decathlon, go to the DOE's website, www.solardecathlon.org, or to the Maryland website at www.enme.umd.edu/solartech/.



Left: The building process begins: pouring concrete footers on a rainy day in April

Below: The team pulled more than a few "all-nighters" in readying the house for the competition. Here, students work on the roof panels late one May night.



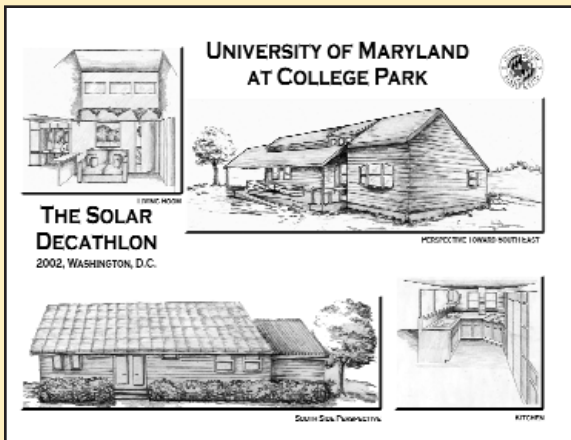
Above: The shell as it looked in June. The walls were pre-fabricated modular sections that fit together like a giant jigsaw puzzle. While the insulating properties of this type of building are much higher than regular stick-built homes, modular building also made building and transporting the house easier.

Left: The beginning: architectural drawings of the house

Right: Putting it together just to take it apart — a crane lifts a roof section off the house and onto a flatbed truck to be taken to the National Mall, while teammate Robyn Hladish looks on.



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Above: Construction begins again, only this time it's on the National Mall



Above: Maryland Pride — Past Project Manager and 2002 alumnus Andrew Hunt and Project Manager Alex Yasbek show off the Maryland colors

Right: Solar Decathlon officials evaluate Maryland's house from the comfort of its living room



Above: Even the transportation had to be solar-powered. Here, Alex Yasbek and Holly Campbell get ready to take their FreedomCAR for a spin



Above: Fame! Project Manager Alex Yasbek and Assistant Project Manager Catherine Buxton are featured on the cover of the September 27, 2002 Washington Post Weekend section



Above: Several members of the Maryland SolarDecathlon Team in front of their house on the National Mall. Visitors were allowed to tour their houses throughout the 10-day competition.

Metrics is published twice a year for alumni and friends of the Department of Mechanical Engineering at the A. James Clark School of Engineering.

Your alumni news and comments are welcome. Please send them to: Editor, Department of Mechanical Engineering, 2181 Glenn L. Martin Hall, College Park, MD, 20742-3035.

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Visit our Web site at www.enme.umd.edu

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Mark Your Calendar

The following lectures and conferences are taking place this Spring — be sure to mark your calendars! For additional events and activities, go to www.enme.umd.edu/news/calendar.html.

Leaders in Mechanical Engineering Lecture Series, Spring 2003

February 14	Arthur Bergles, University of Maryland/RPI
February 28	Earl Dowell, Duke University
March 7	Lex Smits, Princeton University
March 14	Hratch Semerjian, NIST
April 4	Gregory S. Chirikjian, Johns Hopkins University
April 11	Roger Howe, University of California, Berkeley
April 18	Fred Gouldin, Cornell University
April 25	Ron Adrian, University of Illinois

Please check our website, www.enme.umd.edu/dsl, for exact times, locations, and lecture titles.

February 21-23, 2003

Pi Tau Sigma National Convention

College Park, Maryland

For more information go to www.engr.umd.edu/organizations/pts



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