



4-2002

30th Conference on Senior Engineering Design Projects

College of Engineering and Applied Sciences

Follow this and additional works at: http://scholarworks.wmich.edu/engineer_design_projects

 Part of the [Engineering Commons](#)

WMU ScholarWorks Citation

College of Engineering and Applied Sciences, "30th Conference on Senior Engineering Design Projects" (2002). *Senior Engineering Design Conference*. 27.

http://scholarworks.wmich.edu/engineer_design_projects/27

This Conference Program is brought to you for free and open access by the College of Engineering and Applied Sciences at ScholarWorks at WMU. It has been accepted for inclusion in Senior Engineering Design Conference by an authorized administrator of ScholarWorks at WMU. For more information, please contact maira.bundza@wmich.edu.



Senior Design Project

The 30th Conference on Senior Engineering Design Projects

You are invited to attend the thirtieth Conference on Senior Engineering Design Projects. The conference will be held from 9 a.m. to 2 p.m. **Tuesday, April 16, 2002** 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. Please park in metered spaces. There is a charge for parking. Meters accept quarters only.

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

Session locations, starting times for project descriptions:

Construction Engineering	242	10:00 to 12:00
Electrical and Computer Engineering	208	9:00 to 1:30
Industrial Design A-1	204	9:00 to 2:30
Industrial Design B-1	205	9:00 to 11:30
Industrial and Manufacturing Engineering	209	9:00 to 2:30
Materials Engineering	242	9:00 to 10:00
Mechanical Engineering and Aeronautical Engineering A-I	210	9:30 to 2:30
Mechanical Engineering and Aeronautical Engineering B-I	211	9:30 to 2:30
Mechanical Engineering and Aeronautical Engineering C-I	212	9:00 to 12:00
Paper Science and Engineering	213	9:00 to 12:00

Refreshments will be available in the lobby from 8:30 a.m. to 10:30 a.m.

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

For more information about the conference, call [Cathy Smith](#) at (616) 387-4017.

The 30th Conference on Senior Engineering Design Projects

CE = Construction Engineering

ECE = Electrical and Computer Engineering

ID = Industrial Design

IME = Industrial and Manufacturing Engineering

MAE = Mechanical and Aeronautical Engineering

MSE = Materials Engineering

PPSE = Paper Science and Engineering

Time	Room	Dept.	Topic
9:00AM	208	ECE	Laboratory Environment Controller
	204	ID-A1	Vista
	205	ID-B1	Cerebrum: Advanced Personal Digital Assistant
	209	IME	Manufacturing Facility For Specialty Cheeses
	242	MSE	Magnetic Shape Memory Alloys - The Smart Material of Tomorrow
	212	MAE C-I	Miniature Jet-Propulsion Fuel System
	213	PPSE	Digital Plates for Flexography
9:30AM	208	ECE	Arinc 429 Control System
	204	ID-A1	Pullite Camping System
	205	ID-B1	Socorra Phone Booth
	209	IME	Hybrid Engine Evaluation and Optimization
	242	MSE	Fabrication of Silicon Micro-Tip Arrays for Electron Field Emission Applications
	210	MAE A-I	Electro-Mechanical Parking Brake
	211	MAE B-I	Redesign of an Aircraft Cargo Door Actuation Test Stand
	212	MAE-C1	Design of an Unmanned Aerial Vehicle
	213	PPSE	The Effects of Molecular Weight and Acid Functionality on Immobilization Solids
10:00AM	242	CE	Southwest Regional Center Construction Management Program
	208	ECE	Localized Differential GPS System for the Visually Impaired
	204	ID-A1	Axis Digital Talking Book
	205	ID-B1	Panacea Athletic Injury Transport
	209	IME	Diverse Applications for Prototype Fasteners
	210	MAE A-I	Goalball Return Net
	211	MAE B-I	Design and Fabrication of a Laboratory Device for Demonstration of Helmholtz Resonators
	212	MAE-C1	Analysis of the Aerodynamic Efficiency of an Automobile
213	PPSE	The Effects of Coating Porosity and Tortuosity of Inkjet Printing Quality	

10:30AM	242	CE	Renovation of the Three Rivers Waste Water Treatment Plant
	208	ECE	Robotic Arm
	204	ID-A1	Work Surface and Accessories for the Saliz Office Environment
	205	ID-B1	Dakota Shopping Cart
	209	IME	Design and Analysis of a Testing Fixture for Flexible Elements
	210	MAE A-I	Energy Audit for a Campus Ministry
	211	MAE B-I	Measurement Platform for Aircraft Cargo Door Actuator
	212	MAE-C1	Optimal Transition of a Turbine Based Combined Cycle Engine
	213	PPSE	Effect of Hexenuronic Acid in Kraft Bleaching Systems

11:00AM	242	CE	WMU College of Engineering Parking Structures
	208	ECE	Communication Port Adapter
	204	ID-A1	Storage Cart, Pedestal, and Office Partitions for the Saliz Office Environment
	205	ID-B1	Yare Full Suspension Mountain Bike
	209	IME	Relationship of Nylon to Injection Mold Plating Retention
	210	MAE A-I	Centrality of Universal-Joint Assembly
	211	MAE B-I	Break-In Procedures for Axial Piston Pumps
	212	MAE-C1	Reduction of Drag on a Wing Surface by Suction Device
	213	PPSE	Starch Formulations as Corrugated Board Adhesives

11:30AM	242	CE	Reconstruction of the M-86 Bridge over the St. Joseph River
	208	ECE	Internet Based Home Monitoring System
	204	ID-A1	Saliz Chair Design
	209	IME	A Study of Cognitive, Physiological, and Physical Factors Affecting Worker Performance
	210	MAE A-I	Dry Foods Dispenser
	211	MAE B-I	Delamination of Diamond Coatings on Mechanical Seals
	212	MAE-C1	Nacelle-Wing Interference Effects on Wolf Aircraft
	213	PPSE	Solvent Disposal Option Analysis and Comparison

1:00PM	208	ECE	Flow Control and Monitor System
	204	ID-A1	Dreamplay: Digital Learning Tool for Visually Impaired Children
	209	IME	Work-in-Process Levels of a Low Volume High Variety Production Line
	210	MAE A-I	Pneumatic Valve Production Test Stand

	211	MAE B-I	Engine Management System for the Formula SAE Engine
1:30PM	204	ID-A1	Rugged All Terrain Response (AT-R) Trailer
	209	IME	Design and Fabrication of a Thermal Distortion Tester
	210	MAE A-I	Modification of a Portable Infusion Pump for a Pain Relief System
	211	MAE B-I	Height Measurement Device for Racecar Applications
2:00PM	204	ID A-I	Recite Digital Talking Book
	209	IME	Design of Tooling and Testing Procedures for the Measuring of Core Integrity
	210	MAE A-I	Transmission Intake Filtration System
	211	MAE B-I	Formula SAE Racecar Frame

American Axle & Manufacturing
 Barco Graphics
 Copper Development Association, Inc
 The Christman Company
 Eaton Aerospace
 Flowserve Corporation
 Fredericks Design Inc.
 Goodrich Avionics Systems
 Kalamazoo Brewing Co., Inc.
 Michigan Department of Transportation
 Parker Aerospace Abex NWL
 Pharmacia Corporation
 Stryker Instruments
 The Village Link
 Whirlpool Corporation

Argonne National Laboratory
 Benteler Automotive
 Coy Laboratory Products
 DaimlerChrysler
 Eaton Corporation
 Ford Motor Company
 George Fischer Disa Inc.
 Hensley Aircraft, Inc.
 L.D. Docsa & Association, Inc.
 NASA Glenn Research Center
 Parker Hannifin Corpn., Pneumatic Div.
 Power Water Systems, Inc.
 Sweet Manufacturing
 Wesley Foundation of Kalamazoo

The 30th Conference on Senior Engineering Design Projects

CONSTRUCTION ENGINEERING

Session Chair - Osama Abudayyeh
Room 242

SOUTHWEST REGIONAL CENTER CONSTRUCTION MANAGEMENT PROGRAM

by Bill Brushaber, Joshua Fry, and Paul Boyer
Faculty Advisor: L. Jawahar Nesan
10:00 a.m. to 10:25 a.m., Room 242

The Southwest Regional Center is a 45,000 square foot educational facility. Given a limited time frame and budget to construct the Center, an efficient construction management program was required. This construction management program included a schedule, detailed estimate, work breakdown structure, and project management system. Scheduling software was used to develop an accelerated schedule to meet the required project deadline. Take-off quantities were developed, and using cost estimating data, a project estimate was created. The construction management program developed can be used to monitor progress throughout the project and can also be used as a reference to apply to future projects.

RENOVATION OF THE THREE RIVERS WASTE WATER TREATMENT PLANT

by Scott DeVoll, Nathan Finrock, and Cory Harmsen
Sponsor: Jason Docsa, P.E. - L.D. Docsa and Associates, Inc.
Faculty Advisor: Osama Abudayyeh
10:30 a.m. to 10:55 a.m., Room 242

The City of Three Rivers' Waste Water Treatment Plant was in need of renovation. The renovation consisted of updating and replacing old equipment and expanding the capacity of the current holding facilities. A schedule for the project was developed and a project management system was designed to complete the project on time. Project durations were estimated and a Critical Path Method network was used to construct the schedule. Construction of the management system included development of a cash flow system, a safety plan, and other management devices. [top>](#)

WMU COLLEGE OF ENGINEERING PARKING STRUCTURES

by Jeffrey Fedewa, Ryan Leaser, and Jennifer Marble
Sponsor: Tom Alliston, P.E., and Brian Crissman - The Christman Company
Faculty Advisor: Osama Abudayyeh
11:00 a.m. to 11:25 a.m., Room 242

A project management system including a detailed cost estimate, an up-to-date schedule, a safety plan, and a project control system was implemented for the parking structures at Western Michigan University's College of Engineering and Applied Sciences. This system was critical in providing for a smooth transition among the documentation, bidding, and construction phases. The detailed cost estimate enables the owner to assemble an overall budget for the project, while the up-to-date schedule permits the construction manager to establish critical target dates for the project to be complete on time. [.top>](#)

RECONSTRUCTION OF THE M-86 BRIDGE OVER THE ST. JOSEPH RIVER

by Justin T. Barringer, Tim J. Broilo, and Seth D. Horton

Sponsor: Pete Pfeiffer, P.E. - Michigan Department of Transportation

Faculty Advisor: L. Jawahar Nesan

11:30 a.m. to 11:55 a.m., Room 242

The M-86 bridge over the St. Joseph River in Three Rivers, MI was in need of reconstruction because it no longer met state highways codes. A framework was developed to address the project management system including work breakdown structure, schedule, and a cost estimate. The framework can be used as a bidding tool or a schedule for the project. It can also be used to monitor the project's progression.

[.top>](#)

ELECTRICAL AND COMPUTER ENGINEERING

Session Chair - Damon Miller

Room 208

LABORATORY ENVIRONMENT CONTROLLER

by Ashley Coy, Alan Kuipers, and Michael Roussin

Sponsor: Doug Menard, Richard Coy, Carol Coy, and Brian Coy - Coy Laboratory Products

Faculty Advisor: Frank Severance

9:00 a.m. to 9:25 a.m., Room 208

A manufacturer of controlled environment chambers, which are used for research and development projects in biology, chemistry and geology, currently uses individual devices that control one of the three variables: oxygen, humidity, and temperature. The manufacturer determined that a single control unit would lower cost and increase chamber space. This unit, called the "Environment Controller," was designed to maintain the control variables at arbitrary set-points. The Environment Controller is housed in a single self-contained enclosure and includes a user interface.

ARINC 429 CONTROL SYSTEM

by Ronald Blowers, Eric DeKoekkoek, and Jonathan Orweller

Sponsor: Jerry Barofsky - Goodrich Avionics Systems

Faculty Advisor: John Mason

9:30 a.m. to 9:55 a.m., Room 208

A new control system was designed and built to test and troubleshoot avionics devices in a workstation environment. The Arinc 429 control system interfaces a standard personal computer serial port with an Arinc 429 communications bus, as used in many avionics systems. This system will replace more costly custom built devices that are presently used. [top>](#)

LOCALIZED DIFFERENTIAL GPS SYSTEM FOR THE VISUALLY IMPAIRED

by Harryl Martinez, Jim McDonald, and Angelo Petrino

Faculty Advisor: Brad Bazuin

10:00 a.m. to 10:25 a.m., Room 208

A significant challenge for the visually impaired is to know their exact location and then to navigate from that location to another. The Global Positioning System (GPS) provides

hand-held devices that provide such information but with accuracy of only 20 to 30 meters. Augmenting receivers with differential correction factors based on a known basestation receiver location can improve position accuracy to between one and three meters. This project developed a localized differential GPS system consisting of a reference basestation and a remote station that will provide voice annunciation of position and direction for a blind or visually impaired user. [top>](#)

ROBOTIC ARM

by Anys Bacha, Tim Hall, and Hakeem Ogunleye
Faculty Advisor: Ralph Tanner
10:30 a.m. to 10:55 a.m., Room 208

A robotic arm featuring two degrees of freedom and a user interface were designed and built to be used in a microcontroller applications class at Western Michigan University. The device is also available for demonstrations to prospective students. The robotic arm is eight inches long with the ability to move 180 degrees horizontally and 45 degrees vertically. An electromagnet capable of lifting up to two ounces and an infrared detector for simple light detection are attached to the end of the robotic arm. The user interface consists of six push buttons and a liquid crystal display. The device is designed to support control through the user interface or via an external microcontroller. [top>](#)

COMMUNICATION PORT ADAPTER

by Alex Chen, Kate Lanning, Mark Lyons, and Matt Williams
Sponsor: Greg Rabick - Stryker Instruments
Faculty Advisor: Dean Johnson
11:00 a.m. to 11:25 a.m., Room 208

A medical instruments company uses a communication port adapter to program memory devices used in medical equipment. The previous commport adapter design had potential noise and improper timing problems. To circumvent these problems, the refined design utilized a central power supply, metallic cabinet, and a microcontroller-based communications system. The user controls the hardware with graphical user interface software, which was developed concurrently. [top>](#)

INTERNET BASED HOME MONITORING SYSTEM

by Rebecca Covert, Damon Maneice, and Jason Penninger
Sponsor: Spencer Levleit - The Village Link
Faculty Advisor: Massood Zandi Atashbar
11:30 a.m. to 11:55 a.m., Room 208

The Internet Based Home Monitoring System allows a person to monitor and control home appliances (e.g. temperature/lights) from any Internet connection. This system includes a module control unit, a thermostat module, and a light switch module. After the users log on to the module control unit, they are given the current status of the temperature and light switch position. Then they can input a command to alter current settings. The module control unit processes the request and sends the signal through a radio frequency (RF) transceiver to the required module, which carries out the task and sends the user a message verifying that the task was completed. [top>](#)

FLOW CONTROL AND MONITOR SYSTEM

by Mike Gilmore

Sponsor: Power Water Systems, Inc.
Faculty Advisor: Ikhlas Abdel-Qader
1:00 a.m. to 1:25 a.m., Room 208

The Flow Control and Monitor System (FCMS) was developed to be utilized in an oxygenated-water producing operation. The FCMS senses the amount of water flow that travels through the operation, while also providing real-time access of the water flow data via the Internet to a central server database. The FCMS uses a programmable logic controller to interpret signals generated by flow-metering device and transmit the flow data over an H1 Fieldbus and the Internet. [top>](#)

INDUSTRIAL DESIGN A-1

Session Chair - Alvarro Correa
Room 204

VISTA

by Gunther Chanage
Faculty Advisor: Alvaro Correa
9:00 a.m. to 9:25 a.m., Room 204

Life is full of barriers but reading should not be one of them. Vista's goal is to introduce a newly designed digital talking book that simplifies the reading barriers imposed upon blind, visually impaired and physically disabled children. Simultaneously, the product's vision stayed focused in following the design criteria to develop the next generation of digital talking book playback machines. Vista responds to the challenge with a design that offers a sense of discovery and recognition throughout the blind and visually impaired community.

PULLITE CAMPING SYSTEM

by Chris Erlandson and Mike Hanson
Faculty Advisor: Alvaro Correa
9:30 a.m. to 9:55 a.m., Room 204

The Pullite trailer is a camping system designed to make camping easier and more enjoyable for everyone from beginners to experienced families and individuals. The design has all the essentials needed (stove, water storage, refrigerator, sink, and tent) to enhance the camping experience, all included in a compact trailer with the components arranged for easy access and usability. The design incorporates a four person tent that can be attached to the trailer and allows for easy access to the utilities. There is an option for smaller or larger tents depending on users needs. The combination of all the essentials for camping makes the Pullite trailer a camping experience that is affordable, easy to use and more enjoyable. [top>](#)

AXIS DIGITAL TALKING BOOK

by Christy Ennis and Todd Harris
Faculty Advisor: Alvaro Correa
10:00 a.m. to 10:25 a.m., Room 204

In today's growing digital age, cassette technology is quickly becoming obsolete. Therefore, the existing talking book machine for the visually-impaired and physically-handicapped population was redesigned to accommodate their needs and changing lifestyles in this new age of technology. Taking into account various ergonomic standards, manufacturing processes, and the limitations established by the nature of

this project, Axis was designed and engineered as a more intuitive digital machine with navigational improvements and fewer buttons. [top>](#)

WORK SURFACE AND ACCESSORIES FOR THE SALIZ OFFICE ENVIRONMENT

by Tyson Gilmore, Phillip McEwen Jr., and Matthew Trost

Sponsor: Mike Johnson and Jon Moroney - Fredricks Design, Inc.

Faculty Advisor: Alvaro Correa

10:30 a.m. to 10:55 a.m., Room 204

The innovative work surface and accessory system are the notable features of the Saliz professional work environment. This design successfully blends a workstation with personal space. The design foundation lies in the detailed research in office environments, emerging technology, user interface, and manufacturing processes. From that data a filtration process promoted ideas and unique concepts that were selected, resulting in a design that solved problems relating to space, mobility, personalization, and comfort. Saliz offers the option of a wireless unit, lightweight structure, personalized hologram technology, and memory ergonomics feature to enhance the work environment. [top>](#)

STORAGE CART, PEDESTAL AND OFFICE PARTITIONS FOR THE SALIZ OFFICE ENVIRONMENT

by Kristy Gesinski, Angela A. Greenhalgh, and Stephanie A. Lena

Sponsor: Mike Johnson and Jon Moroney - Fredricks Design, Inc.

Faculty Advisor: Alvaro Correa

11:00 a.m. to 11:25 a.m., Room 204

Saliz project requirements included the design of a mobile storage cart, pedestal, and office partitions that will be functionally configurable with the workstation and seating design. Current office units are unable to incorporate futuristic technologies or reconfigure easily because of their mobility, organization, and functionality. To improve on these objectives, extensive research through the Internet, surveys, benchmarking, concept sketches and ideation were performed to respond to the design criteria. The criteria served as the basis to create designs that responded to marketing, engineering, and manufacturing requirements.

The creative designs of Saliz will provide the user with means for mobility, comfort, superior user interface and use of future technologies. [top>](#)

SALIZ CHAIR DESIGN

by Wendy E. Mastal and Andrew Wright

Sponsor: Mike Johnson and Jon Moroney - Fredricks Design, Inc.

Faculty Advisor: Alvaro Correa

11:30 a.m. to 11:55 a.m., Room 204

The Saliz chair line is an extension of the Saliz office environment. Three chair styles, task, stack and leisure, were developed in response to the needs of the users. The design of the chairs began with research of existing chairs; including products, materials, ergonomic studies, user interface, packaging, and manufacturing processes. Practical placement of controls along with an unprecedented range of adjustment allows the task chair user to fit the chair to their needs. Innovative features allow for safer portability of the stacked chairs. A form fitting, voluptuous leisure chair completes the trio. The unique designs of the Saliz chair line allow users to take seating to a higher comfort level. [top>](#)

DREAMPLAY: DIGITAL LEARNING TOOL FOR VISUALLY IMPAIRED CHILDREN

by Brandon D. Hoover

Faculty Advisor: Alvaro Correa

1:00 a.m. to 1:25 a.m., Room 204

Learning is a lifetime necessity - one that develops a higher quality of life. DreamPlay allows children with visual impairments to experience media and learning tools typically designed for the sighted. Current designs are not ergonomically, aesthetically, or functionally tailored to visually impaired children. Research, interviews, and hands on evaluation resulted in diverse thinking that considered the special needs of children, such as a more simplified layout with buttons of varied shapes and textures for differentiation. Having addressed the needs of visually impaired children, DreamPlay allows for creativity and knowledge in tomorrow's world. [top>](#)

RUGGED ALL TERRAIN RESPONSE (AT-R) TRAILER

by Matt Bigari and Dennis Wroblewski
Faculty Advisor: Alvaro Correa
1:30 p.m. to 1:55 p.m., Room 204

The Rugged AT-R is a mobile, multi-task triage response trailer that has the capabilities necessary for treating multiple victims at a disaster scene. The AT-R was developed in response to the increase in large-scale disasters, whether the disaster is man-made or natural. A revolutionary, rapid deployment medi-pack system was especially developed for the AT-R along with a water station and data and communications center. The Rugged AT-R was developed to be an effective tool in disaster relief. [top>](#)

RECITE DIGITAL TALKING BOOK

by Jeremiah Judd
Faculty Advisor: Alvaro Correa
2:00 p.m. to 2:25 p.m., Room 204

Blind and/or physically handicapped individuals are able to borrow audio cassette book players from the National Library Service. These book players are now being offered in a digital format, and a new trend for digital players is being developed. The Recite Digital Talking Book design is focused on increasing portability and creating a much more stylish and modern appearance to fit into everyday use. To increase features without adding complexity, the Recite Digital Talking Book has grouped common functions into tactile and easy to use controls, which will not only reduce learning time but will also increase the desire to use the book. [top>](#)

INDUSTRIAL DESIGN B-1

Session Chair - David Middleton
Room 205

CEREBRUM: ADVANCED PERSONAL DIGITAL ASSISTANT

by Jonathan L. Klautky and Adam M. Nine
Faculty Advisor: David O. Middleton
9:00 a.m. to 9:25 a.m., Room 205

Cerebrum is a solution for eliminating a separate laptop, cell phone and PDA. Although these components have evolved separately, the evolution of technology will require these objects to converge. Cerebrum is composed of a base unit for a car and a portable input/output unit the size of a car radio faceplate. The portable unit includes a stylus that is also a hands free headset. The owner will be able to interact on multiple levels of communication with computers and humans. Daily tasks of life will be performed through your Cerebrum.

SOCORRA PHONE BOOTH

by Karyn McKey
Faculty Advisor: Alvaro Correa
9:30 a.m. to 9:55 a.m., Room 205

The project objective is the redesign of the current pay phone and booth. During the research phase, there were several problems with the pay phone: the receiver and buttons become dirty, it is often hard to hear a conversation because of ambient noise, wheelchair accessibility, and the size of the buttons. The new design, Socorra, which is Greek for assistant, solves many problems: a germicidal light kills germs as the phone is hung up, the buttons are larger, a variety of payment options are offered, a digital phone directory is available for ease of use, and the phone booth surrounds the person for noise reduction. In addition, the design is wheelchair accessible. [top>](#)

PANACEA ATHLETIC INJURY TRANSPORT

by Daniel P. Bayer

Faculty Advisor: Alvaro Correa

10:00 a.m. to 10:25 a.m., Room 205

Panacea Athletic Injury Transport is designed to remedy and cure the problem of insufficient transportation and mobile equipment storage available to today's sports medical personnel. The mission of this project was to design a vehicle to assist medical personnel on the field and ensure that every precaution has been made to address the medical needs of athletes. This is the true goal in designing this transport, which gives athletic departments and organizations an effective tool to protect their athletes. [top>](#)

DAKOTA SHOPPING CART

by Kristen McKey

Faculty Advisor: Alvaro Correa

10:30 a.m. to 10:55 a.m., Room 205

Dakota, which means "friend," is the name of a shopping cart redesigned to improve the use of existing carts. From research and information gathered, the main problem of existing carts is the poor quality of the wheels. Users also want to see compartments for different foods and have access to the bottom of the cart. Ideation sketches showed different ways of solving the problems and solutions were identified that led to the final design. The Dakota shopping cart features areas for different foods, a tray at the bottom of the cart that slides in and out for easier access, and wheels made of nylon that allows for a smoother ride. [top>](#)

YARE FULL SUSPENSION MOUNTAIN BIKE

by H. Anton Schmid

Faculty Advisor: Alvaro Correa

11:00 a.m. to 11:25 a.m., Room 205

The Yare full-suspension mountain bike simplifies the complex frame designs available today and easily adjusts for all types of terrain. Yare, which means agile, lively and prepared, represents exactly how this mountain bike will ride. To ensure the frame is light, materials such as aluminum and composites were used. The suspension is easily adjusted on-the-fly from the handlebar-mounted controls. The Yare's simplistic suspension design enables lower production costs and requires less maintenance for the user. It's custom-built frame allows for a more comfortable ride and is assembled in the shop according to the riders' specific ergonomic dimensions. [top>](#)

INDUSTRIAL AND MANUFACTURING ENGINEERING

Session Chair - Abdolazim Houshyar

Room 209

MANUFACTURING FACILITY FOR SPECIALTY CHEESES

by Tracy Cadorin, Charisse Edmonson, Alaa Sadek, and Hans Schmidt

Sponsor: Larry Bell - Kalamazoo Brewing Co., Inc.

Faculty Advisor: David Lyth

9:00 a.m. to 9:25 a.m., Room 209

A new industry is on the rise to meet the increasing demand of specialty cheeses in the United States. A local brewery is entering this new industry to complement existing product lines. The project team researched the cheese making process, specified and recommended equipment, and developed a facility design. The final design incorporates ergonomics, material flow, energy efficiency and Food and Drug Administration regulations. The final design was tested using a simulation model. The simulation model confirmed machine sequencing and timing as well as material and people flow. The final design produces low volume, high quality cheeses.

HYBRID ENGINE EVALUATION AND OPTIMIZATION

by Joseph Barkman, Jeremy Barron, and Caleb Wei

Faculty Advisor: James VanDePolder

9:30 a.m. to 9:55 a.m., Room 209

Hybrid electric vehicles need very efficient engines to maintain performance while lowering emissions. This hybrid engine is optimized to run at peak efficiency on alternative fuel. The engine was analyzed to determine at which speed and load the lowest specific fuel consumption occurred. Modifications were then made to the combustion chamber and to the fluid flow characteristics of the engine. The engine was re-evaluated to determine improvements in efficiency. top>

DIVERSE APPLICATIONS FOR PROTOTYPE FASTENERS

by De Vanne Burch, Damon Morris, and John J. Mulder

Sponsor: Ford Motor Company

Faculty Advisors: Fred Sitkins

10:00 a.m. to 10:25 a.m., Room 209

A big-three auto maker has developed numerous fastener patents as a part of its production design. Western Michigan University acquired the rights to eight patents that were never used. Alternative applications were investigated for the most applicable patents. These applications may enhance assembly, maintenance, and/or servicing in multiple industries. Each of the patents were researched to obtain information on the backgrounds of the patent's original intended use and it's potential new uses. The research involved learning the differences and similarities of associated patents with the intent of finding the most promising new and existing applications. [top>](#)

DESIGN AND ANALYSIS OF A TESTING FIXTURE FOR FLEXIBLE ELEMENTS

by Kurt Binder, Brandon Hukill, Brian Kretovic, and Nathan Normand

Sponsor: Marcus Hemmye - DaimlerChrysler

Faculty Advisor: Mitch Keil and Jorge Rodriguez

10:30 a.m. to 10:55 a.m., Room 209

A fixture was designed to study the movement of hydraulic hose in a vehicle. The fixture moved in the same manner as an existing vehicle front suspension while allowing for measurements that were impossible to make on the actual vehicle. The data collected from these measurements will be used to verify the predictions of hose movement made by a computer model being developed at Western Michigan University. [top>](#)

RELATIONSHIP OF NYLON TO INJECTION MOLD PLATING RETENTION

by Bruce Fessenden, Kevin Smelter, and Jason Smith

Sponsor: Harold T. Michels - Copper Development Association, Inc.

Faculty Advisor: Paul Engelmann

11:00 a.m. to 11:25 a.m., Room 209

The combination of clamping force and the properties of 33 percent glass filled nylon increases tool wear. The characterization of 33 percent glass filled nylon 6/6 determined the corrosive gases produced and physical wear during injection molding. To study this wear, three chrome plated copper mold

component designs were developed from previous research. Data was collected by testing the mold components in an injection molding machine. Data analysis focused on determining which design experienced the least plating loss. Results from the research provide recommendations that can be implemented in the design of new tooling or the modification of existing tools. top>

A STUDY OF COGNITIVE, PHYSIOLOGICAL, AND PHYSICAL FACTORS AFFECTING WORKER PERFORMANCE

by Amanda K. Bartolino and Elizabeth A. Saverino

Faculty Advisor: Tycho Fredericks and Jorge Rodriguez

11:30 a.m. to 11:55 a.m., Room 209

There are currently no techniques in practice to measure the effects of all causes of cognitive, physiological, and physical stresses as they relate to worker fatigue. This project was the first step in developing a model. Methods of determining these stress factors were applied in the workplace to determine their significance. A laboratory experiment was designed reflecting a working environment to analyze the influence of each factor in predicting the onset of worker fatigue. The results were analyzed and a recommendation was made concerning the model. top>

WORK-IN-PROCESS LEVELS OF A LOW VOLUME HIGH VARIETY PRODUCTION LINE

by Eloisa Marquez, Brian Miller, Mike Tabiadon, and Kailee Ung

Sponsor: Scott Eisen - Benteler Automotive

Faculty Advisor: Tarun Gupta

1:00 p.m. to 1:25 p.m., Room 209

Increased business led to the installation of a new production line for an auto makers exhaust manifold. A kanban system was implemented and the standard work-in-process levels were determined. Simulation, statistical analysis and design in the layout were the tools used to complete the project. It included determining the locations and required quantities for the buffer and safety stock. top>

DESIGN AND FABRICATION OF A THERMAL DISTORTION TESTER

by Ryan R. Omo, David R. Spoon, and Joshua M. White

Sponsor: George Fischer Disa, Inc.

Faculty Advisor: Sam Ramrattan

1:30 p.m. to 1:55 p.m., Room 209

A new Thermal Distortion Tester (TDT) was redesigned and built. The design of the machine included the addition of a chamber that fully enclosed the area where the tests were performed. This chamber allowed the atmosphere to be controlled around the tests being conducted to simulate actual in-mold conditions. Once the fabrication of the TDT was completed, actual testing utilizing the machine was performed on various types of sand binder systems and at varying temperatures within different atmospheric conditions top>

DESIGN OF TOOLING AND TESTING PROCEDURES FOR THE MEASURING OF CORE INTEGRITY

by Zach Brown, Naveen Gopiendran, and Nicholas Stankov

Faculty Advisor: Sam Ramrattan

2:00 p.m. to 2:25 p.m., Room 209

Sand cores are used throughout the metal casting industry to produce hollow regions of cast parts. The first objective of this project was to develop tooling to test sand density in relation to venting sizes and locations within the tool. The geometry of the tool was intended to simulate thick versus thin sections, deep core draws, and complex cavity geometry. The second part of this project was to produce sample cores. The group also observed other properties such as blow pressures, mechanical properties, and tooling and core surface finish. Core densities were compared to vent configuration and results were analyzed. top>

MATERIALS ENGINEERING

Session Chair - Pnina Ari-gur

Room 242

MAGNETIC SHAPE MEMORY ALLOYS - THE SMART MATERIAL OF TOMORROW

by Danielle L. Irwin

Sponsor: Dr. James W. Richardson - Argonne National Laboratory

Faculty Advisor: Pnina Ari-Gur

9:00 a.m. to 9:25 a.m., Room 242

Magnetic Shape Memory (MSM) alloys undergo both ferromagnetic and structural transformations upon cooling. These properties create the memory effect. A magnetic field of 4,000 Oe can produce a reversible five percent shear strain. For comparison, the strain in a strong piezoelectric is about 0.1 percent. Unlike shape memory alloys, MSM alloys change shape quickly in response to an applied magnetic field. The large strain and the speed of reaction make MSM alloys attractive as smart materials. In this project, the properties of the MSM alloys and their impact on the memory effect were examined using x-ray and neutron diffraction.

FABRICATION OF SILICON MICRO-TIP ARRAYS FOR ELECTRON FIELD EMISSION APPLICATIONS

by Mao-Hsiang Chang
Faculty Advisor: Ahalapitiya H. Jayatissa
9:30 a.m. to 9:55 a.m., Room 242

Electron field emission from materials is a very important surface phenomenon for a wide range of applications in electronic devices such as field emission displays and sensors. The search for efficient emission materials and the fabrication of high-density emitter array devices are the main areas of investigations. Fabrication of silicon emitter arrays was investigated using different techniques, such as microlithography, etching, and vacuum deposition. The project addressed the optimization of array fabrication, and the coating of thin layer of a carbon layer using C60 as the source material, without destroying the initial aspect ratio. The surface, structural and electrical properties of emitter arrays were investigated by means of atomic force microscopy, scanning electron microscopy, and emission measurements. Applications of such emitter arrays include electron guns, portable displays, camera tubes, microwave devices, and ultraviolet (UV) detectors. [top>](#)

MECHANICAL AND AERONAUTICAL ENGINEERING A-1

Session Chair - Jerry Hamelink
Room 210

ELECTRO-MECHANICAL PARKING BRAKE

by Stuart Cotey, J. Scott McDonald, and Visnu Sookhai
Sponsor: Thomas N. Riley - Eaton Corporation
Faculty Advisor: Dennis VandenBrink
9:30 a.m. to 9:55 a.m., Room 210

A parking mechanism for a medium duty truck transmission was designed, modeled, and tested using both computational and computer modeling using finite element analysis software. This parking mechanism directly engages the output shaft and forces the vehicle to remain stationary. This unit was developed as a bolt-on accessory for a pre-existing manual transmission. A rapid prototype model of the final design was manufactured.

GOALBALL RETURN NET

by Ron Holder, Rayleen Worth, and Brent Zabel
Faculty Advisor: Jerry Hamelink
10:00 a.m. to 10:25 a.m., Room 210

A ball return net was designed to aid in the practice of the sport Goalball. The net is lightweight, portable and cost effective. The design of the goalball return net instituted the use of finite element modeling and graphical drawings using SDRC ideas. Physical testing was used to evaluate ball return features and ensure durability of the net. [top>](#)

ENERGY AUDIT FOR A CAMPUS MINISTRY

by Hau Cao and Jason Niederhauser
Sponsor: Rev. Jeffrey C. Williams - Wesley Foundation of Kalamazoo
Faculty Advisor: Jerry Hamelink
10:30 a.m. to 10:55 a.m., Room 210

A United Methodist campus ministry, located in the midst of WMU's main campus, requested an energy audit on their building. The primary goals of this investigation were to establish the amount of heat loss, determine the boiler efficiency, and decide on appropriate actions to correct for any deficiencies. To accomplish these goals, analytical and computational practices were used with the aid of physical

testing. Recommendations were made for the best economical decision with the help of a cost analysis. [top>](#)

CENTRALITY OF UNIVERSAL-JOINT ASSEMBLY

by Marybeth C. Dellinger and Martin A. Strauch

Sponsor: American Axle & Manufacturing

Faculty Advisor: Jerry Hamelink

11:00 a.m. to 11:25 a.m., Room 210

Tooling was designed to better centralize the universal joint to the tube assembly of a prop shaft whose bearing cups are retained by means of plastic injection. Utilization of tightly defined machined dimensions of the tooling and the position of the components during the plastic injection process, improved the relationship of the centerlines between the universal joint and the tube assembly. Verification of the design was tested, built, and evaluated for production. The enhanced centrality between the universal joint and the tube assembly reduced runout; created a more balanced prop shaft assembly; and reduced cycle time, labor costs, and operating costs. [top>](#)

DRY FOODS DISPENSER

by Jason Thomas Barton and Steven Joseph Hetra

Sponsor: John VonderHaar and Ronald Vogelwede - Whirlpool Corporation

Faculty Advisor: Jerry Hamelink

11:30 a.m. to 11:55 a.m., Room 210

In many parts of the United States, the relative humidity is such that dry foods will spoil in a relatively short period of time. Various ways to control humidity were studied, and an appliance was designed that would store dry foods for a longer period of time in high relative humidity conditions. The appliance was also designed so that it could measure, dispense, and mix the food, and have low maintenance. The device was built and tested to ensure successful operation. The end result was a convenient and easy to use dry foods dispenser. [top>](#)

PNEUMATIC VALVE PRODUCTION TEST STAND

by Matt Murphy, Jason Walters, and Trent Wendell

Sponsor: Nathan Hunt - Parker Hannifin Corporation, Pneumatic Division

Faculty Advisor: Iskender Sahin

1:00 a.m. to 1:25 a.m., Room 210

A pneumatic valve production test was redesigned using new state-of-the-art electronics. Some of the design criteria included simplicity in set-up, accurate testing, and aesthetics. The stand was designed to test two complete families (sizes) of valves, each one having two hundred possible combinations of parameters. The new test stand will allow the operator to place the valve in the fixture and click a digital start button, and then the stand will automatically run the test. [top>](#)

MODIFICATION OF A PORTABLE INFUSION PUMP FOR A PAIN RELIEF SYSTEM

by Chris Brockman and Joe Rapas

Sponsor: Luis Diaz - Stryker Instruments

Faculty Advisor: Iskender Sahin

1:30 p.m. to 1:55 p.m., Room 210

After an invasive surgery, a pain relief system supplies pain medication to reduce the amount of discomfort. One such device, PainPump2, uses a pumping mechanism to deliver the analgesic fluid. An

increased performance in fluid flow was desired in the design. To increase accuracy and consistency, improvements and alternative solutions were explored including changes to the seal, piston, and cylinder. The new designs were evaluated and tested. Analysis of the current three-lobe cam with piston pumping system led to modifications of the flow system. Through these modifications to the portable infusion pump, a more stable flow rate was achieved. [top>](#)

TRANSMISSION INTAKE FILTRATION SYSTEM

by Frank Hercinger, Beau Kidman, and Seth Van Syckel

Sponsor: John Bair - Eaton Corporation

Faculty Advisor: Iskender Sahin

2:00 p.m. to 2:25 p.m., Room 210

A new internal filtration system for the manual transmission of a heavy truck was designed to replace the existing external system. This process was accomplished by modifying a prefabricated oil filter to the specifications of the existing transmission oil system. To verify this choice of oil filter, several tests were conducted to insure proper operation under various conditions. The results allowed for recommendations to be made on the production of the new intake filtration system. [top>](#)

MECHANICAL AND AERONAUTICAL ENGINEERING B-1

Session Chair - Koorosh Naghshineh

Room 211

REDESIGN OF AN AIRCRAFT CARGO DOOR ACTUATION TEST STAND

by Luigi Guido, Bryan Scherer, and Ryan Whitmore

Sponsor: Dave Snoek - Eaton Aerospace

Faculty Advisor: Koorosh Naghshineh

9:30 a.m. to 9:55 a.m., Room 211

The mechanism that facilitates the opening and closing of the cargo door of an airplane must undergo validation testing before it can be sold. This mechanism consists of three main components: two actuation arms and an electronic power drive unit. A new testing station was desired that would automate the testing procedure and allow these components to be tested separately, all while consuming less floor space than the current system. Hydraulics, pneumatics, and electronics were researched in an attempt to economically redesign the test station. The final design of the test stand takes into consideration the positive aspects of the current design, while incorporating modern ingenuity.

DESIGN AND FABRICATION OF A LABORATORY DEVICE FOR DEMONSTRATION OF HELMHOLTZ RESONATORS

by Zoren Gaspar and Marissa Melchior

Faculty Advisor: Koorosh Naghshineh

10:00 a.m. to 10:25 a.m., Room 211

Helmholtz resonators are used in many applications such as automotive exhausts and fan intakes where noise emission reduction is necessary. Though a simple equation relates frequency and resonator geometry, little is known as to how variables, such as the length and cross section of the resonator neck or the volume and shape of the resonator cavity, affect resonator performance. In practice a resonator is made to target a certain frequency of noise, which is to be suppressed. The noise reduction achieved is dependent on the accuracy of construction of the resonator. A laboratory device was constructed which incorporated many of the most influential variables. This setup will be used as a demonstration device as well as a laboratory apparatus in the Mechanical Engineering curriculum. [top>](#)

MEASUREMENT PLATFORM FOR AIRCRAFT CARGO DOOR ACTUATOR

by Aaron Klap, Daniel Rapin, and Ian Worcester

Sponsor: David Snoek - Eaton Aerospace

Faculty Advisor: Koorosh Naghshineh

10:30 a.m. to 10:55 a.m., Room 211

An upgrade of an existing system to determine compliance of an aircraft cargo door rotary actuator was required to meet company specifications. This actuator acts as a gearbox to aid in the opening and closing of an aircraft cargo door. The actuator performance characteristics tested were torque, vibration and angle of gear slip. In order to do this, applied load, noise, angular speed, and angle of rotation had to be measured. Other factors considered were operational simplicity, size, safety, and data output medium. A measurement platform utilizing computer data acquisition was successfully designed to validate the actuator with minimal user intervention. [top>](#)

BREAK-IN PROCEDURES FOR AXIAL PISTON PUMPS

by Bill Dietzel and Peter Lewis

Sponsor: Dean Pollee - Parker Aerospace Abex NWL

Faculty Advisor: Philip Guichelaar

11:00 a.m. to 11:25 a.m., Room 211

The existing break-in period for axial piston pumps is considered to be too long. If the break-in period is improperly accelerated, the pump might experience premature failure on wear surfaces. In order to correctly accelerate the break-in procedures, the wear surfaces were analyzed. Models were then derived to create more efficient break-in procedures. [top>](#)

DELAMINATION OF DIAMOND COATINGS ON MECHANICAL SEALS

by Claudia Fajardo and Bernadette Goold

Sponsor: Andrew Flaherty - Flowserve Corporation

Faculty Advisors: Philip Guichelaar and Molly Williams

11:30 a.m. to 11:55 a.m., Room 211

Diamond coatings on mechanical seal faces reduce energy losses and extend useful life. However, these coatings may delaminate and become ineffective. This study focused on delamination mechanisms and test methods to determine if specific diamond coatings will delaminate. The results have potential to increase mechanical seal reliability and help diamond coatings evolve into reliable and cost-effective technology. [top>](#)

ENGINE MANAGEMENT SYSTEM FOR THE FORMULA SAE ENGINE

by Tiffany Dickinson, Lucio Gorena, and Derek Harris

Faculty Advisor: Richard Hathaway

1:00 p.m. to 1:25 p.m., Room 211

An engine management system for the formula SAE was developed and tested. The engine used was a Suzuki 600cc with an air restrictor to limit power output. An engine management system was programmed to control the timing and air/fuel ratios to maximize performance. Optimization was achieved by testing the engine with different setups on a dynamometer. An intake manifold was designed to accommodate the air restrictor and to provide optimum tuning for the engine. [top>](#)

HEIGHT MEASUREMENT DEVICE FOR RACECAR APPLICATIONS

by Mun Hoow Kan, Keit Meng Tan, and Dong Jiann Wong

Sponsor: Tom Hillsburg - Sweet Manufacturing

Faculty Advisor: Richard Hathaway
1:30 p.m. to 1:55 p.m., Room 211

A height measurement device was designed and built to continuously measure height values at all four corners of a racecar relative to the ground. The system was designed for use by automotive race teams for the purpose of fine-tuning and monitoring vehicle heights while making chassis changes. The device is independent of the vehicle, lightweight, portable, rugged, and self-powered. It enables accurate (up to 0.05 inches) and reliable adjustments to be made to a vehicle. The design of the device involved the selection of the best possible components and the synthesizing of various design elements to create a feasible, accurate and robust design. [top>](#)

FORMULA SAE RACECAR FRAME

by Martin Barnaby and Juhani Engelberg
Faculty Advisor: Richard Hathaway
2:00 p.m. to 2:25 p.m., Room 211

A frame was designed and assembled for a Formula SAE racecar. Mild steel, chrome moly, and aluminum were studied for the best combination of low weight and high stiffness using required and optimized dimensions. Assembly processes and post treatments of each material were considered before a final decision was made to use chrome moly steel. The frame was designed with Pro-E and a load analysis was performed with Algor software to verify structural integrity. [top>](#)

MECHANICAL AND AERONAUTICAL ENGINEERING C-1

Session Chair - William Liou
Room 212

MINIATURE JET-PROPULSION FUEL SYSTEM

by Melissa M. Conger and James C. Mackie-Smith
Faculty Advisor: William Liou
9:00 a.m. to 9:25 a.m., Room 212

A multiple fuel jet-propulsion system was redesigned into a single fuel system. The goal was to create a manageable self-contained unit that eliminates the bulky start-up equipment currently used. Performance data collected from the two-fuel system was compared to that collected from the one fuel system to determine the overall success of the design. [top>](#)

DESIGN OF AN UNMANNED AERIAL VEHICLE

by Gregory Fisher, David Fuller, and Joshua Saling
Faculty Advisor: Arthur Hoadley
9:30 a.m. to 9:55 a.m., Room 212

The need for a small Unmanned Aerial Vehicle (UAV) for use by the military and law enforcement agencies has become critical in the past year. The UAV designed in this project meets the criteria for use in hostile environments as a remote scout vehicle that carries a small camera for relaying images to the ground controllers. Using the Advanced Design Wind Tunnel, three UAV designs were tested for load carrying capability, stability, control, and efficiency. Data collected was analyzed and the best design was chosen based on the previously mentioned criteria. [top>](#)

ANALYSIS OF THE AERODYNAMIC EFFICIENCY OF AN AUTOMOBILE

by Josh Ross, Habes Wardat, and Kurt Zielinski

Faculty Advisor: Arthur Hoadley
10:00 a.m. to 10:25 a.m., Room 212

The drag force created as an automobile moves forward increases the power required for the vehicle. In an effort to minimize this drag force and decrease the power required, a model was built and tested in a wind tunnel facility. Reference data was collected from the test and aerodynamic changes were made to the vehicle. Subsequent wind tunnel test data was then evaluated and compared to the reference data to determine aerodynamic efficiency. [top>](#)

OPTIMAL TRANSITION OF A TURBINE BASED COMBINED CYCLE ENGINE

by Yuko Hatano and Thomas Heine
Sponsor: Thomas Benson - NASA Glenn Research Center
Faculty Advisor: William Liou
10:30 a.m. to 10:55 a.m., Room 212

Turbine Based Combined Cycle (TBCC) engines use two engines to reach their operational speed. One major problem in designing TBCC engines is developing transition from the turbojet engine to the ramjet engine without a reduction in performance. A study was conducted to determine how to minimize the effects of engine transition on the performance of TBCC engines. A one-dimensional computer simulation was used to analyze the effects of turbojet inlet closure rate on TBCC performance. The results were then verified in Fluent, the Computational Fluid Dynamics software package. [top>](#)

REDUCTION OF DRAG ON A WING SURFACE BY SUCTION DEVICE

by Richard Michael Stodolak
Faculty Advisor: Kasim Biber
11:00 a.m. to 11:25 a.m., Room 212

High drag forces caused by flow separation over the surface of an aircraft wing are common with high-lift airfoils. One way to reduce this negative effect is to remove the buildup of high pressure air in the stalled sections of the wing. Airfoil test sections were designed and built to operate in a small wind tunnel. These test sections incorporated a system of internal nozzles connected to differing patterns of holes and slots on the surface of the model. The internal nozzles were then connected to a suction device to remove the high pressure air from the surface of the airfoil. [top>](#)

NACELLE-WING INTERFERENCE EFFECTS ON WOLF AIRCRAFT

by Eric Bower, David Schulte, and Andrew Wood
Sponsor: Hensley Aircraft, Inc.
Faculty Advisor: Kasim Biber
11:30 a.m. to 11:55 a.m., Room 212

The Wolf aircraft is a twin-engine pusher prop with the engines housed inside enclosed areas called nacelles. The nacelles are mounted above the wing and their shape and proximity to the wing were investigated. Nacelle-wing interference effects were studied by using Computational Fluid Dynamics and wind tunnel methods. Design optimization was made to minimize nacelle-wing interference effects and contribution to total drag of the aircraft. [top>](#)

PAPER AND PRINTING SCIENCE AND ENGINEERING

Session Chair - Peter Parker
Room 213

DIGITAL PLATES FOR FLEXOGRAPHY

by Joseph Goryl

Sponsor: Marc Heimlich - Barco Graphics
Faculty Advisor: Dan Fleming
9:00 a.m. to 9:25 a.m., Room 213

The differences were studied between conventional and digitally imaged flexographic plates. Results were achieved by running printed samples on a flexographic press and analyzing the samples, as well as the plates themselves, with an image analyzer. It was found that because of the lack of dot gain with digitally imaged plates due to a smaller printing dot, flexographic printing now has quality that rivals Offset and Gravure. A cost savings will be achieved with digitally imaged plates because film, film handling, and film storage is not needed.

THE EFFECTS OF MOLECULAR WEIGHT AND ACID FUNCTIONALITY ON IMMOBILIZATION SOLIDS

by Daniel Aleksynas
Faculty Advisor: Margaret Joyce
9:30 a.m. to 9:55 a.m., Room 213

To study the effects of molecular weight and acid functionality on immobilization solids and the rate of dewatering, coatings were made with different molecular weight thickening agents. The amount and type of thickener controls the rate of dewatering of a coating during application, which can have a pronounced influence on the properties of the finished sheet. The different molecular weight coatings were tested using a procedure called the gloss drop test method. Using this method, the time and percent coating solids at which the coating becomes immobilized (dewatering ceases) was found. An understanding of the influence of thickener parameters on the immobilization solids of a coating will aid the paper industry in increasing their productivity. [top>](#)

THE EFFECTS OF COATING POROSITY AND TORTUOSITY OF INKJET PRINTING QUALITY

by Ryan A. Romyak
Faculty Advisor: Margaret Joyce
10:00 a.m. to 10:25 a.m., Room 213

A correlation was developed between mercury porosimetry data, which indicates pore structure and volume of the coating, and optical/print qualities of varying pore sized silica based coating. A procedure was also developed for transferring the mercury porosimetry data into three-dimensional computer modeling system called Porecor. [top>](#)

EFFECT OF HEXENURONIC ACID IN KRAFT BLEACHING SYSTEMS

by Marcus Dickhut
Faculty Advisor: Raja Aravamathan
10:30 a.m. to 10:55 a.m., Room 213

Hexenuronic acids are detrimental to Kraft bleaching systems in the paper making process. They reduce bleaching efficiency by consuming a disproportionate amount of bleaching chemicals. When the bleaching chemicals are being consumed in non-essential reactions there is a decrease in the efficiency of the chemicals, as well as the cost efficiency of an operation. An effective way of reducing hexenuronic acids is through mild acid hydrolysis. Mild acid hydrolysis methods were compared to ozone treatments by measuring color reversion and kappa number reduction. [top>](#)

STARCH FORMULATIONS AS CORRUGATED BOARD ADHESIVES

by Kenneth Isaacson
Faculty Advisor: Raja Aravamathan
11:00 a.m. to 11:25 a.m., Room 213

Two starch formulations differing in terms of their viscosity and their gelatinization temperatures were studied for their effectiveness as corrugated board adhesives on two edge crush test (ECT) and two burst grades. The performance of these starch formulations as adhesives in board manufacturing was analyzed through strength properties of the boards (burst, edge crush, and Cobb tests) and the boards' overall appearance. The frequency of occurrences of quality concerns such as delamination, blisters, pressure problems, score cracking, and warp was also documented. It was found that a higher gelatinization led to a better performing board. [top>](#)

SOLVENT DISPOSAL OPTION ANALYSIS AND COMPARISON

by Tawnya Hatcher, Gretchen Hooper, Erin Zahnow, and Robert Zdrodowski

Sponsor: Joseph W. Geiger - Pharmacia Corporation

Faculty Advisor: Andrew Kline

11:30 a.m. to 11:55 a.m., Room 213

The increasing production and disposal costs of waste solvent streams in a batch processing operation warranted exploration into alternative methods of solvent recovery and disposal. An analysis of the current solvent waste management system was first performed. Improvements were suggested based on changes in solvent recovery processes and alternative solvent disposal options. Because solvent streams vary in composition on a continuous basis in batch processing operations, appropriate solvent recovery and waste disposal systems had to be flexible in design. Various design alternatives also had to ensure compliance with all applicable EPA standards. A lifestyle cost analysis revealed the most economical alternatives. [top>](#)