

MSU Union Building
Friday, December 9, 2005

MICHIGAN STATE
UNIVERSITY

the 22nd
**Design
Day**

DEPARTMENT OF
MECHANICAL ENGINEERING



JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LABOR & ECONOMIC GROWTH
OFFICE OF CAREER AND TECHNICAL PREPARATION
PATTY CANTU, DIRECTOR

DAVID C. HOLLISTER
DIRECTOR

Dear Students, Family Members, Friends from Industry, Alumni, Faculty and Staff

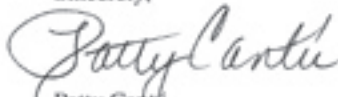
I am thrilled to have the opportunity to participate in the Department of Mechanical Engineering's 22nd Design Day at Michigan State University (MSU). This vibrant conference is a real spectacle because it not only showcases unique learning opportunities for 7th ~ 12th grade pre-collegiate students in the crucial fields of engineering design and innovation, but it also highlights the accomplishments of MSU students in courses requiring the creation and fabrication of machines and devices. Moreover, one of these courses involves collaborative partnerships between educators and numerous employers. That's impressive! Furthermore, a segment of this Design Day is dedicated to the education of pre-collegiate students. It's funded by the Dart Foundation. We join the MSU community in thanking them for "The W. A. Dart Foundation Day of Innovation & Creativity for 7th – 12th Grade Students".

This semester's conference showcases MSU students involved in Advanced Product Design, Heat Transfer Laboratory, Mechanical Design I and II, Mechatronic Systems Design, and Mechanical Engineering Design Projects. The Office of Career and Technical Preparation is committed to helping students identify and develop their career interests through authentic instruction and work-based learning opportunities. This conference is an exemplary example of how education and business working together support the development and enhancement of the workforce in our State and assist all individuals in their development of successful careers. Engineering / Manufacturing & Industrial Technology is one of the six major career pathways for student exploration in grades 9-12. The strength of Michigan's economy depends upon sustained growth in this area.

Michigan continues to experience a shortage of qualified engineers and well-educated scientifically-literate workers. These careers require workers who are intellectually fit for tomorrow's world – prepared to absorb new ideas, adapt to change, cope with uncertainty, perceive patterns, and solve unconventional problems. Students involved in this Student Design Conference have the opportunity to begin developing these skills, as well as to observe them in action in others.

Another key aspect of this outstanding program is the dynamic partnerships between MSU, its students, and industry partners who are grappling with challenging problems on a daily basis. Sponsors of the 19 projects for this semester are: Assembly Technology & Test, Inc., BorgWarner, Inc., The Dow Chemical Company, Eaton Corporation, General Motors Corporation, Gestamp U.S. HardTech, Inc., Louis Padnos Iron & Metal Company, Mahoney Environmental, Inc., Paratech, Inc., Robert Bosch Corporation, Shell Oil Company, Stryker Medical, Inc., Symmetry Medical Othy, Inc., Union Pacific Railroad Company, Visteon Corporation, and Whirlpool Corporation. Michigan State University and these business leaders have proven throughout the past decade that they can provide students with a meaningful capstone experience to their education that is grounded in real work situations – the best of both worlds!

On behalf of the Office of Career and Technical Preparation, I sincerely hope you enjoy the activities of the day and take the opportunity to speak with the students and business partners without whom this day would not be possible.

Sincerely,

Patty Cantu
Director



201 N. WASHINGTON SQUARE • LANSING, MICHIGAN 48913
PO BOX 33712 • LANSING, MICHIGAN 48909
www.michigan.gov • (517) 373-3373

Creativity
Mathematical Modeling
Product Liability
Psychological Impediments
Design-for-Manufacture
Professional Presentations
Intellectual Property
Hands-On Fabrication
Freehand Sketching
Citizenship
Machine Shop Practices
CAD-CAM
Engineering Drawing
Rapid Prototyping
Marketing
Business Practices
Tenacity
Report Writing
Computational Tools
Project Planning
Decision Matrices
Specifications

design 
program

So!
...what
did you *really* learn
in those design
classes?

Problem-Solving
Teamwork
Leadership
Ethics
Professionalism
Innovation
Entrepreneurship
Invention
Economics
Manufacturing
Self-Confidence
Safety
Legal Issues
Resourcefulness
Ergonomics
Industrial Health
Community Service
Technical Communication
Design-for-Assembly
Project Management
Integrity
Customer Sensitivity
Product Development
Interdisciplinary Design



Welcome to the Mechanical Engineering Department's 22nd Student Design Day!

A note from the **Design Coordinator**

This inspiring and spirited gathering of 1000 people with diverse life experiences – pre-collegiate and their schoolteachers, university students and their professors, parents and grandparents, and professional engineers and business leaders – provides an invigorating forum for celebrating the accomplishments of a new generation of engineering designers, innovators, and entrepreneurs!

The basis for this assertion is the contemporary curricula of the Mechanical Engineering Department's design classes and the meritorious educational activities at the Dart Foundation Day of Engineering Innovation and Creativity for 7th ~ 12th Grade Students where pre-collegiate students are confronted by hands-on projects requiring teamwork, problem-solving skills and communication. Undergraduates at the university are subjected to a suite of rigorous design-build-test courses demanding the judicious melding of analytical thinking with creativity and innovation in order to bring functioning mechanical devices to fruition. Graduating seniors, however, are subjected to more eclectic challenges, because they must wrestle with projects involving civic engagement and outreach scholarship that require significant technological literacy, critical thinking, ethical awareness, entrepreneurship, self-confidence and leadership.

Advancing knowledge

Transforming lives

**Invigorating companies
and communities**

Manufacturers in the State of Michigan are continuing to lose thousands of jobs as they struggle to survive in a rapidly-changing, brutally-competitive, global marketplace. The Department of Mechanical Engineering's response to this threat to our state's economic infrastructure is the graduation of a better-educated, enterprising cohort of Spartans with a "can-do" spirit. We are convinced that the profound life-experiences of these energetic graduates, acquired during their college careers, will enable them to not only make a significant contribution to our economy but they will also be able to assume leadership roles in society. The faculty and staff, as privileged members of a taxpayer-funded academic institution, believe it's our moral obligation to meet the pressing needs of the people. It's our duty to serve!

The accomplishments of previous generations of graduates in the professional world and the reputation of the Design Program for multi-disciplinary service-based learning have been responsible for a steady stream of support for this novel educational curriculum. Please join the MSU community in thanking the following organizations for their generosity: The Boeing Company, the W.A. Dart Foundation, Denso International America, Inc., General Electric Company, Honeywell, Inc., A.T. Kearney, Inc., Shell Oil Company and Union Pacific Railroad Company.

I trust that you will relish the opportunity to witness first-hand the spectacular accomplishments of our students at this end-of-semester celebration. Enjoy!

Cordially,

A handwritten signature in black ink that reads "Brian S. Thompson". The signature is fluid and cursive, with the first name "Brian" being more prominent.

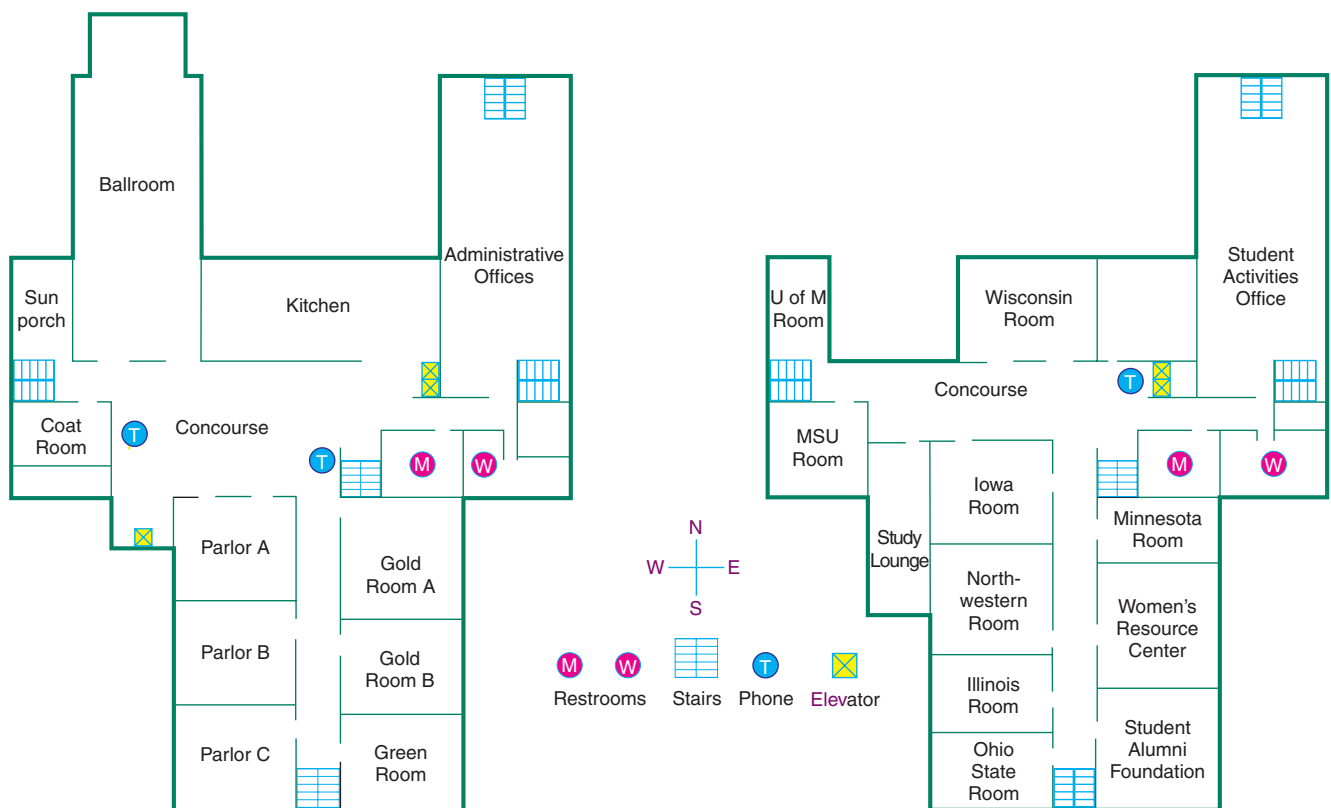
Brian S. Thompson
Professor, Conference Director, and Brochure Editor
MSU Outreach & Engagement Senior Fellow
Department of Mechanical Engineering
Phone: 517-355-2179
E-mail: Thompson@egr.msu.edu

Contents

	Page
Union Building Floor Plan.....	4
Conference Events Schedule for MSU Classes	5
ME 371 Mechanical Design I: <i>Prototypes of Diverse Machines and Mechanisms</i>	13
ME 412 Heat Transfer Laboratory: <i>Solar Coffee Reheater</i>	14
ME 456 Mechatronic Systems Design: <i>Prototypes of Commercial Products</i>	17
ME 471 Mechanical Design II: “ <i>Sip-and-Puff</i> ” <i>Controlled Fishing Rod for Quadriplegics</i>	18
ME 481 Mechanical Engineering Design Projects: Presentation Schedule – Iowa Room.....	24
<i>Gestamp US HardTech: Energy Analysis and Use</i>	26
<i>Eaton Corporation: Rynglok Tool Modification</i>	27
<i>Robert Bosch Corporation: Cap Design for Shipping and Leak Testing</i>	28
<i>Stryker Medical Corporation: Motorized Drive System for a Labor and Delivery Bed</i>	29
<i>Union Pacific Railroad Company: Load Measuring Device</i>	30
<i>Symmetry Medical Othy, Inc: Acetabular Reamer Design-for-Manufacturability</i>	31
<i>Assembly Technology & Test, Inc.: Leak Test Air Regulator Fluctuation Control</i>	32
<i>Shell Oil Company Children’s Humanitarian Project: Multiple Wheel Transportation Device</i>	33
<i>Visteon Corporation: Process Optimization to Reduce Ring Gear Nicks</i>	34
<i>Shell Oil Company Children’s Humanitarian Project: Wheels to Move</i>	35
ME 481 Mechanical Engineering Design Projects: Presentation Schedule – Ohio State Room.....	39
<i>BorgWarner Engine Group: Emissions/Thermal Systems: Optimization of Knit Lines in a Colling Fan</i>	40
<i>General Motors Corporation: Motor Vehicle Exhaust Noise</i>	41
<i>BorgWarner Engine Group: Emissions/Thermal Systems: Fan-drive Integration and Optimization Study</i>	42
<i>Mahoney Environmental, Inc.: Grease Yield Accuracy</i>	43
<i>Louis Padnos Iron & Metal Company: Improved Loading System of Freight Containers</i>	44
<i>Whirlpool Corporation: Advanced Ice-dispenser</i>	45
<i>Whirlpool Corporation: Design-for-Reliability of a Sealed System</i>	46
<i>Paratech, Inc: Re-design of the Pakhammer 90™</i>	47
<i>The Dow Chemical Company: Enhanced Gas Re-circulation System</i>	48
Alumni Quotes about the Design Program	55
ME 491 Advanced Product Design.....	59
Design Day Awards.....	61
W.A. Dart Foundation Day of Innovation & Creativity for 7th ~ 12th Grade Students	
Conference Activities.....	65
Timed Descent.....	66
Expanding Structures	66
MSU πτσ Honor Society Student Presentations	66
Finding Your Way to the Union Building	Inside Back Cover



MSU Union Floor Plan



Second Floor

Third Floor

Education is the best provision for old age.

Aristotle
(384–322 BC)



Conference Events Schedule for MSU Classes

Time	Gold Room A & B	Green Room	Wisconsin Room	Ballroom	Parlor A	Iowa Room	Ohio State Room	MSU Room
7:50		8:30 start	8:10 start		ME 481 Poster Session	ME 481 Project Presentations	8:15 start	
	9:00 start	ME 412 Competition	ME456 Project Presentations	8:30 start			ME 481 Project Presentations	
9:00	ME 371 Project Presentations			ME 471 Competition				
10:00								10:00 start
								ME 491 Project Presentations
12:00	LUNCH SECOND FLOOR CONCOURSE							
12:30	Demonstrations and Awards Ceremony in the Ballroom							

COURSE TITLES AND INSTRUCTORS

ME 371 – Mechanical Design I – Mr. Timothy Hinds
 ME 412 – Heat Transfer Laboratory – Professor Neil Wright
 ME 471 – Mechanical Design II – Professors Farhang Pourboghraat and Brian Thompson
 ME 456 – Mechatronic Systems Design – Professor Clark Radcliffe
 ME 481 – Mechanical Engineering Design Projects – Professor Brian Thompson
 ME 491 – Advanced Product Design – Mr. Robert Chalou

CONFERENCE ORGANIZATION

Professor Brian Thompson, Conference Director and Brochure Editor
 Jill Bielawski, Design Program Budget Director
 Craig Gunn, Operations Coordinator
 Lindsay Kredo, Student Assistant

ENGINEERING TECHNICIAN

Roy Bailiff

STAFF IN THE UNDERGRADUATE CENTER FOR DESIGN INNOVATION AND THE MACHINE SHOP

Daniel Klein, Eliot Radcliffe, Steven Richert, Trevor Ruckle and Gerard Westover

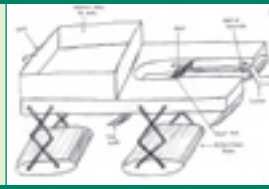
PHOTOGRAPHY

Iain Bogle, Harley Seeley, and Ashley Thompson

BROCHURE

Brochure design by Iain Bogle, based in part on an earlier design by Okemos Press, East Lansing, Michigan

Visit the design program website at <http://www.egr.msu.edu/classes/me481>



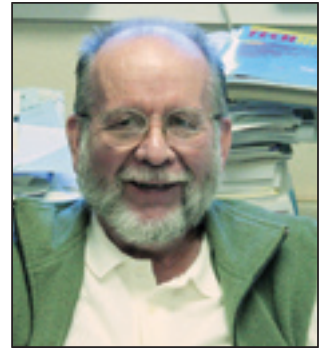
Ronald Averill



Giles Brereton



Robert Chalou



Gary Cloud



Alejandro Diaz



Abraham Engeda



Cevat Gokcek



Craig Gunn



Timothy Hinds



M. Koochesfahani



Patrick Kwon



Dahsin Liu



John Lloyd



Alfred Loos



Norbert Müller



Ranjan Mukherjee



Thomas Pence



Farhang Pourboghraat



Clark Radcliffe



Craig Somerton



Brian Thompson



Indrek Wichman



Neil Wright

MECHANICAL  ENGINEERING

Design Program

Instructors for the Design Program



THE DESIGN PROGRAM'S GOALS AND OBJECTIVES

- To educate junior- and senior-level mechanical engineering students in contemporary engineering design practices.
- To develop in our students the wider innovative competencies of the professional engineer, such as financial management, project management, team building, and working to a tight schedule.
- To provide manufacturers with a competitive advantage in the marketplace by flooding them with a deluge of out-of-the-box thinking, entrepreneurship, innovation and creativity. The essence of this town-and-gown enterprise is the synergistic confluence of ideas from seasoned industrialists and energetic, technologically adept undergraduates.
- To provide manufacturers with new ideas so that they are able
 - to develop new products
 - to improve production protocols
 - to increase the number of job opportunities
 - to increase market share and profitability
 - and to improve the quality of life in the communities where the companies are situated
 - to enhance existing products
 - to enhance workforce development
 - to stimulate company growth
 - to enhance economic development
- To undertake humanitarian projects in Michigan communities.
- To educate pre-collegiate students about the benefits of a college education, mechanical engineering practices, and the role of professional engineers in society.



Engineering your future...



**BOEING IS PROUD
TO PARTICIPATE IN
THE MECHANICAL
ENGINEERING
DEPARTMENT'S
22ND DESIGN DAY**



Engineering design is all about ideas. And all ideas have a beginning. That magical moment of inspiration. When the spark of an idea is combined with a high octane fuel comprising an indefatigable, indomitable, enterprising Spartan Spirit it triggers the combustion to power the engine of innovation. Subsequently something bold, daring and new emerges to satisfy the needs of Michigan's citizens. Something for the public good.

The moral test of a society is how that society treats those who are at the dawn of life – the children; those who are in the twilight of life – the elderly; and those who are in the shadows of life – the sick, the needy, and the handicapped.

– Hubert H. Humphrey (1911 – 1978)

THE SHELL CHILDREN'S HUMANITARIAN PROJECT

In the fall of 1998, humanitarian projects were added to the diverse set of options offered to students registered for the ME481 Capstone Design Projects Course. These special projects have triggered the development of unique devices to improve the quality of life for children affected by a range of diseases such as cerebral palsy or static encephalopathy.

This humanitarian initiative is part of a more eclectic, broader educational directive. One that extends beyond the confines of the classical engineering curriculum to include character development, leadership, citizenship, and service. With these types of projects, our students abundantly give of themselves in an emotionally charged environment but they are in turn showered with the numerous gifts associated with service to other human beings.

These projects require considerable entrepreneurial spirit, inventiveness, and of course, considerable innovation because they

Our task is not to make merely better farmers, or veterinarians, or engineers, but better citizens; capable of appreciating the finer things in life, able and willing to take their part in shaping the destiny of their country.

John A. Hannah (1902 – 1991)
12th President of MSU (1941-1969)

lack the dedicated support of a commercial enterprise: a manufacturer. However it is this very thing, this practical innovation, which was primarily responsible for America becoming preeminent while other nations failed. Thus we strive to foster that traditional American ingenuity that has served us so well for over 200 years!

In the past, these projects have been unfunded; but we are now delighted to announce that the Shell Oil Company has decided to underwrite this segment of our Design Program. We heartily applaud their generosity and the implicit vision in their decision! On behalf of all the children that will benefit from this donation, and of course their parents, who will witness the recovery, or enhanced performance, of their child: *Thank you!*





ME 371

9:00 – 12:00
Second Floor
Gold Room A & B

PROTOTYPES OF DIVERSE MACHINES AND MECHANISMS

INSTRUCTOR: Mr. Timothy Hinds

PROBLEM STATEMENT

Teams of students were required to design and manufacture machines and mechanisms using linkages, cams, and gears to accomplish tasks selected by each team. These mechanical systems are displayed in conjunction with a poster session where students demonstrate these prototypical systems. Pre-college students will select the best designs by interviewing the ME 371 students. Subsequently, the winning team will be presented with the *Sparty Plaque* that was designed and built by students at Holt Junior High School.

Section 1

Team 1

Anthony Beal
Agatha Bone
Andrew Brown
Christopher Brzak

Team 2

Melissa Carrier
Daniel Cassar
Meridith Cischke
Pinal Desai

Team 3

Scott Dosson
George Elliott
Jason Flanigan
Andrew Gillett

Team 4

Brandon Gulker
Michael Hagedorn
Kyle Jose
Zachary Kaltz

Team 5

Charles Kless
David Klipfel
Andrew Kosinski
Yip Leung

Team 6

Brad Lewis
Darius Libiran
Brielle Meadows
Kevin Miller

Team 7

Mahad Musa
Sean Noonan
Bethany Pickett
Alejandro
Reciosada

Team 8

Thomas Sanders
Jared Scott
Matthew Siero
William Smits

Team 9

Naomi Thomas
Ashley Wright
David Wyrembelski
Steven Yang



Section 2

Team 1

Joaquin Affonso
Mark Benton
Daniel Booker
Jimmy Chen

Team 2

Daniel Diebolt
Tiffany Dipetta
Joshua Ewing
Richards Gates

Team 3

Nurit Golenberg
Jesse Grove
Matthew Kimball
Chad Kleinow

Team 4

Samuel Leitkam
Allison Lewis
Jeffrey Mann
Uday Mathur
Kevin McKay

Team 5

Christoph Miller
Matthew Nagle
Keith Ortman
Keith Pigeon

Team 6

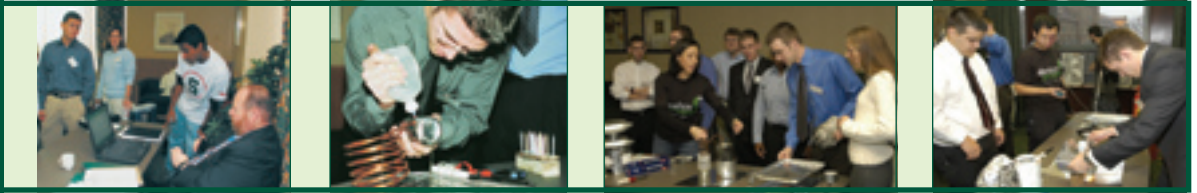
Stacie Proctor
Jay Richards
Ronald Rogers
Matthew Ryerkerk

Team 7

John Sanburn
Kevin Sherman
Nancy Sidrak
Andrew Siefert

Team 8

Ryan Spiekermann
Sandip Suvedi
Richard Utrup
Brendan Vidmar



SOLAR COFFEE REHEATER INSTRUCTOR: Professor Neil Wright

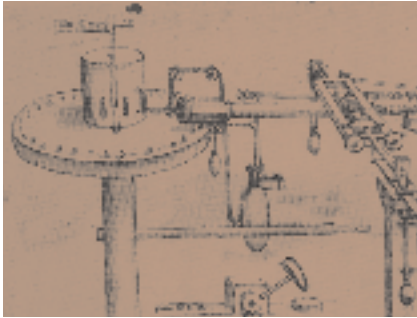
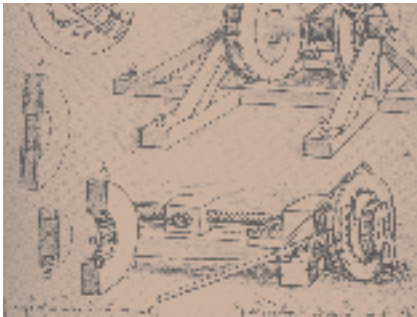
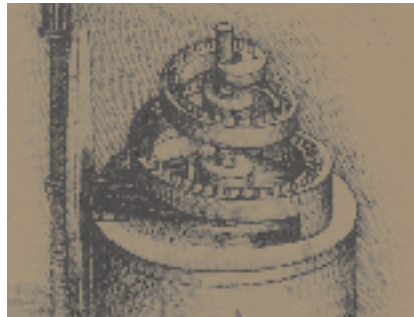
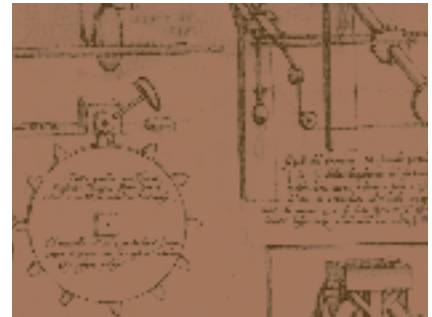
TA STAFF: Jeremy Metternich, Mayank Mittal, Kaniska Sharma

PROBLEM STATEMENT

Solar energy research and development was popular in the 1970's and 1980's when fossil fuel prices jumped and environmental protection became a central public concern. The recent spike in energy prices suggests that alternative energy technologies may again become popular. The Solar Coffee Reheater is an exercise in designing, analyzing, and building a solar collector that will heat 250 ml of room temperature coffee. The flow of coffee is by gravity only, and the sun is simulated by several heat lamps. Scoring is equally weighted between greatest energy rise, fastest heating time, and most accurate prediction of the results.

TIME	TEAM MEMBERS				
8:30	Steve Barwin	Neil Bokemeier	Alex Nee	Tom Tomovski	
8:40	Melanie Badgley	Jerrod Braman	Viraj Mokashi	Ryan Monroe	
8:50	Keith Bury	Dan Gipper	Rino Hilman	Joe Keech	Mark Mouland
9:00	Chris Bibby	Michelle Haddad	Dan Ionescu	Katie Presnell	
9:10	David Majeski	Ashley Miller	Kaija Siljander	Derek Thelen	
9:20	Ashley Jones	Carl Luyendyk	Matt Schwartz	Trung Tran	
9:30	David Gasparovich	Armon Mahajerin	Margaret McHale	Saleel Pradhan	
9:40	Jason Aerts	Sameer Ashaibi	Caryn Pytleski	Stephen Richert	
9:50	Ryan Hager	Andrew Hartsig	Nicholas Laplaca	Peng Lee	
10:00	Joseph Baldorim	Daisuke Matsuura	Shawn White	Danielle Wigley	
10:10	Amanda Danielson	Timothy Hunter	Matthew McKay	John Periat	
10:20	Arthur Gould	Eric Johnson	Trevor Winter		
10:30	Jesse Black	Logan Cook	Rob Huel	Andy McMaster	
10:40	Kevin Douglas	Scott Neideck	Ryan Shannon	Martha Smith	
10:50	Kaid Cousineau	Michelle Kimball	Sarah Overman	Marcus Rademacher	
11:00	Marc Kawecki	Kristen Papuga	James Rogers	Derek Strittmatter	
11:10	Matt Beacom	Chris Boltan	Brandon Dawson	Jordan Fountain	Young Park
11:20	Mike Fullerton	Marc Issner	Ciara Royal	Tim Terry	

ENGINEER & ARTIST & SCIENTIST LEONARDO DA VINCI



The Leonardo da Vinci Undergraduate Design Scholarship

This scholarship has been initiated by the Department of Mechanical Engineering to honor and encourage the adoption of the spirit and creative approach of a truly great man – Leonardo da Vinci. Born in Italy in 1452, da Vinci was the living embodiment of what would later be described as a Renaissance Man. Leonardo didn't restrict his interests to one field – and all his work benefited from this innovative philosophy. His drawings demonstrate the mingling of scientific precision with an intense, imaginative intellect and his notebooks reveal the immense range and versatility of this genius. He studied anatomy, he designed armored tanks and flying machines, he deduced a complete cosmology and he created works of art that, to this day, hang in museums around the world. Throughout his life Leonardo, retained an intense curiosity about virtually every field of human endeavor and his drawings reveal a brilliant mind which, among other things, imagined inventions, that would in some instances not be realized for hundreds of years after his death. Inventions such as the helicopter, the hang glider, the paddle boat, underwater breathing equipment and the ball bearing all appear in his detailed notes and drawings. He was a man who dared to dream and excel.

**MICHIGAN STATE
UNIVERSITY**

design 
program

EXAMPLES OF THE DESIGN PROGRAM'S GLOBAL ADVERTISING INITIATIVE



Ottawa, Canada



Chicago, Illinois

Golden Gate Bridge
San Francisco, California



Innsbruck, Austria



Mammoth Cave,
Kentucky



Blarney Castle, Ireland



Virginia Beach, Virginia

CHECK OUT SOME OF THE MANY PLACES
DESIGN PROGRAM T-SHIRTS & STUDENTS
APPEARED AROUND THE GLOBE – EXPOSING
THE WORLD TO MSU MECHANICAL
ENGINEERING. SEND YOUR DIGITAL SHOTS
TO DR. THOMPSON AND MAYBE YOU'LL
BE INCLUDED IN FUTURE DESIGN DAY
BROCHURES!

MECHANICAL  ENGINEERING
Design Program



ME 456

8:10–11:10
Third Floor
Wisconsin Room

PROTOTYPES OF COMMERCIAL PRODUCTS

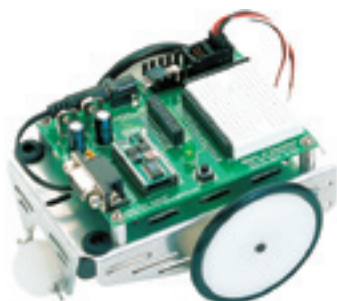
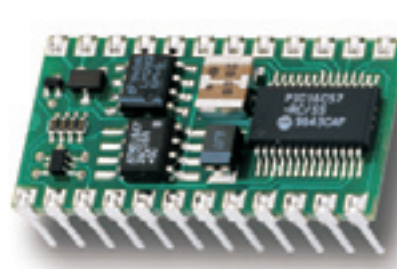
INSTRUCTOR: Professor Clark Radcliffe

TA Staff: Eliot Motato

PROBLEM STATEMENT

The students in this course were challenged to develop, test, and demonstrate an innovative design for a commercial product that synthesized mechanical, electrical and fluidic components plus imbedded microcontrollers. Typical applications range from automotive engine controls and robotic manufacturing systems to toys and consumer appliances such as microwave ovens. Each group will make a 15-minute presentation and demonstration of a working prototype of their product.

Time	Team Members
8:10	Joel Cook, Gerritt Meyers, Jason Peabody, Stephen Richert
8:30	Chad Boonyasith, Marc Kawecki, Joseph Keech, Steven Quinn
8:50	Christopher Matulis, Nicholas Muntz, Nicole Pawelec, Matthew Rivers
9:10	John Carter, Matthew McKay, Jaya Vallabhaneni
9:30	Jerrold Braman, Sebastian Dorado, Gregory Gartland, Andrew Schafer
9:50	Steven Gerrish, April Richardson, Ibrahim Sy, Trevor Winter
10:10	Chet Chamberlin, Peng Lee, Alan Rhodes, Derek Strittmatter
10:30	Amanda Danielson, Nobuyuki Fujiwara, Anil Kamat
10:50	Bradley Herbeck, Marcelino Hernandezserafin, Paul Podzikowski, Peter Truskoski



ME 456 Mechatronic Systems Design



“SIP-AND-PUFF” CONTROLLED FISHING ROD FOR QUADRIPLLEGICS

INSTRUCTORS: Professors Farhang Pourboghrat and Brian Thompson
TA Staff: Shalabh Srivasta

PROBLEM STATEMENT

Teams of students must design and build a prototype apparatus that will permit a quadriplegic to cast a fishing lure accurately, to retrieve that lure, to make additional casts without assistance, and finally to reel in and lift a heavy object simulating a fish on at least one cast. Each member of the winning team shall receive a Leonardo da Vinci Design Scholarship and a magna cum laude medallion.

COMPETITION SCHEDULE					
Time	Track	Team Members			
8:30	A	Christine Abele	Robert Bell	Adam Link	Mary McCullen
8:38	B	Andrew Ball	Geresa Franklin	Bradley Herbeck	Richard Humphries
8:45	A	George Bibbs	Adam Brenna	Kacy King	Ryan Monroe
8:53	B	Keith Bury	Kamal Hasan	Marcelino Hernandezserafin	Jason Palmer
9:00	A	Jeffrey Clemens	Shannon Hunt	Ashley Jones	
9:08	B	Joel Cook	Shawn Klann	Pranav Mokashi	Eric Truskoski
9:15	A	Danielle Duckworth	Grace Fitzpatrick	Cipto Joegiono	Richard Pospiech
9:23	B	Nobuyuki Fujiwara	Nicholas Pash	Caryn Pytleski	Alan Rhodes
9:30	A	Dmitriy Kats	Joseph Kondratek	Kevin Obeirne	Nathan Zeigler
9:38	B	Jacob Kirshman	Cody Squibb	Kalvis Terauds	
9:45	A	Eric Gawel	Christopher Matulis	Jason Peabody	
9:53	B	Kimberly Nankee	Jacquelyn Rondo	Jared Sickles	Brett Smith
10:00	A	Steven Pisarski	Matthew Rivers	Joseph Tideswell	Matthew Warner
10:08	B	Trevor Ruckle	Charles Spaniola	Justin Straley	Gerard Westover
10:15	A	Daniel Bak	Gerritt Meyers	Jamie Ueda	
10:23	B	Jeffrey Bazzi	Chad Boonyasith	Mikal Brewer	Kyle Krzemien
10:30	A	Jonathan Bendert	David Gasparovich	Andrew Hartsig	Aaron Huber
10:38	B	Matthew Carlson	Allison Mendel	Heather Pung	Jeffrey Steele
10:45	A	John Carter	Nathan Chase	Daniel Colleran	Nicholas Muntz
10:53	B	Raymond Gallagher	Eric Gorman	Daniel Isaac	Nicholas Strevel
11:00	A	Derek Gessert	John Hauska	Erika Kopulos	Jennifer Langridge
11:08	B	Chad Lindsly	Shawn Miller	Nicole Pawelec	Andrew White
11:15	A	Matthew Hartman	Timothy Locker	Thomas Pabst	Peter Schupska
11:23	B	Michael McDonnell	Daniel Mutschler	Kristen Penk	Megan Raidl

listen / learn / lead



innovate / inspire / motivate



**TECHNICALLY, IT'S GROWING UP AND GETTING A JOB,
BUT YOU STILL GET TO PLAY WITH TRAINS.**

Really big Union Pacific trains, with thousands of miles of track. Trains that, as part of a high-tech, Fortune 200 company, play an indispensable role in our nation's economy. That takes bright minds in the fields of finance, marketing and sales, information technology, supply and operations. So if you're ready to start your career doing meaningful work that you'll really enjoy, visit www.up.com for more information.

BUILDING AMERICA®



www.up.com



Shell is a proud sponsor of Michigan State University's Senior Design Program. Congratulations to the seniors who are the technical leaders of tomorrow.

Shell invests in winning partnerships. Like our technical partnership with Ferrari to develop the special fuels that have driven us to world championship titles in Formula One racing.

This belief in technical innovation is why Shell values and supports Michigan State's Senior Design Program. The elements of a successful design project – teamwork, communication, creative problem-solving, performance and results – are the very qualities that we seek in our future employees at Shell.

We are committed to attracting, training, developing and rewarding world-class people for this truly world-class business. We have opportunities in areas as diverse as Engineering, Geosciences, Supply Chain, Accounting/Finance and Trading. We acknowledge and reward ideas and solutions, and recognize and nurture each person's abilities. How far and how fast you develop within Shell depends on your individual contribution.

To learn more, visit your campus career center or our website.

Shell Companies in the U.S. are Equal Opportunity Employers.

www.shell.com/careers



Need
innovation?

Let MSU
students *help!*





MECHANICAL ENGINEERING DESIGN PROJECTS

PRESENTATION SCHEDULE — IOWA ROOM

Course Coordinator: Professor Brian Thompson

Academic Advisors: Professors Averill, Brereton, Cloud, Diaz, Engeda, Gokcek, Koochesfahani, Kwon, Liu, Lloyd, Loos, Müller, Mukherjee, Pence, Pourboghrat, Somerton, Thompson, Wichman, Wright and Mr. Gunn

Time	Sponsor	Industrial Advisor(s)	Academic Advisor	Project Title
7:50	Gestamp US Hardtech, Inc.	P. Preston	I. Wichman	Energy Analysis and Use
8:15	Eaton Corporation	K. Pike W. Thelen	G. Cloud	Rynlock Tool Modification
8:40	Robert Bosch Corporation	S. Ahsan J. Haley S. Soubjaki	A. Loos	Cap Design for Shipping and Leak Testing
9:05	Stryker Medical, Inc.	C. Siler	B. Thompson	Motorized Drive System for a Labor and Delivery Bed
9:30	Union Pacific Railroad Company	S. Slobidsky	C. Gokcek	Load Measuring Device
9:55	Symmetry Medical Othy	J. Hurd	R. Averill	Acetabular Reamer Design-for-Manufacturability
10:20	Assembly Technology & Test	J. Markey	P. Kwon	Leak Test Air Regulator Fluctuation Control
10:45	Shell Oil Company Heartwood School	M. O'Brien	R. Mukherjee	Shell Oil Company Children's Humanitarian Project: Multiple Wheelchair Transport Device
11:10	Visteon Corporation	G. Kotes L. Rodriguez	F. Pourboghrat	Process Optimization to Reduce Ring Gear Nicks
11:35	Shell Oil Company M.E. Beekman Center	S. Davenport	C. Somerton	Shell Oil Company Children's Humanitarian Project: Wheels to Move

DENSO

Visionary Engineering + Innovative Partnerships

We work to provide automotive systems and components to our customers that excel—not only in terms of quality, functionality and cost performance, but also the degree to which the products incorporate environmental considerations.

In 31 countries around the world, DENSO's 90,000 employees are doing their part to produce green technologies to reduce the environmental impact of automobiles. In North America, DENSO employs 14,000 people at 26 locations.

For more about DENSO's environmental initiatives, career opportunities and product line, visit www.densocorp-na.com.



Engine Related



Body Electronics



Driving Control & Safety



Climate Control



EC / Sensors



Info & Communications

ENERGY ANALYSIS AND USE

Gestamp US HardTech is an automotive supplier to General Motors, Ford Motor Company, Daimler Chrysler and BMW. Gestamp uses the technology of hardening boron steel in connection with compression stamping to develop and manufacture safety and structural components. The process uses press hardening technology which produces narrower tolerances, reduced installation problems and reduced weight. Gestamp also meets stringent safety requirements, which provide lighter, more cost-effective solutions than alternative methods. HardTech is TS 16949 and ISO 14001 certified. They are committed to high environmental standards in efforts to reduce possible impacts of their operations on the environment.

The HardTech plant in Mason currently has four furnaces containing from forty-four to seventy-six burners. These furnaces are used to heat steel blanks before being stamped into the final product. The goal of this project was to assess the energy available from the furnace exhaust gases and to determine the most efficient use of this resource. Considering the current issues regarding the need for improvement of resource usage and the need to control harmful emissions, this project will allow the Gestamp US HardTech Student Design Team to aid in reducing harm to the environment while reducing operating costs at HardTech.

The waste heat recovered from the furnaces at Gestamp US HardTech can be used in two different ways: direct heating, or electricity generation. To solve this problem the team analyzed heat restoration devices and used mathematical modeling techniques to develop alternative solutions.

... The Gestamp US HardTech Student Design Team



US HARDTECH



This project is part of our commitment to the environment and supports our efforts centered on ISO 14001. The results could reduce costs while reducing the impact on the environment.

Phil Preston
EH & S Manager
Gestamp US HardTech, Inc.

Team Members and Home Towns

Melanie Badgley
Higgins Lake, Michigan

Matt Beacom
Auburn Hills, Michigan

Mike Fullerton
Clinton Township, Michigan

Ciara Royal
Detroit, Michigan

Industrial Sponsor

Gestamp US HardTech, Inc.
Mason, Michigan

Industrial Advisor

Mr. Phil Preston

Academic Advisor

Professor Indrek Wichman

RYNGLOK TOOL MODIFICATION

Eaton Aerospace is a leading designer, manufacturer, and integrator of fluid power generation and conveyance. For eighty years, Eaton has been the innovator and pioneering leader in the development of hydraulics and motion control components and systems. One of Eaton's many products is a *Rynglok*, along with the associated assembly tool. A *Rynglok* is a fastener used to connect hydraulic tubing junctions in aircraft. To correctly install a *Rynglok* fastener, it must be properly positioned on the tube to which it is connected and then pressed into place using a pneumatic *Rynglok* tool. A key feature of the *Rynglok* assembly is the requirement that the tool only requires 180-degree contact with the *Rynglok* to function effectively. This makes operation much simpler for technicians. However, having only 180-degrees of contact surface allows the tool to be improperly positioned, and this can result in an undesired deformation of the *Rynglok*. Currently an additional bridge, providing 360-degrees of contact, is used to increase support and eliminate possible misalignment. The addition of this bridge nullifies the benefits of the advertised 180-degree tool functionality.

The problem proposed to the *Eaton Aerospace Student Design Team* was to modify the design of the current *Rynglok* tool to incorporate the benefits of the addition bridge, while keeping the 180-degree functionality. This new design will permit consistent proper alignment of the tool on the fitting, while adding no additional steps to the process. The new design will also add additional support during *Rynglok* installment. Our proposed solution is to create an automatic bridge function to the tool, using mechanical actuation.

...The Eaton Aerospace Student Design Team



Industrial Sponsor

Eaton Aerospace Corporation
Jackson, Michigan

Industrial Advisors

Mr. Kevin Pike
Mr. William Thelen

Academic Advisor

Professor Gary Cloud

Team Members and Home Towns

Sameer Ashaibi
Hamtramck, Michigan

David Heckel
Rochester Hill, Michigan

Peng Lee
Detroit, Michigan

Shawn White
Saginaw, Michigan

The successful completion of this project would result in a cost and weight reduction of the final assembly. Weight reduction is extremely important to our customers in the aerospace industry. The reduction in cost and weight could also potentially increase our market share, if it were large enough to influence customers who currently buy from our competitors.

Kevin Pike
Senior Program Manager
Eaton Corporation



CAP DESIGN FOR SHIPPING AND LEAK TESTING

Founded in 1886 in Stuttgart, Germany, the *Robert Bosch Corporation* operates on every continent throughout the world. While maintaining a strong presence within the automotive sector, *Bosch* also produces a wide variety of industrial products and consumer goods. Through an outstanding reputation for quality, *Bosch* has expanded its North American operations to over 80 locations and the company employs over 242,000 people in over 50 countries worldwide.

Bosch currently uses vinyl caps to protect intake manifold fittings from dust and debris during shipping, and to retain pressure throughout cold testing. The caps are manually placed on three distinctly different fittings when the manifolds are produced, and they are removed following the final placement of the manifold on the vehicle.

Currently, the caps in production cause operator ergonomic issues during removal, and they frequently fail to retain the required pressure. The project goal was to find an optimal cap design that will allow for easy removal during assembly, while meeting the pressure requirements. Due to the short product life-cycle of the cap, as it is discarded after a single use, cost was a large factor in the new design. This factor, though very important, does not outweigh the need for a reliable cap to meet the design specifications set at the onset of this project.

To meet the goals, testing fixtures were designed and built to assist in the benchmarking of existing caps as well as prototype caps. The results from the benchmarking were used to determine the final design.

....*The Robert Bosch Corporation Student Design Team*



BOSCH



The project will permit young minds to provide the *Robert Bosch Corporation* with fresh ideas, innovation and creativity in the realm of automotive parts. When these ideas are melded with the expertise and experience of the *Bosch* engineering staff, we are confident that together we can provide dramatic benefits to our automotive customers. In addition, the *Bosch*-MSU partnership surely benefits all parties involved.

Sam Soubjaki
Senior Design/Development Engineer
Robert Bosch Corporation

Team Members and Home Towns

Daniel Carps
Farmington Hills, Michigan

Ashley Miller
Howell, Michigan

Martha Smith
Milford, Michigan

Derek Thelen
Westphalia, Michigan

Industrial Sponsor

Robert Bosch Corporation
Farmington Hills, Michigan

Industrial Advisors

Mr. Sohail Ahsan
Mr. John Haley
Mr. Sam Soubjaki

Academic Advisor

Professor Alfred Loos

MOTORIZED DRIVE SYSTEM FOR A LABOR AND DELIVERY BED

Today, *Stryker Medical* is one of the preeminent medical products and service providers in the world. Company growth has come from offering an unparalleled variety of high quality, innovative products and services. One of *Stryker Medical's* growing product lines is that of the labor and delivery (LD) bed.

The LD bed meets a birthing mother's need of resting, transport, and infant delivery during a hospital stay. Sometimes, for special or emergency procedures, a birthing mother needs to be quickly transported to a different location in the hospital. The current LD bed design requires that a clinician manually push and maneuver the mother on the bed down a hospital hallway. This has created a growing market need to incorporate a motorized drive system on the LD bed. Studies show that more than half of all nursing injuries are a result of overexertion. With the combination of the LD bed and patient weighing up to 1200 pounds, a successfully designed drive system could make patient transport almost effortless, while helping to reduce staff injuries.

The *MSU Design Team* collaborated with *Stryker Medical* engineers to develop design specifications from which creative and innovative solutions were derived. These solutions, primarily driven by safety, reliability and performance, integrate both complex and easily implemented concepts.

To effectively identify and solve the design problems, local hospitals were contacted and nurses were surveyed to obtain the user's perspective. With the team's innovative concepts and analysis, *Stryker Medical* will have the ability and options to implement the new motorized drive system onto the current labor and delivery bed.

...The *Stryker Medical Corporation Student Design Team*



stryker®

Industrial Sponsor

Stryker Medical Corporation
Kalamazoo, Michigan

Industrial Advisor

Mr. Chris Siler

Academic Advisor

Professor Brian Thompson

Team Members and Home Towns

Neil Bokemeier
Okemos, Michigan

Michael Godlew
Beverly Hills, Michigan

Carl Luyendyk
Grand Haven, Michigan

Devin O'Connor
Okemos, Michigan

There is a market need to have a motorized drive system on a labor and delivery bed to assist hospital clinicians when moving a birthing mother from one area of a hospital to another. More than half of all nursing injuries are a result of overexertion. A motorized drive system could make patient transport almost effortless, and will help reduce back injuries in the hospital environment.

Chris Siler
Design Engineer R&D
Stryker Medical Corporation



LOAD MEASURING DEVICE

The *Union Pacific Railroad Company* has a rich history dating back to 1865 when the first rail was laid in Omaha, Nebraska. Subsequently *Union Pacific* has evolved to cover 23 states and it is the largest railroad in North America. Each day a very wide range of commodities is shipped by trains and these include chemicals, coal, food, metals, minerals and automobiles.

These commodities come in various shapes and sizes; therefore the external dimensions of loads must be carefully measured prior to departure in order to ensure that they do not contact structures or objects adjacent to the tracks. The current practice is for at least two *Union Pacific* employees to perform these measurements. The process is time-consuming and it also has an element of danger because loads can be as high as 25 feet above the ground and the operator must climb a ladder and use a plum line and tape measure to obtain the relevant dimensions.

The objective of the project was to design a portable load-measuring device that could be used by a single operator to quickly measure the relevant dimensions. Many options were explored and subsequently evaluated before transforming the best vision into reality.

...*The Union Pacific Railroad Company Student Design Team*



The main benefit of this project would be to improve the safety of measuring loads by eliminating or reducing the need to carry and climb ladders. It could reduce the time required to carry out this work. If the device were capable of storing and downloading measurements, it would also reduce the chance for error in transferring this information. The accuracy of the information is critical to prevent the load from coming in contact with structures or other fixed objects near the tracks on which it will move. This device could also reduce the time necessary to make these measurements.

A successful device would be placed into a field test immediately after completion. On the *Union Pacific* we measure approximately seventy-five of these loads on a daily basis throughout our system. This tool could also become available to other North American railroads, which have similar needs.

Steve Slobidsky, Mechanical Engineer
Union Pacific Railroad Company

Team Members and Home Towns

Anil Kamat
Mumbai, India

Paul Podzikowski
Ferndale, Michigan

Steven Quinn
Midland, Michigan

Mike Syrylo
Hartland, Michigan

Industrial Sponsor
Union Pacific Railroad Company
Omaha, Nebraska

Industrial Advisor
Mr. Steve Slobidsky

Academic Advisor
Professor Cevat Gokcek

ACETABULAR REAMER DESIGN-FOR-MANUFACTURABILITY

Symmetry Medical Othy manufactures acetabular reamers, which are biomedical devices used to shape the cup-shaped cavity at the base of the hipbone, called the acetabulum, into which the ball-shaped head of the femur fits. These tools are hemispherically shaped and have a helix of cutting holes spiraling outward from the center to near the base. They are used to carve out a section of the acetabulum so that a prosthetic device can later be fitted into it.

Volume requirements for acetabular reamers are increasing rapidly and the 5-axis laser machines currently used in a portion of the manufacturing process is an expensive constraint. The goal of this project is to develop a new manufacturing process that is not dependant on the 5-axis laser machine in which the final product design does not change.

The *Symmetry Medical Othy Design Team* determined that the best process by which this goal could be accomplished was to cut the holes into a flat plate of metal and then form the metal into a hemisphere. As with all materials, steel deforms when it is bent and the team optimized the initial hole positions so that after being deformed, each hole was in the desired position.

... *The Symmetry Medical Othy Student Design Team*



Industrial Sponsor

Symmetry Medical Othy, Inc.
Warsaw, Indiana

Industrial Advisor

Mr. Jeff Hurd

Academic Advisor

Professor Ronald Averill

and Home Towns

Dan Ionescu
West Bloomfield, Michigan

Marc Kawecki
Belleville, Michigan

Brandy Norman
Southfield, Michigan

Logan Scott
Columbiaville, Michigan

Danielle Wigley
Howell, Michigan

Symmetry Medical is a market leader in Acetabular reamer manufacturing with almost half of the non-captive domestic market. Manufacturing currently is very time intensive and very capital intensive. This project may allow *Symmetry* to increase capacity to capture an additional 20 percent of the market with little capital increase, lower costs, and shorter lead times.

Jeff Hurd
Six Sigma Quality Engineer
Symmetry Medical Othy, Inc.



LEAK TEST AIR REGULATOR FLUCTUATION CONTROL

Asssembly Technology & Test (ATT) is a worldwide leader of automotive systems and solutions fundamental to the assembly, testing, and handling of a wide variety of automotive, consumer, industrial and pharmaceutical products. One method of testing performed by ATT is called air leak testing.

Leak testing performed with air has an inherent problem due to the nature of test regulators. A standard regulator set at a test pressure tries to keep the air pressure regulated based on the input supply from the plant system. As the input air pressure fluctuates, so will the regulated pressure, causing fluctuations in the test results. This fluctuation in the output causes additional test time, a need for additional equipment, and test results that vary due to the unstable conditions. Therefore, the objective of this project was to develop an affordable test circuit utilizing new or existing products and technologies in order to provide a stable air pressure supply to the test circuit.

Assembly Technology & Test has approximately twenty test units in the field that have regulators experiencing fluctuation problems. Developing a new leak air test circuit, which will eliminate these fluctuations, will benefit their customers by providing stable test results and reducing test time. The Assembly Technology & Test Student Design Team assisted with this by providing a better quality product that will reduce the necessary investment, with fewer machines needed to meet production requirements.

...The Assembly Technology & Test Student Design Team



Assembly Technology & Test, Inc. currently has at least 20 test units in the field that have regulators experiencing fluctuation problems that can degrade the accuracy of the tests. Developing a test air regulator circuit that eliminates these fluctuations would be of benefit to our customers in providing stable test results, with a possible reduction in test times. This would provide a better quality product that could reduce investment, with fewer machines required to meet production requirements.

John Markey
Product Engineering Specialist
Assembly Technology & Test, Inc.

Team Members and Home Towns

Chris Bibby
Webster, New York

Marc Issner
West Bloomfield, Michigan

Kate Presnell
Mt. Pleasant, Michigan

Steve Richert
Wayne, Michigan

Industrial Sponsor

Assembly Technology
& Test, Inc.
Saginaw, Michigan

Industrial Advisor

Mr. John Markey

Academic Advisor

Professor Patrick Kwon

A SHELL OIL COMPANY CHILDREN'S HUMANITARIAN PROJECT: MULTIPLE WHEELCHAIR TRANSPORT DEVICE

Hearthwood School was built and established in 1978. It is a school reserved for students ages 3-26 with developmental disabilities including cognitive impairment, autism, and severe multiple impairment. The school's curriculum includes academics, personal care, communication, mobility, domestic activities, and community involvement as well as vocational exploration and preparation. *Heartwood School* serves all twelve school districts in Ingham County and has an enrollment of 106 students, with over 25 dependent on wheelchairs.

Due to the high number of students, dependent on wheelchairs, requiring caregiver assistance, it is often difficult for classes to be mobilized. With the low caregiver-to-student ratio, transporting a group of students from one place to another is time consuming, inefficient, and inconvenient for the caregivers. This constraint lowers the potential for learning, stimulation, socialization, and recreational opportunities for the students of *Heartwood School*. Furthermore, some caregivers attempt to avoid this problem by transporting multiple wheelchairs manually, which present dangers not only to the students, but also to the caregivers themselves. These problems have created concern for *Heartwood School* and an opportunity for the *Heartwood School Student Design Team*.

The main objective was to create a new device that could be used to safely transport multiple wheelchair-dependent students of *Heartwood School*. Successful completion of this objective would greatly improve safety and the quality of many students' education. Due to the open-ended nature of this problem, there were numerous possibilities discussed. After proper analysis and deliberation, the optimal design was chosen and pursued.

...The *Heartwood School Student Design Team*



Industrial Sponsors

Shell Oil Company
Houston, Texas

Heartwood School
Mason, Michigan

Industrial Advisor
Ms. Marcia O'Brien

Academic Advisor
Professor Ranjan Mukherjee

Team Members and Home Towns

Stephen Casey
Lansing, Michigan

Timothy Hunter
Troy, Michigan

Eric Keefe
Linden, Michigan

Young Park
Saline, Michigan

Bryan Wiedyk
Bay City, Michigan

This project will enhance the educational day of 30-35 wheelchair students at *Heartwood School*, or a little less than one third of our population. It will allow for increased stimulation, socialization and leisure/recreation and educational opportunities for each individual student. It will also increase safety of students as this device will allow staff to get students from one place to another in a more timely, efficient manner.

Marcia O'Brien
Principal
Heartwood School



PROCESS OPTIMIZATION TO REDUCE RING GEAR NICKS

Recognized as a leader in the automotive supplier industry, *Visteon Corporation* strives to satisfy customer needs. *Visteon* is a global enterprise with nearly a century of automotive engineering and design expertise and more than 80 years of experience in accomplished integrated systems. The customer base includes the 19 largest vehicle manufacturers in the world. With more than 50,000 employees, they achieved revenues of \$18.7 billion in 2004. Headquartered in Van Buren Township, Michigan, United States, *Visteon* encompasses a global system with more than 170 technical, manufacturing, sales, and service facilities in 24 countries.

The *Visteon Corporation Student Design Team* was assigned the task to optimize an existing, or combination of production processes, within gear manufacturing to reduce the amount of ring gear nicks. Ring gear nicks internally affect the manufacturing process and are generated throughout various stages of the process.

The intent of this project was to reduce gear nicks by 50 percent which will have a direct impact on customer satisfaction and enable *Visteon* to improve quality metrics.

...*The Visteon Corporation Student Design Team*



For the 9.75 inch Large Truck Axle Program (F-150, Expedition, and Navigator), this manufacturing defect costs approximately \$10,000/month in labor hours, pieces lost (scrap), cycle losses (FTT). There are also additive costs associated with this manufacturing defect in other value stream operations, which also can benefit from optimizing the process to reduce ring gear nicks. *Visteon's* goal is to reduce gear nicks by 50 percent.

George Kotes
9.75 inch Premium Gear Upgrade Engineer
Visteon Corporation

Team Members and Home Towns

Steve Barwin
Sterling Heights, Michigan

Jason Hunter
Okemos, Michigan

Tim Terry
Shelby Township, Michigan

Tom Tomovski
Grosse Pointe, Michigan

Industrial Sponsor

Visteon Corporation
Sterling Heights, Michigan

Industrial Advisors

Mr. George Kotes
Mr. Luis Rodriguez

Academic Advisor

Professor Farhang Pourboghtrati

A SHELL OIL COMPANY CHILDREN'S HUMANITARIAN PROJECT: WHEELS TO MOVE

The Marvin E. Beekman Center is a center based school program intended for children with various physical and cognitive impairments. The impairment that the student design team was dealing with is cerebral palsy, a group of chronic disorders impairing control of movement.

The project that was assigned to the team was to design and build a mobility device that allows children with cerebral palsy to use leg extension to propel the device. In order to present these children with some independent mobility, a cycle has been designed and constructed on the basis of adjustability, a trouble-free steering and braking system, and ergonomically designed seating that provides good trunk support for the child's comfort.

Over the years, cycles have been developed which allow the rider to rest on their chest while kicking back on the pedals and using the machine's steering handle for additional support. Such an orientation not only lacked the desired comfort level for the children, but it also lacked the ability to adjust to multiple students. For this project, a cycle was created that utilized a recumbent adjustable seat for additional comfort, a modified slider steering system, and a gearing scheme, which permits variable resistance while pedaling the machine. This new design is successful, as clearly evidenced by the immense satisfaction of the children.

... The Marvin E. Beekman Center Student Design Team



Industrial Sponsors

Shell Oil Company

Houston, Texas

Marvin E. Beekman Center

Lansing, Michigan

Industrial Advisor

Ms. Susan Davenport

Academic Advisor

Professor Craig Somerton

Team Members and Home Towns

Kevin Douglas
Burt, Michigan

Nicholas LaPlaca
Dearborn, Michigan

Nicholas Periat
Lambertville, Michigan

Saleel Pradhan
Okemos, Michigan

The Beekman Center is a center-based school program. The students have various physical and cognitive impairments and range in age from 2.5 - 26 years of age. The specially designed mobility device will meet the needs of the more severe physically involved students. It will give them a way for some independent mobility. The adjustability will allow for numerous students to use the equipment. This mobility device will impact the lives of many physically impaired students at the Beekman Center.

Susan Davenport
MSPT
Marvin E. Beekman Center



innovate / create / lead



Industrial Partners

FROM THE RECENT PAST

Aerotech, Inc.
Alcoa/Ford Motor Company
Air Hydraulics, Inc.
Airmaster Fan Company
American Coil Spring Company
Applied Process, Inc.
Assembly Technology & Test, Inc.
A. T. Kearney
Autocam
Roger Bandeen, DDS, MS, PLLC
Bayer AG
Behr America, Inc.
Bekum America Corporation
Big Cat Human Powered Vehicles
BorgWarner
Bundy Corporation
Mari Rodriguez-Cabello
Caraustar-Saginaw
Chippewa Middle School
Consumers Energy Corporation
Crankshaft Machine Group
Cummins Engine Company/Ford
Dana Corporation
Delphi Automotive Systems
Delphi Saginaw Steering Systems
Denso
DePuy Orthopaedics, Inc.
Detroit Diesel Corporation
Dilesco Corporation
Dow Automotive, Inc.
Dow Chemical Company
DT Industries: Assembly & Test
DynaTorque, Inc.
Eaton Corporation
Efficiency Production, Inc.
EDS/Delco Electronics
EDS
Engine Power Components, Inc.
Environmental Consulting & Tech.

ESPEC Corporation
Fasco DC Motors, Inc.
FCI Automotive
FIAMM Technologies, Inc.
Ford Motor Company
Ford/Visteon Automotive Systems
Gast Manufacturing Corp.
Geämi Limited
Geiger Technic, Inc.
GE Industrial Systems
GE/Mid-Michigan Fabrication
GE Motion Systems
General Motors Corporation
Gilreath Manufacturing, Inc.
Gougeon Brothers, Inc.
Granco Clark
Greater Lansing UN Association
Herman Miller
Holland Signaal Apparaten
Holt Junior High School
Honeywell
Howmet Castings Corporation
Impression 5 Museum
Ingersoll-Rand
Integrated Metal Technology
ITT Automotive
The John Henry Company
Johnson Controls, Inc.
Lamb Machining Systems
Lamb Technicon
Lear Corporation
Link Engineering
Louis Padnos Iron & Metal Co.
Magline, Inc.
Mahoney Environmental, Inc.
Mann + Hummel Automotive, Inc.
McDonnell Douglas Aerospace
Meridian Incorporated
Michigan Automotive Compressor

MSU Athletics Department
MSU College of Veterinary Medicine
MSU Physical Plant
Midbrook, Inc.
Modern Metal Processing
Northern Tube, Inc.
O & S Manufacturing
Okemos Seahawks Aquatic Club
Paratech Incorporated
Pemco Die Cast Corporation
The Post Family
Production Engineering
Progressive Dynamics, Inc.
Quantum Consultants, Inc.
Rennco, Inc.
Robert Bosch Corporation
Rowe International, Inc.
Shell Oil Company
Simpson Industries
StageRight Corporation
Stryker Medical Corporation
SUSPA, Inc.
Symmetry Medical - Othy
Tecumseh Products Company
3M Corporation
Trippensee Corporation
TRW Automotive, Inc.
Union Pacific Railroad Company
VCF Films
Viatic, Inc.
Visteon Corporation
Warner Electric/Dana Corp.
Whirlpool Corporation
Wolverine Vinyl Siding Corporation



What 100 Manufacturing Jobs Mean to a Town

\$1,948,353*
more personal
income each year

64
more jobs in
other local
economy sectors

102
families added to
the community

Reduced
welfare
obligations

7 new
businesses
formed

Payment of rent
or mortgage on
100+ homes or
apartments

Income to
support
202
people

\$245,000
average increase in
property tax revenues
(decrease of \$13/person/year)

\$1,477,453*
more in annual
retail sales

*According to a study by the Forecast Section, Chamber of Commerce of the United States. The study, conducted after the 1980 census, tracked six test communities wherein manufacturing employment was increasing. The study also includes a Georgia study that found an average increase of \$245,000 in property tax revenues for every 100 new manufacturing jobs in a community, which is a reduction in property taxes of about \$13.00 per person per year. The Georgia study also indicated that the increase in manufacturing jobs in a community resulted in a reduction in the cost of local welfare obligations, thus reducing certain government expenditures.



ME 481

8:15 – 12:00
Third Floor
Ohio State Room

MECHANICAL ENGINEERING DESIGN PROJECTS

PRESENTATION SCHEDULE – OHIO STATE ROOM

Course Coordinator: Professor Brian Thompson

Academic Advisors: Professors Averill, Brereton, Cloud, Diaz, Engeda, Gokcek, Koochesfahani, Kwon, Liu, Lloyd, Loos, Müller, Mukherjee, Pence, Pourboghrat, Somerton, Thompson, Wichman, Wright and Mr. Gunn

	Sponsor	Industrial Advisor(s)	Academic Advisor	Project Title
8:15	BorgWarner Engine Group: Emissions – Thermal Systems	D. Buckley J. Stagg	A. Engeda	Optimization of Knit Lines in a Cooling Fan
8:40	General Motors Corporation	S. Ernster A. Graf A. Lubeke C. Lynema J. Miller D. Moore	T. Pence	Motor Vehicle Exhaust Noise
9:05	BorgWarner Engine Group: Emissions – Thermal Systems	D. Pickelman T. Tyner	J. Lloyd	Fan-Drive Integration and Optimization Study
9:30	Mahoney Environmental, Inc.	T. Keasler, Sr.	G. Brereton	Grease Yield Accuracy
9:55	Louis Padnos Iron & Metal Company	R. Herweyer	A. Diaz	Improved Loading System of Freight Containers
10:20	Whirlpool Corporation	K. Chase T. Koenigsknecht	M. Koochesfahani	Advanced Ice-Dispenser
10:45	Whirlpool Corporation	D. Conrad	N. Müller	Design-for-Reliability of a Sealed System
11:10	Paratech, Inc.	G. Roxton	D. Liu	Re-design of the <i>Pakhammer90</i>
11:35	Dow Chemical Company	C. Reid	N. Wright	Enhanced Gas Re-circulation System

ME 481 Mechanical Engineering Design Projects

OPTIMIZATION OF KNIT LINES IN A COOLING FAN

BorgWarner is a leader among suppliers to the automotive industry. They supply component parts of cars, trucks and SUV's. BorgWarner's diverse range of products includes turbochargers, transmission components, and engine cooling systems. The *BorgWarner Emissions/Thermal Systems* group located in Marshall, Michigan, wants to improve the capabilities of their nylon injection-molded cooling fans.

Currently, BorgWarner produces a nylon ring-fan by the injection-molding process using six gates evenly spaced around the fan hub. The injected plastic melt flows from the center hub outward through each blade. After it flows through each blade, the melt flows into the ring in both directions. In the ring area halfway between each blade, the two plastic flow fronts meet and form a knit line. The knit lines create structural weaknesses that BorgWarner would like reduce. If a general solution can be found to improve the strength of the knit lines, BorgWarner will be able to produce larger diameter nylon ring-fans that can withstand higher centripetal forces in the outer ring.

BorgWarner has already thought of several general concepts for improving the strength of the knit lines by making changes to the design of the ring-fan. Additionally, the *BorgWarner Student Design Team* created some alternative concepts. The task of the *BorgWarner Student Design Team* was to develop, analyze, and prototype the most promising of the potential solutions. If a solution can be shown to be practical and profitable, BorgWarner should be able to increase the range of applications where the nylon ring-fan can be used, and in this way BorgWarner will be able to increase overall future sales of ring-fans.

...The BorgWarner Engine Group Student Design Team



BorgWarner
Emissions/Thermal Systems



The company's application engineers and sales departments are anticipating product improvements that will help expand sales of engine cooling modules on future SUVs, light trucks and rear-wheel-drive passenger cars.

Don Buckley
Senior Product Engineer
BorgWarner Engine Group:
Emissions/Thermal Systems

Team Members and Home Towns

Ryan Boertman
Hanover, Michigan

Sebastian Dorado
Santiago, Chile

Andy McMaster
Concord, Michigan

Erik Schubert
Grand Haven, Michigan

Industrial Sponsor

*BorgWarner Emissions/
Thermal Systems*
Marshall, Michigan

Industrial Advisors

Mr. Donald Buckley
Mr. Jonathan Stagg

Academic Advisor

Professor Abraham Engeda

MOTOR VEHICLE EXHAUST NOISE

General Motors Corporation (GM) is one of the world's leading manufacturers and suppliers in the automotive industry. GM has recognized that exhaust noise levels from motor vehicles have been a concern for many citizens. The objective of this project was to collect data and analyze the acoustical characteristics of various motor vehicle exhaust systems.

The General Motors Student Design Team was challenged to properly perform multiple exhaust noise level tests on a variety of vehicles while following the International Organization for Standards (ISO) and Society of Automotive Engineers (SAE) testing guidelines. In developing the test setup, it was important to ensure that an individual be able to perform the test with minimal training and preparation. Testing equipment was purchased based on the fact that it was portable and easily operable by novice users.

Government regulations in a handful of states have required the maximum acceptable sound level of legal exhaust systems to be 95 decibels. Any sound level pressure above 95 dB(A) does not meet state noise regulations.

The range of vehicles tested consisted of stock vehicles straight from the manufacturer, vehicles with modified exhaust systems, including repaired or personally enhanced systems, and motorcycles. Key results from this testing were derived from a direct comparison of a stock exhaust on a specific vehicle to a modified exhaust on the same type of vehicle. Successful results will provide General Motors with data to establish simple and accurate testing procedures and regulations for future exhaust noise level testing.

...The General Motors Corporation Student Design Team



Industrial Sponsor

General Motors Corporation
Milford, Michigan

Industrial Advisors

Ms. Stephanie Ernster
Mr. Aaron Graf
Ms. Amy Lubeke
Mr. Chad Lynema
Mr. Jason Miller
Mr. Doug Moore

Academic Advisor

Professor Thomas Pence

Team Members and Home Towns

Emily Driggett
Fenton, Michigan

Brianna Jablonski
Rochester, Michigan

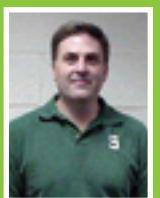
Robert Johnson
Saginaw, Michigan

Ahren Kolka
Dewitt, Michigan

Trevor Winter
Lake Orion, Michigan

The Traffic Noise Project will benefit General Motors by contributing data and analysis from Michigan State University to the ISO and UN committees responsible for procedures and regulations. GM will derive value from the project by being able to anticipate future regulations and to enable proactive design work.

Doug Moore
GMNA Regulated Noise Lead Engineer
General Motors Corporation



FAN-DRIVE INTEGRATION AND OPTIMIZATION STUDY

BorgWarner is a leading global automotive supplier. Furthermore, the company is recognized for achievements in advanced product design and technology in the area of engine and powertrain components.

BorgWarner Engine Group Emissions/Thermal Systems is heavily associated with engine cooling technology for the global automotive and commercial trucking industries. Large demands placed on trucking components place a large demand on the engine cooling system. Thus, a relatively large cooling fan is needed to satisfy these high demands. The large cooling fan requires a substantial amount of engine power that is undesirable in conditions where substantial cooling is not needed. Given this scenario, it is desirable to vary the fan speed relative to that of the engine in order to increase both the engine performance and mileage covered per gallon of fuel. An undesirable consequence of this is the unwanted heat created in the drive mechanism used to vary the fan speed.

The goal of this project was to increase the cooling of the variable-speed drive mechanism using convective heat transfer from induced airflow. Any modifications or redesigns must not compromise the structural integrity of any component. To solve the problem, solid modeling and empirical testing were employed which would later lead to developing a prototype of the optimized design.

... *The BorgWarner Engine Group Student Design Team*



The company's application engineers and sales departments are anticipating product improvement that will help expand the sale of this new engine cooling system. It will be offered to the commercial trucking industry (as more rigorous emission regulations take effect) as well as to the agricultural industry.

Todd Tyner
Fan Aerodynamicist
BorgWarner Engine Group:
Emissions/Thermal Systems

Team Members and Home Towns

Dylan Caddy
Royal Oak, Michigan

Jonathan Gould
Northville, Michigan

Rino Hilman
Ann Arbor, Michigan

Scott Neideck
Farmington Hills, Michigan

Industrial Sponsor

*Borg Warner Emissions/
Thermal Systems*
Marshall, Michigan

Industrial Advisors

Mr. Dale Pickelman
Mr. Todd Tyner

Academic Advisor

Professor John Lloyd

GREASE YIELD ACCURACY

Mahoney Environmental is a 52-year-old company that provides services and storage systems for the food service industry. The company is dedicated to protecting the environment by converting waste products into raw materials that can be used to manufacture new products. The primary service area for *Mahoney Environmental* is the Midwest, with their largest processing facility located in Mendota, Illinois.

The *Mahoney Environmental Student Design Team* was assigned the task of determining the yield percentage of grease that is currently stored in bulk grease containers outside restaurants. Outside grease containers are open containers, which can create yield percentages that vary greatly from customer to customer. The grease yield percentage determines the cost of processing and associated customer service charges. It is of vital importance to determine the accurate grease yield from each customer's grease container every time a driver picks up the grease.

The grease yield in bulk containers is based upon the fact that grease will float in water. In every container there is a clear dividing point between the grease and water stored in the container. Identifying the dividing point determines the means of calculating the grease yield percentage stored in each container. The current method for the grease yield percentage involves estimation by *Mahoney Environmental* drivers. This method provides accuracy to three percent, and the new method should have accuracy within one percent.

The device created by the *Mahoney Environmental Student Design Team* to accurately measure the grease yield percentage has a substantial impact on the company. *Mahoney Environmental* can properly assess costs for each pick-up and determine changes in yields over time.

...The *Mahoney Environmental Student Design Team*



Industrial Sponsor
Mahoney Environmental, Inc.
Joliet, Illinois

Industrial Advisor
Mr. Tom Keasler Sr.

Academic Advisor
Professor Giles Brereton

Team Members and Home Towns

Chris Bolten
Clarkston, Michigan

Paul Elsey
Clinton Township, Michigan

David Majeski
Grosse Pointe Farms, Michigan

Viraj Mokashi
East Lansing, Michigan

The successful completion of this project has a twofold impact: 1) it provides credibility and validation of our business model, and 2) it provides competitive advantage. Specifically this means accuracy that allows us to properly assess costs for each pick-up and to determine changes in yields over time for each customer, enabling customers to manage their costs. It allows us to operate our business in a way that recognizes our economic reality: yields define costs.

Tom Keasler, Sr.
Area Manager
Mahoney Environmental, Inc.



IMPROVED LOADING SYSTEM OF FREIGHT CONTAINERS

Louis Padnos Iron & Metal Company has been collecting, processing, and supplying scrap material since the turn of the twentieth century. *Padnos* processes a large variety of scrap such as cast iron, cut steels, and non-ferrous metals into recyclable materials. The company has grown from a small service-based local business to a large business, operating from fourteen locations throughout Michigan, and influencing industries world-wide. *Padnos* is driven by the belief that scrap is a valuable renewable resource, and environmental awareness is a priority. The company is dedicated to being a full-service resource for quality recyclable materials. Their world-wide influence is the result of decades of hard work, dedication, and fair dealing.

Currently at *Padnos* they load shipping containers using a small Bobcat loader to move the material from the scrap yard into the container. *Padnos* has identified a need to improve this process, aiming to decrease the time it takes to load the container, and simultaneously increase the packing density of the loaded container. Improving the loading process of the scrap shipping containers allows *Padnos* to move into new markets, to sell more scrap overseas, and to improve the balance of trade between the US and Asian markets.

The goal of this project was to create a more efficient shipping container loading system for the *Padnos Iron & Metal Company*. The improved shipping container loading system will decrease the time spent loading containers, increase the packing density of the loaded containers, and save the shipping containers from experiencing damage during the loading process.

To solve the problem, three main areas were identified: loading time, packing density, and mobility. After analyzing multiple possible solutions, the optimal process was identified.

... *The Louis Padnos Iron & Metal Company Student Design Team*



We anticipate that this new approach to packing will permit us to be more cost-effective when moving the cargo throughout the global transportation network.

Bob Herweyer
IXL Machine Shop Supervisor
Louis Padnos Iron & Metal Company

Team Members and Home Towns

Michelle Haddad
Clinton Twp., Michigan

Ryan Hager
South Haven, Michigan

Margaret McHale
Grosse Pointe Woods,
Michigan

Alex Nee
Saugatuck, Michigan

Industrial Sponsor

*Louis Padnos Iron &
Metal Company*
Holland, Michigan

Industrial Advisor

Mr. Bob Herweyer

Academic Advisor

Professor Alejandro Diaz

ADVANCED ICE-DISPENSER

Whirlpool Corporation, which was established in 1911, is now the world's leading manufacturer and marketer of major home appliances with 68,000 employees and nearly 50 manufacturing and technology research centers around the globe. *Whirlpool* has been utilizing innovation as their major differentiating strategy and this provides them with a significant competitive advantage.

One home appliance system that *Whirlpool* manufactures is a side-by-side refrigerator unit that dispenses ice through the door. Ice is created and then stored in an ice bucket, located in the freezer door, until the consumer requests ice. This causes an auger to rotate inside the bucket, which breaks apart the ice and pushes it into a hole at the bottom of the bucket where it is dispensed to the consumer.

The goal of the team was to satisfy the consumer need for a more consistent dispense rate through the current side-by-side refrigerator. There were two problems that needed to be solved: find a way to feed a consistent amount of ice into the current dispensing mechanism and to maintain the current feed-rate and dispenser functionality.

To solve this problem, a method was developed to consistently dispense ice one cube at a time. This allows the consumer to designate the number of cubes requested through a user interface and involved changes to three main areas: the auger, the dispensing chute connecting the ice supply to the crushing system, and the crushing system. After developing twenty-five design concepts, the best concept was chosen using a design matrix.

...*The Whirlpool Corporation Student Design Team*



Industrial Sponsor

Whirlpool Corporation
Benton Harbor, Michigan

Industrial Advisors

Mr. Kevin Chase
Mr. Tony Koenigsnecht

Academic Advisor

Professor Manoochehr
Koochesfahani

Team Members and Home Towns

Brandon Dawson
Dearborn, Michigan

Jordan Fountain
Cedarville, Michigan

Ryan McCollum
Flushing, Michigan

Matt Schwartz
Northville, Michigan

The results of this project will be used to further enhance *Whirlpool's* offering for ice and water dispensing solutions and have significant impact and benefit on *Whirlpool's* refrigeration business. The functional prototype for this project is intended for use in customer market research and consumer usability studies. Customer insights will be used to further develop this student-designed concept for implementation into the *Whirlpool* product line.

Kevin Chase
Engineer
Whirlpool Corporation



DESIGN-FOR-RELIABILITY OF A SEALED SYSTEM

Whirlpool Corporation is the world's leading manufacturer and marketer of major home appliances, with annual sales of over \$13 billion, 68,000 employees, and nearly 50 manufacturing and technology research centers around the globe. Whirlpool is driven by creative designs and innovations to make customer's lives easier. The Whirlpool Corporation in Benton Harbor, Michigan, wants to improve the reliability of the sealed system cooling apparatus for all the air conditioners they currently produce.

Warranty claims concerning faulty air conditioning units are causing increasing costs. Commonly when failure occurs, this is due to errors in the sealed system and the compressor. Both of these items are difficult to repair and replace, thus in most cases, the complete unit must be replaced. Due to these high costs, it is desirable to find ways that Whirlpool can reduce the failure rate of the units, while maintaining high performance and high customer satisfaction. The goal of the team was to prepare a list of recommendations that would permit Whirlpool to reduce errors in the sealed system so that the overall reliability was improved.

All recommendations were analyzed systematically to determine the feasibility of each proposal, while maintaining low cost of implementation. Upon completion of this project, it is hoped that Whirlpool will utilize these recommendations to save money on the company bottom line.

...The Whirlpool Corporation Student Design Team



The project will permit young minds to provide Whirlpool with fresh ideas, innovation and creativity in the realm of domestic appliances. When these ideas are melded with the wisdom and experience of the Whirlpool engineering staff, we are confident that together we can provide a dramatic increase in our competitiveness in the international marketplace. In addition, these refinements should also enable us to increase our stature in the industry.

Daniel Conrad
Manager CIT, Reliability & Safety Science
Whirlpool Corporation

Team Members and Home Towns

Mark Mouland
Livonia, Michigan

Kristen Papuga
Clinton Township, Michigan

James Rogers
Grand Rapids, Michigan

Jared Vermeulen
West Bloomfield, Michigan

Industrial Sponsor

Whirlpool Corporation
Benton Harbor, Michigan

Industrial Advisor

Dr. Daniel Conrad

Academic Advisor

Professor Norbert Müller

RE-DESIGN OF THE PAKHAMMER 90™

Established in 1962, *Paratech Incorporated* is a small company based in Frankfort, Illinois that manufactures an ever-increasing number of emergency service products with a special emphasis on tools for technical rescue. These products include lifting bags, rescue struts, pneumatic impact tools, and the very popular pry axe. Their products are utilized by the US Air Force, US Navy, and fire departments around the country. *Paratech's* products have aided in the rescue of many people around the world in collapse situations and have helped in such major events as the 9-11, and more recently the hurricanes in the Gulf Coast region and the earthquakes in Pakistan.

Paratech's Airgun 40 and Pakhammer 90 are the only pneumatic penetrating tools designed for use with a self contained breathing apparatus cylinder which allows them to be mobile and able to be used in confined spaces. These two tools were the focus of the project. Being a small company, *Paratech* does not have the engineering resources needed to analyze and quantitatively test their products to provide their customers with requested performance data. The project goal was to provide *Paratech* with an accurate analysis of the performance of both pneumatic tools and to provide suggestions for improvement.

To accomplish this goal, testing was implemented to determine the performance of the tools, materials selection was inspected in areas of concern, and the functionality of the product design was investigated to provide *Paratech* with options for optimization.

... *The Paratech Student Design Team*



PARATECH

Industrial Sponsor

Paratech, Inc.
Frankfort, Illinois

Industrial Advisor

Mr. George Roxton

Academic Advisor

Professor Dahsin Liu

Team Members and Home Towns

Mitchell DeJonge
Muskegon, MI

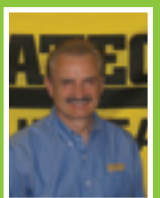
Megan Kelley
Redford, MI

Matthew Lassiter
Sterling Heights, MI

Matthew Thurman
Shelby Township, MI

The tool should be analyzed for improved efficiency, durability, cost reduction and appearance.

George Roxton
Chief Engineer
Paratech Incorporated



ENHANCED GAS RE-CIRCULATION SYSTEM

Based in Midland, Michigan, *The Dow Chemical Company* is the largest chemical company in the United States with approximately 43,000 employees and annual sales totaling over \$40 billion. *Dow Automotive*, a division of *Dow Chemical Company*, offers materials, parts, modules and systems for automotive interior, exterior, chassis/powertrain and body engineered systems applications. In addition to the company's broad product portfolio, *Dow Automotive* delivers research and development, design expertise, advanced engineering and supply-chain management support to customers worldwide. *The Dow Automotive Research and Development facility* is responsible for developing new products and manufacturing processes.

One such product currently under development is a diesel particulate filter to be used by multiple automotive manufacturers. Important to the manufacturing process of these filters is the circulation of a gas through the filters. The current system is currently being enhanced to improve the circulation of the gas through the filters.

Dow Automotive asked the *Dow Student Design Team* to produce a more efficient solution that will allow different geometries to be accommodated, as well as lowering the overall cycle-time of the process, which will increase production volume and lower production cost.

...*The Dow Chemical Company Student Design Team*



This project would help *Dow* achieve a higher quality product and expedite the process for *Dow* to enter this new technology/product into the market. These learnings will be leveraged within the *Dow Chemical Company* wherever applicable to help develop the most effective technologies.

Christina Reid
Research Engineer
The Dow Chemical Company

Team Members and Home Towns

Chris Bolin
Ames, Iowa

Chet Chamberlin
Allenton, Michigan

Kris Colpean
Haslett, Michigan

Trung Tran
Lansing, Michigan

Industrial Sponsor

The Dow Chemical Company
Midland, Michigan

Industrial Advisor

Ms. Christina Reid

Academic Advisor

Professor Neil Wright

critical thinking



At Honeywell, we are convinced that our future depends on the steady stream of intellectual talent from flagship universities like Michigan State. Your Design Program will undoubtedly continue to provide us with talented graduates possessing the creativity

and the innovation that we need in order to maintain our leadership position at the technological frontiers.

Honeywell

Honeywell is a proud supporter of the MSU Mechanical Engineering Department's award-winning Design Program and we offer heartfelt thanks for over a decade's worth of service to Michigan's manufacturers and citizens.

©2005 Honeywell. All rights reserved

The Thomas Alva Edison Undergraduate Design Award

Thomas A. Edison, who spent his formative years in Port Huron Michigan, is America's most prolific inventor with 1,093 patents to his name. During his lifetime, his restless fertile eclectic mind was responsible for numerous profound inventions in many fields; his creations spawned three industries...electricity-supply, musical entertainment and motion pictures; and of course he sketched the blueprint for the modern research and development laboratory, Menlo Park. He was a superstar of innovation and entrepreneurship!

With the initiation of this design award, the Department of Mechanical Engineering wishes to encourage the adoption by our students of Edison's indefatigable indomitable spirit, his innate curiosity and creativity, and most importantly, his innovative entrepreneurial prowess. It was these specific human traits that were primarily responsible for the ascension of the USA to the position of world dominance. Edison created profound concepts and he transformed them into commercial realities with enormous societal consequences. We applaud this multi-disciplinary philosophy!

The Edison Scholars shall comprise the members of the best ME481 team each semester. This team shall be identified by an august panel of judges unrelated to the Department's faculty and staff or the manufacturers sponsoring projects. It will be characterized by a philosophy of shrewdly melding the art of invention with the business of innovation. It will be characterized by students with relentless drive and determination who bring an embryonic concept to the bustle of the marketplace. It will be characterized by enterprising students with the Edisonian spirit!



Be a role model



Please don't forget that the next generation of potential engineers come to visit us every Design Day. If the opportunity arises, take some extra time to make their visit a memorable one. Show them what a vital and exciting profession engineering really is. Answer their questions and stimulate their imaginations. Remember how much it meant to you when you were younger and an older person took some extra time to make you feel special? Return the favor. Experience firsthand the joy of giving!

design 
program

The Department of Mechanical Engineering at Michigan State University has hosted two Design Days each year since 1994. Many pre-collegiate students who attended prior Design Days have since gone on to study engineering at universities throughout the United States and abroad.



ME481:

OVER A DECADE OF SOCIETAL SERVICE BEYOND THE CAMPUS BOUNDARY

American higher education is frequently accused of abdicating its responsibility to society. Colleges and universities are criticized for inattention to teaching, for an overemphasis on research that is perceived to be irrelevant and costly, and for failing to address the pressing needs of local communities. Furthermore, this situation has been exacerbated recently by reduced funding from legislators to flagship universities like MSU. Clearly the future of the United States is being sabotaged!

While there is considerable truth in these assertions, the Department is striving diligently to maintain standards and become actively engaged with groups of taxpayers throughout Michigan and beyond. Consider the capstone design class, ME481, for example. In this senior-level course, each team of four students functions in an unstructured industrial environment with a professorial mentor assigned to each team, research is prosecuted on contemporary issues that industry perceives to be relevant, and through this advancement of knowledge, economic development and also community growth are fueled. Thus we remain firmly wedded to the fundamental canons of the Morrill Act of 1862 that provided the basis for land-grant institutions like MSU: the public good. Let's examine this thesis by briefly chronicling the history of the class.

"Congratulations on another extraordinary 'Design Day.' You and your colleagues have shaped a truly unique event that brings the scholarship of engineers together with community partners in a program that benefits Michigan State University students, potential MSU students via the pre-college event, and all of the faculty, advisors, and mentors who combine their talents to upgrade the quality of products produced by Michigan businesses. I don't think that there is an aspect of outreach scholarship that this program fails to touch." These sentences, written by Dr. H.E. Fitzgerald Assistant Provost for University Outreach and Engagement at MSU, are merely one set of complimentary remarks that the Department has received from numerous societal sources including Senator Carl Levin's office and also Governor Granholm's office. But it wasn't always like this!

Collaboration with manufacturers began in the 1994 Fall Semester following decades of academically-neutered sterile paper studies. Projects didn't involve design-build-test and

report. The 80+ students worked on two industry-sponsored projects: one from General Motors in Lansing and a second from 3M in St. Paul, Minnesota. Thus, while the students were excited by this paradigm shift, project choice was severely limited in this embryonic outreach program! But things changed very quickly because manufacturers vigorously embraced this new program of societal service, the Department's faculty and staff were dedicated to its mission, and the students relished the opportunity to work on real-world industrial projects. This triumvirate provided the foundation for success.

The first semester of this win-win program involved the re-design of products to enhance their performance, but subsequently new products have been developed, manufacturing facilities have been enhanced, and products have been refined to reduce costs. During the past decade, students have completed over 400 projects sponsored by manufacturers in Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, Ohio, Ontario and Tennessee. These projects have involved interactions with over 100 large, medium-sized and small companies in over 50 different municipalities, and over 30 distinct industries ranging from orthodontic devices, furniture, veterinary equipment and aerospace structures, to consumer electronics, materials recycling, food processing, machine tools and of course, automotive.

In addition to projects offered by manufacturers, in 1998 the humanitarian projects were initiated. These projects are focused on the development of devices to improve the quality of life for children affected by diseases like cerebral palsy or meningococemia. Currently Shell Oil funds them and they are part of a more eclectic, broader educational initiative: one beyond the confines of the classical college curriculum that includes not only scholarship

but also character development, leadership, and service. It is eloquently captured by the following sentence penned by John A. Hannah, 12th President of MSU; "Our task is to make not merely better farmers, or veterinarians, or engineers, but better citizens, capable of appreciating the finer things in life, able and willing to take their part in shaping the destiny of their country." We wholeheartedly support this assertion.

The above meritorious features and significant accomplishments of ME481 have been responsible for the class being recognized as one of the nation's premier capstone programs and this is reflected in the abundance of projects submitted by manufacturers each semester. This condition has been achieved because of clear societal needs for such collaborative efforts between town-and-gown. Indeed for any nation to excel in the international marketplace, societal vortices must be established where streams of knowledge from both academia and industry mix synergistically to not only change the human condition but also create viable solutions to contemporary societal problems.

Thus in ME481 we are privileged to advance knowledge through the collaborative efforts of student teams, professors, university staff and industrialists. We transform lives on campus and in the communities that we serve. We invigorate companies through the generation of fresh ideas, out-of-the-box thinking, innovation and creativity. And we enhance lives in the municipalities where these companies are located because we stimulate economic development and community growth.

These impressive characteristics should be no surprise to any Spartan because MSU is a land-grant university. Our mandate is the public good...despite budget cuts and criticism from beyond the banks of the Red Cedar River!

Ideas that let you know you're O.K.

At GE, we believe in the power of ideas. Ideas like the LightSpeed® CT scanner that can scan your entire body in a matter of seconds.

We invite you to come power your ideas at GE. We offer careers in Communications, Engineering, Finance, Human Resources, IT and Sales & Marketing.

gecareers.com

An Equal Opportunity Employer



imagination at work

A diversified technology, financial
services, media company.

Alumni Quotes:

ABOUT THE DESIGN PROGRAM

Since its inception in 1994, hundreds of mechanical engineering students have vigorously responded to the unique challenges of the Design Program. Here are some genuine quotes from several alumni who have generously taken time to write down and share their reflections on the program – and what it means to them.

As a Mechanical Engineering student at Michigan State, you can expect to walk away with a firm knowledge of engineering theory, mathematics and an assortment of applicable problem-solving skills. But these classes merely created a foundation for me. It wasn't until I began my ME 481 Senior Design Class that I truly had an appreciation for what engineering was all about. And it wasn't until I began my "real world" engineering career that I truly grasped an appreciation for what the Mechanical Engineering Design Program was all about.

The ME 481 Senior Design Class was at first an overwhelming and intimidating course. What is this DFM/A? What is this cost information we have to gather? Modular design? Common parts? Benchmarking? Why is this important? Why is Dr. Thompson being so demanding and constantly wanting more out of us? When do I get to use my heat transfer and thermodynamics formulae! Still, my senior design team and I went through the motions and began working with a small company out of Jackson, MI. For the first time we saw a "real world" engineering problem. We began interfacing with customers and end-users. We looked at new technologies to improve the function of their machine. We looked at reducing mass, eliminating mechanical switches and improving safety. In the end, we had a functioning prototype of a new design for our customer. It was after our presentation on Design Day that I realized what this class had done for me. This course had shown me how to be an Engineer. It had shown me how I could apply my textbook theory to solve problems. It had shown me how to organize and solve problems in a smart, step-by-step process. It had shown me the importance of hands-on/"getting dirty" type work. It had shown me how important communication was and brought in the human factor, which cannot be taught in textbooks. After all of the struggle, work and debate, I finally understood what Dr. Thompson was trying to teach me! In what I consider my short time as an engineer(a decade), I find myself constantly looking back



to the education I received in my ME 481 Design Class. At the start of a new program, I find myself referring to "lessons learned" and warranty information from previous programs. I find myself looking for common fasteners and carry-over parts. I find myself benchmarking like products for best-in-class design concepts. I find myself in the assembly plant talking to people on the assembly line and finding out what they like and dislike about installing and assembling certain parts. I find myself in comprehensive design reviews with a cross-functional team looking over master sections so that a design can be released for tooling with confidence. The results of this legwork are invaluable. They result in components with fewer engineering changes, lower tooling investment and components that assemble with relative ease.

The ME 481 Senior Design Class was the most significant course I took as a Mechanical Engineering student at Michigan State. The lessons and education obtained from this course are priceless. I would not trade my experience in the program for anything.

GO STATE!

*Larry Shell
Senior Product Engineer/DRE
Rieter Automotive Systems
Farmington Hills, Michigan*

Not a day, project, or problem goes by when I am not utilizing the skills I learned and developed through MSU's Design Program. Whether it's championing a major process design problem at Colgate-Palmolive or solving the ever open-ended problem of my career path, I continuously refer to the skills I gained through this program.

I have always had an analytical, creative, and innovative mindset. However, I lacked the necessary discipline of a standard design approach and the experience working with prototypes. The design classes further developed my creative aptitude by planting a solid foundation on which to solve open-ended design problems. The projects involved with Design Day gave me the experience building and refining working prototypes from my designs. In addition, as a result of the Design Day competition format, I was able to further learn by studying other students' approaches and results for their design challenges.

The atmosphere of Design Day is unforgettable! As a freshman, feeling excited and determined when setting goals to win every design competition; to a senior, feeling awestruck when witnessing the implications of my project's impact on a local school. This program not only enhanced my abilities as an engineer through the design-test-build philosophy, but gave me a greater perspective of what I can do with my talent for the betterment of a community.

The Design Program, in particular the humanitarian project that I was a part of, spawned a desire in me to make a real difference. This project taught me firsthand that the most important thing I can do with my talent is to give it back to my community.

That's what this program was all about for me. Not only to provide students with real world projects to develop their engineering competences, but to prepare them for challenges beyond the classroom; challenges that include making a difference in the local community.

*Marc Ruiz
Production Manager
Colgate-Palmolive
Kansas City, Kansas*

Alumni Quotes Continued:

A B O U T T H E D E S I G N P R O G R A M

It is really difficult to absorb everything taught and all that can be learned through Michigan State University's Design Program. Still, a year later, working at General Electric Aircraft Engines as a design engineer, essentially an extension of the ME 481 capstone and an independent study, iteratively improving my communication skills and learning technical information as-required for unfamiliar open-ended problems, I am surviving only as a result of exposure to imperfect group work situations and the opportunities provided by those who have passed through the design program, as well as Dr. Thompson.

I'm thankful for the opportunities given to me through Dr. Thompson, the Design Engineering Program, MSU and the participating companies, such as the summer internship from Louis Padnos Iron & Metal Company, an internship for which Dr. Thompson had advertised via e-mail and critiqued résumés. A part of ME 481 design were weekly guest lecturers from Ford Motor and other companies, where I eventually met with the speaker from GE aircraft engines.

The Design Program's problem/goal: develop young engineering talent to some adequate degree, re-invigorate the region's companies and economy with creative, innovative problem-solvers that apply common sense and ease the transition between academia and industry, and instill a sense of gratitude and goodwill toward the community through projects for children with particular needs.

The Design Program realistically sets student groups against each other competing, sometimes cooperating, to solve a problem much like businesses and countries do. There

are several motives, egos, thoughts, strengths, weaknesses, cultural, psychological, intellectual, and emotional barriers working for and against solving the problem within a specified amount of time. Those group settings bring out frustrations, decisions and compromise.

I did not know, at the time, that the process by which the group projects were approached: defining the problem first, conjuring potential solutions, analyzing these potentials, re-evaluating the problem/solutions and iteratively repeating these steps until arriving at a design which satisfied our criteria was applying a six-sigma approach, which many companies are striving to learn/use and a method that is useful over and over again for problems in engineering at GE.

It was clear that closed-form mathematical solutions often are not present for the task. Internet engineering, a black-hole, is occasionally useful for benchmarking. Books, though more efficient than the Internet, are similar in that they frequently are not tailored to the particular situation. In industry as well as the design program, the problem may appear too difficult to tailor, analytically intractable, overwhelming at first, requiring mathematical manipulation or programming well beyond one's knowledge, a need for more competency with computer aided design tools, Excel, Unigraphics, and Ansys than may be palatable but the design programs taught us to persist. It highlighted that imaginative and creative ideas are critical when technical difficulties arise. We learn that these personal and technical limitations should be encountered as soon as possible, rather than before midnight when under deadline pressures when frayed sleepless nerves and stress dull the spirit into making mundane details

monumental insurmountable mountains. Doubts begin to surface. The design of the program is arranged such that deadlines will be close unless the team diligently plans ahead.

The best thing that Dr. Thompson and the ME 481 design program taught is to learn everything necessary to understand and solve a problem regardless of whether it pertained to one's field of study or not, whether one was told to or not, whether one liked it or not. This meant asking very basic questions to experts at the risk of appearing uneducated. It also meant learning programs and information that were frustrating in painful and non-ideal situations via detaching emotion from the task at hand. This skill has had enormous value in business for motivation with on-the-job training. Communication with group members, learning my own weaknesses, bad habits, and reasons others had difficulties communicating are also incredibly useful skills gained through the design program. Groups at General Electric and other places have had similar communication lapses.

I'm not sure to whom this quote is attributed, John L. Smith perhaps, but it's true, 'the best way to have a good idea is to have lots of ideas' [it was Linus Pauling ~ The Editor] Every single day this approach has proved that an entry-level engineer can discover better ways to solve problems that years of habit have hidden and discouraged.

Matthew Younker
Design Engineer
Large Military Engines
Rotating Parts Center of Excellence
GE Aircraft Engines, Cincinnati, Ohio

Some Inspirational Quotes of Note:

Oliver Evans (1755 – 1819)

Developer of a high-pressure steam engine: "He that studies and writes on the improvements in the arts and sciences labors to benefit generations yet born. For it's improbable that his contemporaries will pay any attention to him."

Thomas Edison (1847 - 1941)

Created the science of innovation: "Any other bright-minded fellow can accomplish just as much if he will stick like hell and remember nothing that's any good works by itself. You have got to make the damn thing work."

Lewis Tappan (1788 – 1873)

Developed a credit rating for transactions: "Eagerness to amass property robs a man and his family of rational enjoyment and tempts him to doubtful and disreputable acts."

STEERING A COURSE FOR GROWTH



Gaining and sustaining top-line growth takes teamwork and talent from the top to the bottom of the company — and all across the value chain.

Who can help your company travel the road to strong and sustainable growth?

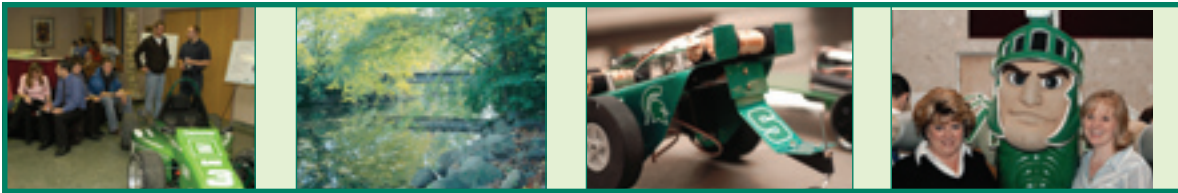
A.T. KEARNEY — the automotive management consulting leader.

We've worked with automotive OEMs and suppliers for decades. From research on new markets to next generation cost management. From boardroom to shop floor. We bring our well-recognized collaborative style and deep industry insights—so we can help get your top line growing, while ensuring bottom line results.

ATKEARNEY IDEAS THAT LAST.

create / engineer / inspire





ME 491

10:00–11:00
Third Floor
MSU Room

ADVANCED PRODUCT DESIGN

INSTRUCTOR: Mr. Robert Chalou

PROBLEM STATEMENT

ME 491-602, entitled Advanced Product Design, is the capstone design class in the Product Design cognate in the Engineering Arts major. In this class, students are required to design and manufacture a functional and aesthetically pleasing product. This semester's project required the virtual design of a Neighborhood Environmental Vehicle (NEV) and an associated recharging station.

ME 491-602 Advanced Product Design

Andrew Friar
Joshua Hall
Keith Koenigsnecht
Jason Krause
Linton Macklin



More Related Inspirational Quotes of Note:

Thomas Watson (1874 – 1956)

He created International Business Machines (IBM)

"Time lost is time lost forever."

"There is no such thing as standing still."

"Teaching has no value unless somebody learns what is being taught."

"You cannot be a success in any business without believing that it is the greatest business in the world."

"You have to put your heart in the business and the business in your heart."

"IBM products are sold, not bought."

Thomas Watson Jr (1914 – 1993)

He motivated the development of mainframe computers

"You don't hear things that are bad about your company unless you ask. It's easy to hear good tidings, but you have to scratch to get the bad news."

Ruth Handler (1916 – 2002)

The creator of Barbie dolls

"We adopted the razor-blade theory. Sell the razor at a reasonable price and the people will buy the razor blades."

Herbert Boyer (1936 -)

Stimulated the birth of biotech
"I've always thought that naïveté has a great deal to do with the success of any venture. Whatever you want to do, if you overanalyze it, start looking at all the pluses and minuses, you might never start."

ME 491 Advanced Product Design Class

Some Useful Tips:

FROM SUCCESSFUL AMERICAN INNOVATORS

Practical innovation more than anything else is the primary reason why America has achieved preeminence in the world while other well-endowed nations have failed to excel. Over 100 years ago, ambitious risk-takers characterized the flood of immigrants to enter this country and these pioneers possessed numerous desirable attributes. But it was their gifts for innovation that accelerated our nation's growth. It wasn't that they were simply good at invention but they excelled at putting that inventiveness to public use. These innovators were responsible for changing the very fabric of our society and ultimately the face of the world.

Here are ten lessons that can be learned from these pioneers:

1. MAKE NO ASSUMPTIONS ~ Break-throughs come when assumptions are discarded.
2. FIRST ISN'T ALWAYS BEST ~ Understanding comes from failure; success comes from understanding failure and acting upon this knowledge.
3. IT'S OK TO STEAL ~ More innovations come from borrowing and the combination of ideas than from simple invention. The imaginative association with ideas previously considered separate is a hallmark of innovation.
4. DIFFIDENCE WON'T DO ~ An idea might work only when it's pushed to its limits.
5. NOTHING WORKS THE FIRST TIME ~ Innovation is often cut off too soon because backers fail to appreciate that it takes time to work out the wrinkles.
6. NEW IDEAS DISTURB ~ If the majority of observers don't pooh-pooh a new idea, then it is probably not a very good idea.
7. CROSS-POLLINATION WORKS ~ Boundary transgressors are able to mobilize knowledge more flexibly and selectively than others.
8. SUCCESS IS RISKY ~ The most dangerous moment in the life of a company is when it has succeeded; because it will stop innovating. This is when the company will be attacked in the marketplace by imitators. Innovators are, by definition, barrier-breaking troublemakers.
9. WHEN ONE-PLUS-ONE EQUALS THREE ~ Many innovators flourish in partnerships. However the partnerships must be psychologically complementary.
10. PLUGGING INTO NETWORKS ~ Individual innovators may be successful but they are much more likely to succeed in a network.

Final Related Inspirational Quotes of Note:

Henry Ford (1863 – 1947)

Developed the people's car

"I refuse to recognize that there are impossibilities. I cannot discover that anyone knows enough about anything on this earth definitively to say what is and what is not possible."

"Businessmen go down with their businesses because they like the old way so well they cannot bring themselves to change. One sees them all about – men who did not know that yesterday is past, and who woke up this morning with their last year's ideas."

Amadeo Giannini (1870 – 1949)

The people's banker

"The tendency when a man gets on top is to shut himself off from the masses, forgetting the little fellow who made him."

Juan Trippe (1899 – 1981)

He took the world into the jet age

"A man can be born rich, he can be born brilliant. He can be lucky or he can be persistent. The most important thing is to be persistent."

George Doriot (1899 – 1987)

He started the first venture capital company

"A committee is an invitation to do nothing. Very few committees can perform better than the weakest man."

Samuel Insull (1859 – 1938)

He served cheap electricity to America

"Here is an industry (the electricity-supply industry), which supplies convenience and comforts to the day laborer, which kings could not command half a century ago."

Design Day Awards:

S O M E N E W I N I T I A T I V E S

You will no doubt recall from your high school Latin classes that the word “engineering” is derived from the medieval Latin root “ingenium,” and this ancient word means “to design” or “to create.” Thus from a linguistical perspective, engineering is design. If there were no design activities in the curriculum, there would be no engineering degrees, no classes to attend, and no examinations to pass! Yes, quite a thought!

The Kids’ Choice Award

It is therefore quite logical for design methodologies to have a special place in the undergraduate curriculum because it is the very essence of engineering. It is the very heart of the engineering profession; a vortex where eclectic streams of knowledge mix. At MSU this observation is certainly true, as clearly evidenced by the thread of design woven through the fabric of the course offerings and also our end-of-semester Design Day in the MSU Union Building. This memorable day, with the largest attendance on the College calendar, has developed even more prestige recently with the creation of two new awards for students at the junior and senior levels. We anticipate that they will serve as a steadfast fulcrum for leveraging the development of enhanced design appreciation in the student body. My purpose here is to provide you with some background on these awards.

The Scottish-born American classicist Gilbert Highet penned the words, “Whenever there are beginners and experts, old and young, there is some kind of learning going on, and some sort of teaching. We are all pupils and we are all teachers.” This fundamental truism implicitly provided the motivation for The Kids’ Choice Award presented to a team of ME371 students on Design Day. This award comprises a gift voucher, a certificate and *The Sparty Plaque*.

The plaque was designed and manufactured by Mr. John Thon’s 7th grade technology class at Holt Junior High School. It features a plate engraved with past winners of the award and a Spartan helmet created from two valves and a piston. This award, and the associated activity for experiential learning, was motivated by numerous requests from pre-collegiate students who had expressed the overwhelming desire to learn more about the diverse collection of

machines showcased by ME371 students. In response to these requests, a forum for constructive dialog between pre-college students and ME371 students was established. Thus, groups of 7th – 12th grade students are required to interview MSU students to learn more about the engineering principles associated with their prototypical systems displayed in the Gold Room of the Union. Based on these lively conversations, each group assigns points for the best designs. Pre-college students gain scientific knowledge from engineering students, and since the ME371 students are compelled to explain clearly the features of their machines, they develop valuable communications skills. Both sets of students learn from the conversations. Both are students, and both are teachers!

The winners in the 2004 Spring Semester were Trevor Ruckle, John Schauerte, Aaron Smith, and Charles Spaniola.

The Leonardo Scholars

In the 2003 Fall Semester, the Department began the process of creating an endowment fund for undergraduate design education and initiated the Leonardo da Vinci Undergraduate Design Scholarships to recognize excellence in mechanical engineering design. These scholarships were created to honor and encourage the adoption of the spirit and innovative approaches of this universal genius by the undergraduate population.

In addition, these scholarships were created to emulate the prizes and the associated prestige established by the inventor Alfred Nobel. This Swede was one of history’s great innovators, holding 355 patents, and whose invention of dynamite in 1866 made him one

of the world’s wealthiest men. “Justice,” wrote Nobel, “is to be found only in imagination.” No greater proof of this Swedish inventor’s faith in individual genius is likely to be found than the prizes that have been awarded in his name during the past century. Upon his death, his last will and testament set forth the unprecedented idea of rewarding those whose works of innovation and imagination have conferred the greatest benefit to humankind. These prizes, the Nobel Prizes, have since become synonymous with human excellence. Indeed, the prestige associated with these Nobel Laureates is immense and it dwarfs the accompanying financial award. That’s our template!

Now at MSU we are indeed focused on technical innovation rather than literature or peace; and yes, we are concerned with much smaller amounts of money. However, we are nevertheless recognizing and saluting the spectacular design accomplishments of the Department’s talented students...they are the very future of our nation!

And, you might ask, they are called Leonardo da Vinci Scholarships? Not Nobel Scholarships? Yes, that’s right! While Alfred Nobel was undoubtedly a superstar, his accomplishments are dwarfed by those of Leonardo da Vinci because the Italian exhibited an intense curiosity and an insatiable desire for knowledge about every field of human endeavor.

The Leonardo Scholars (*continued*)

This Renaissance man was one of the most versatile geniuses in history. While he created some of the most famous paintings of all time, his domains of expertise extended beyond the warp and weft of the canvas to anatomy, astronomy, botany and geology, and in addition, he designed machines and drew plans for hundreds of inventions. Furthermore many of these inventions were 500 years ahead of their time!

ME471 is the class where the fundamentals of the design process are presented coherently, and where a semester-long, design-build-test-validate project and associated competition comprise a major portion of the final grade. Furthermore, since this project incorporates numerous diverse aspects of many under-

graduate disciplines, it was decided to use this "hands-on" engineering project as the criterion for selecting the Leonardo Scholars. The winning team in the class competition is awarded Leonardo da Vinci Undergraduate Design Scholarships comprising a financial component, a medallion and a commemorative certificate.

The winners of the 2004 Spring Semester were Steven Gerrish, Rino Hilman and Carl Luyendyk. The winners of the 2004 Summer Semester were Jason Aerts, Jerod Braman and John Schauerte.

These gifted students have clearly demonstrated tenacity and teamwork; the ability to integrate theory and practice; the intelligence to complete intertwined analytical and creative tasks; and the managerial skills to fully capi-

talize on right-brained and the left-brained thinking. Of course these facets of innovation are essential not only for success in engineering design, but also in numerous other aspects of life too. The design faculty anticipate the maturing of these attributes in these students and we strongly encourage the current Scholars, and future generations of Leonardo Scholars, to exploit their meritorious talents in societal service for the public good. The consequences will be immeasurable!



We must share our strengths...

We must share our resources, and we must share our wealth. Only then can this land-grant university's Design Program in the Mechanical Engineering Department effectively serve the needs of contemporary America by effectively educating university students, by effectively fueling economic development in Michigan's communities, by effectively invigorating manufacturers, and by effectively creating a robust foundation for the nation's future. A future that will undoubtedly feature our current generation of technologically-adept MSU students who will have been transformed into innovative professional engineers and societal leaders.



Individuals in eight large organizations enthusiastically embraced the above clarion call and it is because of their financial generosity that the current generation of MSU students, and also those who come later, will be able to receive an enhanced educational experience in the Department. The industrial philanthropists are:

Derek Andrews, Senior Manager, **The Boeing Company**, St. Louis, Missouri

Houston Brown, Manager, Graduate Recruitment & University Relations, **Shell Oil Company**, Houston, Texas

Brian Green, Military Inlet & Exhaust Systems Mechanical Engineer, **General Electric Company**, Cincinnati, Ohio

James Lammers, Vice President, **W.A. Dart Foundation**, Mason, Michigan

Eric Leaman, Mechanical Design Team Leader, **Honeywell, Inc.**, Boyne City, Michigan

Jeffrey Schmitz, Associate, **A.T. Kearney, Inc.**, Southfield, Michigan

Mitsunobu "Tony" Takeuchi, CEO and Chairman, **Denso North America Foundation**, Southfield, Michigan

Edward Willis, Assistant Vice President, **Union Pacific Railroad Company**, Omaha, Nebraska

On behalf of the students who will benefit immeasurably from these monetary gifts, and also their parents who will witness the intellectual growth of their offspring, we sincerely applaud the benevolence of these eight industrialists. Clearly they are wise stewards of their funds, they embrace a panoramic vista of life and its numerous challenges and opportunities. And they are clearly good citizens. They have noble motives. Sir Richard Steele, that benevolent English essayist, dramatist, journalist and politician wrote, "The noblest motive is the public good." How very true!



Thomas Alva Edison Scholars:

I N U N D E R G R A D U A T E D E S I G N

"Any other bright-minded fellow can accomplish just as much if he will stick like hell and remember nothing that's any good works by itself. You got to make the damn thing work." These words were uttered in a fit of frustration by Thomas A. Edison, America's most productive inventor, who has 1,093 patents to his name. He was an impresario of innovation. He was the quintessential American inventor.

Thomas Edison spent his formative years in Port Huron, Michigan, where he failed to excel at school. Nevertheless, upon entering the workforce he quickly made a science of innovation and he made innovation from science. His fertile eclectic mind was responsible for numerous diverse groups of inventions including those associated with the telegraph, the mimeograph, the incandescent light bulb, the phonograph, the telephone transmitter, an ore separator, cement manufacturing facilities, the kinetoscope, alkaline batteries and of course Menlo Park, the blueprint for the modern research and development laboratory. Furthermore, Edison's diverse accomplishments were ultimately responsible for the creation of at least three industries: electricity-supply, musical entertainment and motion pictures. What a laudable contribution to the human race!

The spectacular accomplishments of this creative genius and classic innovator have motivated the initiation of an award in the ME481 course to honor this Michigania superstar. Our objective is to encourage the adoption by our students of Edison's indefatigable indomitable spirit, his innate curiosity and creativity, and his innovative entrepreneurial prowess.

Of course you may wonder why we regard these specific human traits as being so important. Well, it's because we are convinced that practical innovation, more than anything else, is the primary reason why America was catapulted into such a preeminent role on the international stage in recent history while other well-endowed countries failed. It's not so much our ability to invent but rather our ability to put that inventiveness to practical use. Namely, our ability to excel at the process of product development and commercialization for financial gain.

Edison excelled in this arena; at conceptualizing a new vision, at transforming that vision into a viable product, at fulfilling the entrepreneurial role of raising money, at arranging the legal rights-of-way and at cultivating the market. He created important ideas and he transformed them into commercial realities with enormous societal impact. We applaud this multi-disciplinary philosophy and we are convinced that these human characteristics should be emulated by our students upon entering the workforce because Michigan is currently struggling to survive in a rapidly-changing brutally-competitive global marketplace. Indeed America's longstanding worldwide supremacy is being challenged as never before.

Each semester the T. A. Edison Undergraduate Design Award will be presented to the best ME481 student team. In this capstone course, teams of four students confront contemporary open-ended design problems presented by industry partners. Thus students must function successfully in an industrial setting by adopting the traits of Thomas Edison. There, teams create, fabricate, and subsequently test prototypical systems for small,

medium, and large manufacturers throughout the Midwest. They wrestle with complex "real world" issues not found on university campuses where lifestyles and motives are generally divorced from the pressing needs of society. It is this very real, practical, experience in Edison's domain of invention and innovation that distinguishes our graduates from those of other universities, and why they are so highly sought after by employers.

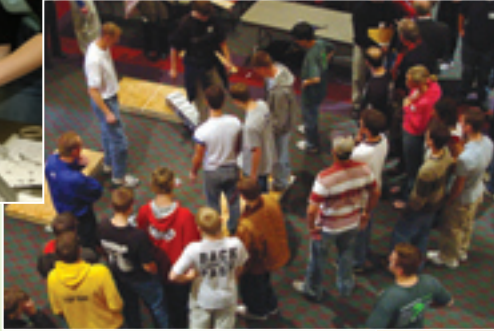
The names of the first group of Edison Scholars shall be announced at The Awards Ceremony on Design Day by University Distinguished Professor H. E. Fitzgerald, the Assistant Provost for Outreach and Engagement. The winning team shall receive \$2,000 and each scholar will be presented with a unique medallion and a certificate of accomplishment. Half of this financial award is provided by a generous gift from the Shell Oil Company and the remainder is from The Leonardo da Vinci Undergraduate Design Endowment plus assorted gifts to the Design Program.

An independent panel of distinguished judges from companies unrelated to the semester's industry partners shall visit campus to review the activities of each team before and during Design Day prior to determining the winning team. In the 2005 Fall Semester, the panel will comprise engineers from The Boeing Company, The General Electric Company, A.T. Kearney, Inc. and The Shell Oil Company plus two professors from the College of Communication Arts and Sciences.

With the Design Program's inception of Thomas Edison Scholars from the ME481 course to complement the current cohort of Leonardo Scholars from the ME471 course, two superstars have been strategically placed on pedestals to serve as role models for our students in the context of scholarship, character-building, service and leadership.

Leonardo's talents are regarded with reverential wonder in every field that he contemplated, and his dreams of engineering marvels were often 500 years ahead of their time. He was the most versatile genius that ever lived, but he didn't venture into the business world.

Edison's visions were much more near-term and pragmatic, but he shrewdly melded the art of invention with the business of innovation. Herein lies the difference between them. Edison was an innovator: somebody with the relentless drive and determination to bring an embryonic concept to the bustle of the marketplace. Indeed, these Edisonian characteristics in the US population during the previous two centuries were the essential potent high-octane fuel that powered America's engine of industrial reform to the lofty pinnacle of world dominance. Can we sustain the flow of this fuel?



*Inspiring the world's
next generation
of engineers and
societal leaders...*



Innovation & Creativity for 7th-12th Grade Students

W.A. Dart Foundation Day of Innovation & Creativity for 7th-12th Grade Students **FALL 2005 PROGRAM**

Time	Ballroom	Parlor B	Parlor C	Gold Room A and B
9:00	Expanding Structures	Timed Descent	MSU students talk about the engineering profession and life on the MSU campus Repeats at 9:45, 10:30, and 11:15	Pre-college students interview MSU teams and select the best machine in the ME 371 class
12:00	LUNCH SECOND AND THIRD FLOOR CONCOURSES			
12:30			Wrap-up Session and Awards Ceremony	

MEMBERS OF THE ORGANIZING COMMITTEE FOR THE 7th – 12th GRADE CONFERENCE

Jill Bielawski – Michigan State University
Lindsay Kredo – Michigan State University
Russ Pline – Okemos High School
Brian Thompson – Michigan State University
John Thon – Holt Junior High School

SCHOOLS ATTENDING THE CONFERENCE

Benton Harbor Technical Center, Benton Harbor, Michigan
Dansville High School, Dansville, Michigan
Da Vinci Primary School, Jackson, Michigan
Dwight Rich Middle School, Lansing, Michigan
Eaton Rapids High School, Eaton Rapids, Michigan
Genesee Area Vocational Center, Flint, Michigan
Holt Junior High School, Holt, Michigan
Maple Valley High School, Nashville, Michigan
Port Huron High School, Port Huron, Michigan
Sexton High School, Lansing, Michigan
St. Claire Shores High School, St. Claire Shores, Michigan

Education would be so much more effective if its purpose were to ensure that by the time they leave school every boy and girl should know how much they don't know, and be imbued with a lifelong desire to know it.

Sir William Haley
(1901–1987)

9:00–12:00 Second Floor Parlor B

TIMED DESCENT

Since the dawn of time people have been trying to keep track of and manage time; now it's your turn. Ancient cultures like the Incas, Aztecs, and Mayas all left behind artifacts related to understanding time. Whether it was as broad as seasonal changes or sunrise to sunset, the understanding of the passage of time was important to these people. Even the famous Stonehenge site is believed to be an installation to keep track of time. Today, we have pushed timekeeping to the extreme with atomic clocks that are triggered by the oscillations of a cesium atom. Can you and your group effectively use your time during this session to master time itself?



9:00–12:00 Second Floor Ballroom

EXPANDING STRUCTURES

Whether crossing wild rivers, rescuing victims from burning buildings, or deploying solar arrays on satellites, in countless circumstances, society depends on devices that start small but grow larger. Fortunately, engineers respond with innovative devices that grow, reach, and extend to meet new needs.

Chuck Hoberman, the Buckminster Fuller of the 1990s, created a plethora of artistically elegant expanding inventions that go far beyond the classic Rock 'em Sock 'em Robot or the iconic inflatable balloon. But even fishing

poles and drawer sliders allow one to reach further than expected. Now too, students will explore the complex possibilities of geometry and kinematics.

In this activity, teams will work to create pneumatically activated structures that will grow beyond their original size. With limited time and constrained materials, students will no doubt reach new levels of creativity and understanding as they stretch their minds around this escalating challenge.



9:00–12:00 Second Floor Parlor C

MSU $\pi\tau\sigma$ HONOR SOCIETY STUDENTS TALK INFORMALLY ABOUT THE ENGINEERING PROFESSION AND LIFE ON CAMPUS: Moderated by Professor Alejandro Diaz



Students from the Mechanical Engineering Honor Society Pi Tau Sigma will deliver informal question-and-answer presentations on the engineering profession and campus life at 9:00, 9:45, 10:30 and 11:30. These presentations will provide the basis for seventh through twelfth grade students to ask questions and learn firsthand from the experts! So do come with your questions about the impact of engineering on society; the role of science, mathematics, and communication skills in shaping your future; how to develop good study skills; and how to get good tickets to watch the Spartans.

9:00 Session

Jeffrey Bazzi
Jordan Fountain
Michelle Kimball
Ciara Royal

9:45 Session

Kayla Batchelor
Ashley Jones
Nicholas Potocki
Dennis Suminski

10:30 Session

Agatha Bone
Jerrod Braman
Melissa Cole
Carl Luyendyk

11:30 Session

Jonathon Bendert
Allison Lewis
Margaret McHale
Nicholas Pash

"Our future lies in some very precious hands..."

Our children are our future. Without the next generation of engineers, scientists and other professionals, the advances we enjoy today would quickly grind to a halt.

At the W.A. Dart Foundation, we are committed to developing scientifically literate students in Michigan. Therefore we are delighted to help fund the MSU Department of Mechanical Engineering's Design Day for pre-collegiate students.

An investment in our children's future will pay big dividends for this generation, and also generations yet unborn, in Michigan, America and ultimately the world.

A Salute to Some Outstanding Teachers & Pre-collegiate Students!



Russ Pline of Okemos
High School, Okemos



John Thon and his students,
Holt Junior High School, Holt



Genesee Area Vocational Center Students



Genesee Area Vocational Center
Instructor, Robert Cadwell



Lori Crouch of Da Vinci
Primary School, Jackson



Gerald Adams of Eaton Rapids
Middle School, Eaton Rapids



Duska Brumm of Maple Valley
High School, Nashville

The teacher's task is not to implant facts, but to place the subject to be learned in front of the learner and, through sympathy, emotion, imagination and patience, to awaken in the learner the restless drive for answers and thoughts which enlarge the personal life and give it meaning.

Nathan M. Pusey
(1906–1978)

A Message to Our Pre-collegiate Guests and Their Teachers

This conference provides numerous unique opportunities for 7th–12th grade students to participate in innovative activities involving experiential learning. They include:

- ◆ An opportunity to creatively solve several hands-on projects requiring the design, construction and subsequent testing of a device. These projects are offered concurrently and each student attendee has the opportunity to participate.
- ◆ An opportunity for collaboration with students from other schools to solve engineering problems.
- ◆ An opportunity to attend an informal question-and-answer session presented by Honor Society students studying engineering. These graduating seniors typically provide motivational remarks on study skills, the rationale for the educational process in schools, and life on a large university campus.
- ◆ An opportunity for 7th–12th grade students to interact with, learn from, evaluate and then assign a grade to teams of engineering students in the ME 371 course. These teams design and build machines and mechanisms to perform various functions such as shredding vegetables or autonomously cooking and flipping a pancake! The winning ME 371 team is awarded the *Sparty Plaque* and the first three teams receive a cash award.
- ◆ An opportunity to attend professional sessions where graduating engineering students deliver formal presentations to a corporate audience of engineers from our industrial partners, parents and other guests.
- ◆ An opportunity to spend a morning on campus learning many new concepts that are difficult to impart in the confines of a traditional school classroom.
- ◆ An opportunity to meet the MSU mascot *Sparty*.
- ◆ An opportunity to indulge in a delicious, free luncheon of pop, subs, pizza and cookies!

Whenever there are beginners and experts, old and young, there is some kind of learning going on, and some sort of teaching. We are all pupils and we are all teachers.

Gilbert Highet
(1906 – 1978)

envision / solve / learn



Innovation & Creativity for 7th-12th Grade Students

challenge / react / thrive



Did you know that we are seeking financial support for the Leonardo da Vinci Design Endowment?



This flexible fund, created to promote excellence in undergraduate design education, furnishes valuable resources for enriching the programs, initiatives and activities associated with the Department of Mechanical Engineering's design sequence. At Design Day you will have clearly observed how this educational experience is transforming students into innovative thinkers, professional engineers and the societal leaders of tomorrow.

Two segments of the design program that will benefit immensely from this endowment are:

- **DESIGN SCHOLARSHIPS:** The Leonardo da Vinci Undergraduate Design Scholarship has recently been established to honor and encourage the adoption of the spirit and the innovative thinking of this universal genius. Recipients are the winners of the senior-level ME471 class competition where teams must design-build-test and validate an engineering system.
- **PHILANTHROPIC COMMUNITY PROJECTS:** Each semester ME481 students complete an emotionally charged humanitarian project for the community. They typically create a unique engineering device tailored to the specific needs of a child without charge to the recipient. Children suffering from cerebral palsy, meningococemia, static encephalopathy, amputations and many other medical ailments have been given a new lease on life.

The core design courses, that represent the very heart of the engineering curriculum, are spectacular – ME471 students have won the annual ASME Mid Western Regional Design Competition nine out the past ten times against teams from the University of Toronto, the University of Michigan, Carnegie Mellon University, The Ohio State University, Case Western Reserve University, the University of West Virginia, etc., and the ME481 capstone class was ranked 6th in the USA in 2003 by *US News and World Report*. In addition to ensuring our students receive a spectacular educational experience, we wish to further enhance the design sequence of classes so that they really excel at the national level.

Gifts of all sizes are sought – small, medium and substantial. Can you please help? Don't be shy; invest in the education of our students. The very future of our nation! I'm convinced that the consequences will undoubtedly be immeasurable! You may recall the following sentences penned by Leonardo da Vinci, "I've been impressed with the urgency of doing. Knowing is not enough; we must apply. Being willing is not enough; we must do." What will you do?

If you require further information, please contact Professor Brian S. Thompson, the Departmental Design Coordinator at (517)-355-2179 or by email at thompson@egr.msu.edu.

Thanks!



FINDING YOUR WAY TO THE UNION BUILDING...



Parking is available in lots and ramps north of Grand River Avenue in the downtown area of East Lansing and on campus in lots with parking attendants. Limited parking for visitors is available in metered areas on campus streets. Buses can park in the large lot south of the football stadium.



BOSCH



SINCE 1905



ATKEARNEY

PARATECH



Shell



US HARDTECH

Honeywell



DENSO



STATE OF MICHIGAN
DEPARTMENT OF LABOR & ECONOMIC GROWTH



stryker

**MICHIGAN STATE
UNIVERSITY**