Conference On
Senior Engineering
Design Projects

Tuesday, December 5, 1995
Bernhard Center
8 a.m. to 5 p.m.

College of
Engineering and
Applied Sciences
WESTERN
MICHIGAN
UNIVERSITY
A Map of the Campus
You are invited to attend the seventeenth Conference on Senior Engineering Design Projects. The conference will be held from 8 a.m. to 5 p.m. **Tuesday, December 5**, at the Bernhard Center on the campus of Western Michigan University.

The College of Engineering and Applied Sciences sponsors the conference to showcase the work of its graduating seniors, who are required to complete a capstone project that puts into practice what they have learned. Many of the projects are sponsored by business and industry.

The conference is **free** and open to the public. You are welcome to attend all or part of the day's events. Reservations are not necessary.

**High School and community college** teachers are encouraged to bring students to the conference. Buses can drop off passengers in the circular drive in front of the Bernhard Center and then park in the lot in front of Hoekje Hall. (See map; take North Dormitory Road. Hoekje is #65 on the map.)

Teachers who cannot accompany their students to the conference may ask their students to sign in and out at the information table in the lobby on the second floor of the Bernhard Center. Sign-in sheets will be mailed to teachers the day after the conference.

**Parking** is available in the ramp near the Bernhard Center.

**Presentations begin on the hour and half hour.** Please do not enter a room after a presentation has begun.

**Session locations, starting times, and page numbers for project titles:**

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A **lunch** break is scheduled from noon to 1 p.m.

**For more information,** call Dace Copeland at (616) 387-4017.
CMD = Construction Engineering, Materials Engineering, and Industrial Design  
ECE = Electrical and Computer Engineering  
IME = Industrial and Manufacturing Engineering  
MAE = Mechanical and Aeronautical Engineering  
PSE = Paper Science and Engineering

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<td>211</td>
<td>PSE</td>
<td>Bod and Cod Levels of Recycled Korean and American Boxboard</td>
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NOON TO 1 - LUNCH BREAK

1 | 210 | ECE | Navigational Aid for the Visually Impaired                           |
| 209 | IME-B| Designing Revisions for Autocad Using Autolisp                     |
| 208 | MAE-A-II| Redesign of Dishwasher Spray Wash for Reduced Sound                 |
| 213 | MAE-B-II| Elevated Armrest Attachment for Wheelchair                         |
| 211 | PSE  | Bod and Cod Loading Effects of Repeatedly Recycled Paper Fibers     |

1:30 | 210 | ECE | An "H-Bridge" Inverter to Control a Permanent Magnet D.C. Motor     |
| 209 | IME-B| The Importance of the Automobile Industry's Customer Satisfaction Index (CSI) |
| 208 | MAE-A-II| Water Duct Design for Marine Power Boat Application                |
| 213 | MAE-B-II| Design of a Replacement for the Grumman A-6 Aircraft               |
| 211 | PSE  | The Effect of Suspending Liquid Viscosity on Flocculation           |

2 | 210 | ECE | Personal Medication Scheduling Device                               |
| 209 | IME-B| The Development of a QS-9000 Quality System                        |
| 208 | MAE-A-II| Analysis and Optimization of Dishwasher Energies                   |
| 213 | MAE-B-II| Design of an Orthopedic Swimming Aid                              |
| 211 | PSE  | The Effect of Internally-Filled Pulp on Recycling                  |

2:30 | 210 | ECE | FPGA-Based Risc Processor Array                                    |
| 209 | IME-B| Glueline Shear Strength in Pre-Glued Dowel Joints                  |
| 208 | MAE-A-II| Redesign of an Articulating Arm                                    |
| 213 | MAE-B-II| Adjustable Caster/Camber Plate for an Automobile                   |
| 211 | PSE  | Repulping Beverage Carrier Paperboard                              |

3 | 209 | CMD | Blister Resistance of Carbon/Graphite Materials                    |
| 210 | ECE | PC Interfacing With an Analog Sonar Device (Lowerance X-16)         |
| 213 | MAE-B-II| Analysis and Optimization of Connector Lock Beams                  |
| 211 | PSE  | Repulping Beverage Carriers                                        |

3:30 | 210 | ECE | Audio Signal Fourier Analyzer                                      |

4 | 210 | ECE | Power Supply Transformer Design                                    |

4:30 | 210 | ECE | National Time Standard Clock (WWV)                                  |
BLISTER RESISTANCE OF CARBON/GRAPHITE MATERIALS
by Tim Warren
Sponsor: Vince Pilletteri - Durametallic Corporation
Faculty Advisor: Vladimir Tsukruk
3:00 to 3:25 p.m., Room 209
AUTOMATED TEST FIXTURE FOR A CIRCUIT BOARD ASSEMBLY
by Gordon Grove, Allan Hoffman, and Regina Roiter
Sponsors: Michael L. Casey, Richard Markle, and Mickey Noonan - Stryker Instruments
Faculty Advisor: Frank Severance
8:00 to 8:25 a.m., Room 210

SPEECH RECORD AND PLAYBACK DEVICE FOR THE DISABLED
by Nimalan Kanagasabai, Aravindan Rajoo, and Salam Zeidan
Faculty Advisor: Frank Severance
9:30 to 9:55 a.m., Room 210

BLIND ZONE DETECTOR FOR SCHOOL BUSES
by Sallah Bensaleh, Pei Ling Cheng, Teong Aik Lim, and Chee Wee Ooi
Faculty Advisor: John Gesink
10:00 to 10:25 a.m., Room 210

CONDUCTIVITY AND TEMPERATURE METER
by Ping Haur Chang, Wai Hoong Lim, and Woh Hon Siew
Faculty Advisor: Lambert VanderKooi
10:30 to 10:55 a.m., Room 210

DIGITAL PRESSURE GAUGE
by Marc Miller and Joe Palid
Sponsor: Dan Housermann - Ronningen-Petter
Faculty Advisor: Lambert VanderKooi
11:00 to 11:25 a.m., Room 210

AUTOMATED ELECTRONIC TEST AND VERIFICATION SYSTEM
by Douglas Joel DeHaan, Micheal D. LaPerre, and Jeffrey R. Spitzner
Faculty Advisor: Marek Nikodem
11:30 to 11:55 a.m., Room 210
NAVIGATIONAL AID FOR THE VISUALLY IMPAIRED
by Chee Hiean Ooi, Thelge Pubudu Nuwan Peiris, and Tiew Yong (David) Toh
Sponsor: David Guth and Robert LaDuke, Department of Blind Rehabilitation, Western Michigan University
Faculty Advisor: John Gesink
1:00 to 1:25 p.m., Room 210

AN "H-BRIDGE" INVERTER TO CONTROL A PERMANENT MAGNET D.C. MOTOR
by King Ho Lau, Yen Thong Lim, and Chee Hoe Teh
Faculty Advisor: Joseph Kelemen
1:30 to 1:55 p.m., Room 210

PERSONAL MEDICATION SCHEDULING DEVICE
by Steven S. Beattie, Jeffrey W. Decker, and Paul R. Lieber
Faculty Advisor: John Mason
2:00 to 2:25 p.m., Room 210

FPGA-BASED RISC PROCESSOR ARRAY
by Doug Johns and Brad Ree
Faculty Advisor: Sharon Hu
2:30 to 2:55 p.m., Room 210

PC INTERFACING WITH AN ANALOG SONAR DEVICE (LOWRANCE X-16)
by S. Ahsan Alam, Soong Lin Teng, and Aik Khoon Yeoh
Sponsor: William A. Sauck, Department of Geology - Western Michigan University
Faculty Advisor: Sharon Hu
3:00 to 3:25 p.m., Room 210

AUDIO SIGNAL FOURIER ANALYZER
by Shaw Wei (David) Chin, Kok Keong Lai, and Keng Ann Low
Sponsor: Joseph G. Reish and The WMU Undergraduate Research and Creative Activities Award Review Committee
Faculty Advisors: Janos Grantner and Frank Severance
3:30 to 3:55 p.m., Room 210

POWER SUPPLY TRANSFORMER DESIGN
by Hasan Alwraikat, Alan Darlison and Abdul Nasser Kalban
Faculty Advisor: Joseph Kelemen
4:00 to 4:25 p.m., Room 210
NATIONAL TIME STANDARD CLOCK (WWV)
by Allen Eichenberg, Nathan Felt, Timothy Trang, and Mike Wallace
Faculty Advisor: John Mason
4:30 to 4:55 p.m., Room 210
A PAPERLESS APPROACH TO MANUFACTURING
by Rob Dial, Marvin Wilkins, and Jennifer Woodard
Sponsor: Verna Kober and Jim Zawacki - GR Spring & Stamping, Inc.
Faculty Advisor: Larry Mallak
9:30 to 9:55 a.m., Room 204

WORK-IN-PROCESS REDUCTION THROUGH PROCESS REDESIGN
by Chris Chojnowski, Eric Kelso, and Steve Olsen
Sponsors: Robert Gill and Bill Kellogg - Gill Industries, Inc.
Faculty Advisor: Larry Mallak
10:00 to 10:25 a.m., Room 204

COST REDUCTION IN CABINET PRODUCTION
by Joseph T. Gravlin and Christian M. Nix
Sponsor: David Postma - AM Fab Inc.
Faculty Advisor: Larry Mallak
10:30 to 11:00 a.m., Room 204
IMPLEMENTATION AND INSTALLATION OF DESIGN EXPERT: AUTO SURF AND ADVANCED MODELING EXTENSION
by Thomas M. Brian Jr., Christopher Cotting, and Joseph Rewa Jr.
Faculty Advisor: Michael Atkins and Ralph Tanner
9:00 to 9:25 a.m., Room 209

QUICK BARREL CHANGE ON AN 85 TON INJECTION MOLDER
by Brian Dorman, Mark Lazor, and Troy LeRoux
Faculty Advisor: Paul Engelmann
9:30 to 9:55 a.m., Room 209

CAR TOP CARRIER
by Scott Berg, Joanna Berreth, Alicia Drost, and Suzanne Hawes
Sponsor: Cindy Allen - Falcon Foam and Kenneth J. Harris - KL Industries
Faculty Advisor: Dmitry Azrikan and Charles Woodward
10:00 to 10:25 a.m., Room 209

FOLDABLE SULKY FOR COMMERCIAL LAWN MOWERS
by Steve Cochrane, Todd Harroun, Leslie Larson, and Matt Zielke
Faculty Advisor: Dmitry Azrikan and Charles Woodward
10:30 to 10:55 a.m., Room 209

REDESIGN OF THE WIRE AND PIN COLLET
by Sevetra Hodge, William Peless, TraShawn Pruitt, and David VanderKolk
Faculty Advisor: Fred Sitkins and Charles Woodward
11:00 to 11:25 a.m., Room 209

HUMAN POWERED VEHICLE
by Scott Gourlay, Chris Holmes, Russ Melchert and Dan Tatman
Faculty Advisor: Charles Woodward
11:30 to 12:00 p.m., Room 209

DESIGNING REVISIONS FOR AUTOCAD USING AUTOLISP
by John Frei and Steven J. Parker
Faculty Advisor: Charles Woodward
1:00 to 1:25 p.m., Room 209
THE IMPORTANCE OF THE AUTOMOBILE INDUSTRY'S CUSTOMER SATISFACTION INDEX (CSI)
by Peter Langsdorf and D. Robert MacLeod
Faculty Advisor: James VanDePolder
1:30 to 1:55 p.m., Room 209

THE DEVELOPMENT OF A QS-9000 QUALITY SYSTEM
by Kenneth T. Bennick and Patrick Kevin Murphy
Faculty Advisor: Fred Sitkins
2:00 to 2:25 p.m., Room 209

GLUELIFE SHEAR STRENGTH IN PRE-GLUED DOWEL JOINTS
by Michael D. Carlson, John Howley, and Robert Ruthven
Sponsors: Jeff Oliverson - Mountain View Marketing
Faculty Advisor: Roman Rabiej
2:30 to 2:55 p.m., Room 209
MECHANICAL AND AERONAUTICAL ENGINEERING - A-I
Session Chair - James Kamman
Room 208

DESIGN OF A THEFT-DETERRING DOOR STOP
by Jay Andrews and Marc Mitchell
Sponsor: Todd Sutton - QUEST Engineering, Ltd.
Advisor: James Kamman
9:00 to 9:25 a.m., Room 208

ANALYSIS AND REDESIGN OF A TORSIONAL VIBRATION ABSORBER
by Richard Lapinski and Chong-Ming Lim
Faculty Advisor: James Kamman
9:30 to 9:55 a.m., Room 208

DESIGN OF A FLEXIBLE ARM SYSTEM TO DEMONSTRATE CLOSED-LOOP CONTROL
by Pei Cheng Kwa and Chin Heang Yeoh
Faculty Advisor: James Kamman
10:00 to 10:25 a.m., Room 208

THERMAL-HYDRAULIC DESIGN OF SHELL-AND-TUBE HEAT EXCHANGERS
by Soon Chin Dennis Lim and Jeremy Yip Chian Tan
Sponsor: Douglas Mathews - Koolant Koolers, Inc.
Faculty Advisor: Srinivas Garimella
10:30 to 10:55 a.m., Room 208

DESIGN OF A DOMESTIC HEAT RECOVERY SYSTEM
by Waleed Al-Wafi and Zulkiflee Ismail
Faculty Advisor: Srinivas Garimella
11:00 to 11:25 a.m., Room 208

MEASUREMENTS AND PREDICTIONS OF HEAT TRANSFER COEFFICIENTS FOR MECHANICAL SEALS
by Mohd Azlan Abas and Hin Loon Khow
Faculty Advisor: Parviz Merati
11:30 to 11:55 a.m., Room 208
MECHANICAL AND AERONAUTICAL ENGINEERING - A-II
Session Chair - Iskender Sahin
Room 208

REDESIGN OF DISHWASHER SPRAY WASH FOR REDUCED SOUND
by Tom Goffas and Everett Kettle
Sponsor: Victor Vukorpa - Whirlpool Corporation
Faculty Advisor: Iskender Sahin
1:00 to 1:25 p.m., Room 208

WATER DUCT DESIGN FOR MARINE POWER BOAT APPLICATION
by Kevin J. Beber and Jeff D. Gary
Sponsor: Glenn Hall - Torque Engineering Corporation
Faculty Advisor: Iskender Sahin
1:30 to 1:55 p.m., Room 208

ANALYSIS AND OPTIMIZATION OF DISHWASHER ENERGIES
by Michael Brown II and Nathan Hunt
Sponsor: Todd Jozwiak - Whirlpool Corporation
Faculty Advisor: Jerry Hamelink
2:00 to 2:25 p.m., Room 208

REDESIGN OF AN ARTICULATING ARM
by John Drust and Julie Ann Dubiel
Sponsors: Gary Speet, Sintel Incorporated and Ronald Santoro, Aero-Motive Company
Faculty Advisor: Jerry Hamelink
2:30 to 2:55 p.m., Room 208
ADJUSTABLE WING DESIGN FOR A RACECAR APPLICATION
by James Brewer and Eric Lesher
Sponsor: Willard Stutzman - Stutzman Racing
Faculty Advisor: Richard Hathaway
9:00 to 9:25 a.m., Room 213

FRAME DESIGN FOR A SUPER MODIFIED RACE CAR
by Brian Crum and Robert Knepple
Sponsor: Willard Stutzman - Stutzman Racing
Faculty Advisor: Richard Hathaway
9:30 to 9:55 a.m., Room 213

DESIGN OF A TEST FIXTURE FOR MEASUREMENT OF TRUCK TRANSMISSION EFFICIENCY
by Ron Duis and Paul Kinney
Sponsor: Michael Lempke and Larry Loedeman - Eaton Corporation, Truck Components Operations - North America
Faculty Advisor: Koorosh Naghshineh
10:00 to 10:25 a.m., Room 213

DESIGN OPTIMIZATION OF A PISTON FOR REDUCED EMISSIONS
by Scott Ferriell and Kevin Ullrey
Sponsor: Andreas Bahr and Darryll Boos - Karl Schmidt Unisia, Inc.
Faculty Advisor: Koorosh Naghshineh
10:30 to 10:55 a.m., Room 213

REDESIGN OF FORGING PROCESS FOR A TURBINE HUB
by Elizabeth Beecham and Brian Engel
Faculty Advisor: Phillip Guichelaar
11:00 to 11:25 a.m., Room 213

DESIGN OF AN O-RING DRAG TESTER
by Todd Adams and Brent Brower
Sponsor: Joseph C. Parker - Durametallic
Advisors: Phillip Guichelaar
11:30 to 11:55 a.m., Room 213
ELEVATED ARMREST ATTACHMENT FOR WHEELCHAIR
by Todd Greve and Kim Schell
Faculty Advisor: Judah Ari-Gur
1:00 to 1:25 p.m., Room 213

DESIGN OF A REPLACEMENT FOR THE GRUMMAN A-6 AIRCRAFT
by Michael Schierbeek
Faculty Advisors: Judah Ari-Gur and John Valasek
1:30 to 1:55 p.m., Room 213

DESIGN OF AN ORTHOPEDIC SWIMMING AID
by Jeff Bither and Robert Geneseo
Faculty Advisors: Judah Ari-Gur and John Gesink
2:00 to 2:25 p.m., Room 213

ADJUSTABLE CASTER/CAMBER PLATE FOR AN AUTOMOBILE
by Russ Ferguson and Tom Pate
Sponsor: Dave Stone - Performance Machine Works Ltd
Faculty Advisor: Dennis VandenBrink
2:30 to 2:55 p.m., Room 213

ANALYSIS AND OPTIMIZATION OF CONNECTOR LOCK BEAMS
by Scott Finstrom and Chee Cheong Loo
Sponsors: Bruce N. Sech and Dean Weurding - Mol-Son Inc
Faculty Advisor: Dennis VandenBrink
3:00 to 3:25 p.m., Room 213
PAPER TESTING CORRELATIONS FOR PRINT QUALITY
by Michelle Reno
Faculty Advisor: Brian Scheller
9:00 to 9:25 a.m., Room 211

PARAMETER OPTIMIZATION FOR SOFTNIP CALENDERING
by Jung-Kyu Yang
Faculty Advisor: Brian Scheller
9:30 to 9:55 a.m., Room 211

BRIGHTENING AGENT OPTIMIZATION IN LATEX COATINGS
by Mark P. Comensoli
Faculty Advisor: Brian Scheller
10:00 to 10:25 a.m., Room 211

THERMO-CHEM CONVERSION OF STARCH USING AMMONIUM PERSULFATE
by Ronn Englehart
Faculty Advisor: Ray Janes
10:30 to 10:55 a.m., Room 211

EFFECTS OF SURFACTANTS ON SEMIMECHANICAL PULPING
by Timothy Schemanski
Faculty Advisor: Ray Janes
11:00 to 11:25 a.m., Room 211

BOD AND COD LEVELS OF RECYCLED KOREAN AND AMERICAN BOXBOARD
by Craig Mefford
Faculty Advisor: Van Maltby
11:30 to 11:55 a.m., Room 211

BOD AND COD LOADING EFFECTS OF REPEATEDLY RECYCLED PAPER FIBERS
by Ken Stager
Faculty Advisor: Van Maltby
1:00 to 1:25 p.m., Room 211
THE EFFECT OF SUSPENDING LIQUID VISCOSITY ON FLOCCULATION  
by Heather Groat  
Faculty Advisor:  David Peterson  
1:30 to 1:55 p.m., Room 211

THE EFFECT OF INTERNALLY-FILLED PULP ON RECYCLING  
by Anne Spruit  
Faculty Advisor:  David Peterson  
2:00 to 2:25 p.m., Room 211

REPULPING BEVERAGE CARRIER PAPERBOARD  
by Jennifer A. Giver  
Faculty Advisor:  Ellsworth Shriver  
2:30 to 2:55 p.m., Room 211

REPULPING BEVERAGE CARRIERS  
by Mahsa Khosravani  
Faculty Advisor:  Ellsworth Shriver  
3:00 to 3:25 p.m., Room 211
THANK YOU

The College of Engineering and Applied Sciences is grateful to these firms, which have provided or cooperated in Senior Engineering Design Projects being presented in December 1995. If you have a project for our students or if you would like more information, please call Dace Copeland at (616) 387-4017.

Aero-Motive Company
AM Fab, Inc.
Durametallic Corporation
Eaton Corporation TCONA
Falcon Foam
Gill Industries, Inc.
GR Spring & Stamping, Inc.
Jernberg Industries, Inc.
Karl Schmidt Unisia, Inc.
KL Industries
Koolant Koolers, Inc.
Mol-Son Inc.
Mountain View Marketing
Quest Engineering, Ltd
Performance Machine Works Ltd.
Ronningen-Petter
Sintel Inc.
Stryker Instruments
Stutzman Racing
Torque Engineering Corporation
Whirlpool Corporation
The College of Engineering and Applied Sciences offers a wide variety of programs.

**School of Aviation Sciences**
- Aircraft maintenance engineering technology
- Aviation flight science
- Aviation technology and operations

**Construction Engineering, Materials Engineering, and Industrial Design**
- Construction engineering and management
- Industrial design
- Materials engineering

**Electrical and Computer Engineering**
- Computer Engineering
- Electrical Engineering

**Industrial and Manufacturing Engineering**
- Automotive engineering technology
- Engineering graphics and design technology
- Engineering management
- Industrial engineering
- Industrial management
- Manufacturing engineering technology

**Mechanical and Aeronautical Engineering**
- Aeronautical engineering
- Mechanical engineering

**Paper and Printing Science and Engineering**
- Paper engineering
- Paper science
- Printing

The master of science in engineering is offered in computer, electrical, mechanical, and industrial engineering.

The master of science is offered in engineering management, manufacturing science, materials science, operations research, and paper science and engineering.

The Ph.D. is offered in industrial and in mechanical engineering.