



Impacting the South's Automotive Industry

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Presentation at the Southern Automotive Conference

Chattanooga, TN; October 11, 2012





CAVS



CAVS Extension (Canton, MS)

CAVS Research (Starkville, MS)

Professional Development

- Rapid Problem Solving
- Lean Certification
- Six Sigma (Green Belt, Black Belt)
- Welding for Engineers
- Instrumentation & Diagnostics
- Simulation Modeling

Technology Transfer & Field Engineering

- Lean Transformation
- Quality Improvement
- Kaizen Events
- Simulation Modeling
- Product Launch
- Plant Layout
- Quality Engineering
- Solid Modeling
- Innovation Engineering

K-12 Initiative

- STEP Robotics Competition
- Near Space Balloon
- Summer Engineering Experiences

Engineering Mechanics & Materials Science

- Multi-scale experimentation
- Materials characterization
- Materials processing
- Nano/microstructure analysis
- Lightweight materials
- Bio-materials
- Particulate materials
- Engineering informatics
- V&V
- Biomechanics
- Cyberinfrastructure

Computational Fluid Dynamics

- Mesh generation
- Simulation tools
- Energetics
- Thermal mgmt
- Aerodynamics
- Chemically reacting flow
- Multidisciplinary design optimization
- Fluid-structure interaction
- Uncertainty analysis

Advanced Vehicle Systems

- Automotive Electronics
- Hybrid technologies
- IC Engines
- Dynamometer
- Noise, vibration and harshness
- Emissions

Computational Engineering & Science in Mechanics

- Multi-scale modeling
- Material models
- Theoretical mechanics
- Design optimization
- Uncertainty analysis
- Bio-inspired design
- Process modeling
- Manufacturing

Human Factors

- Human factors
- Ergonomics
- Product lifecycle mgmt



MISSISSIPPI STATE
UNIVERSITY™

CAVS is an interdisciplinary center comprised of engineering, research, development, and technology transfer teams focused on enhancing human and payload mobility.



Innovative Use of Lightweight Materials

CAVS is a leader in the use of lightweight materials for automotive applications.



Success Stories

U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy

1. Magnesium Engine Cradle

65–70% weight reduction compared to steel

2. Vehicle Plastics Recycling

Process being commercialized to save 40% of residue from retired vehicles from landfills and incinerators

3. Quick Plastic Forming of Aluminum

On GM vehicles weight savings of 40% on a per part basis mid-sized automobile

4. Low Sulfur Diesel Fuel

40B Gallons of low sulfur diesel fuel used annually



**ULTRA-LOW SULFUR
HIGHWAY DIESEL FUEL**
(15 ppm Sulfur Maximum)

Required for use in all model year 2007 and later highway diesel vehicles and engines.
Recommended for use in all diesel vehicles and engines.

<http://www.eero.energy.gov/>



CAVS

**Driving Simulator to Study
Human Driver Performance**

CAVS

JAMES WORTH
BAGLEY
COLLEGE OF ENGINEERING
MISSISSIPPI STATE UNIVERSITY



CAVS

Research to improve diesel engine performance, reliability, fuel efficiency, and reduce harmful exhaust emissions

CAVS

Mechanical Testing

- Five Instron loading frames with various static and cyclic loading capacities and temperature control settings
- An Instron multi-actuator system for component or subsystem structural testing
- Hysitron Triboscope nanoindentation system
- Fullam in-situ SEM fatigue testing
- Hopkinson bars systems with individual tension, compression, and torsion setups
- Trilion optical strain measurement system
- Questar QM100 long focal microscope with a power pak
- Q-panel salt-fog corrosion tank
- Engine and chassis dynamometers
- Shock/vibration

Materials Characterization

- Taylor-Hobson Talysurf CLI 2000 gauge system with 3-d surface measurement
- X-Ray Tomography
- ZEISS optical stereological microscope
- VJ 1000 X-ray inspection system
- JEOL6500F high performance SEM with EBSD and EDS capability
- JEOL JEM-100CX II transmission electron microscope
- STRUERS metallographic set

Manufacturing Equipment:

- Injection molding machine; twin extruder
- HAAS CNC mill and lathe
- Powder metallurgy

Developing Technologies for Improving Quality ... “Clear Vision” Student Project

Real World – Undergraduate
... Student Engineering Design
Projects ... resulting in
increased testing capability ...
increasing vehicle quality.

- Transferred technology to Nissan
- Integrated measurements from vehicle (e.g., VIN), test results into plant wireless network
- World-wide standard



Support for Student Led Design Teams ... National Champions!

- **Challenge X**

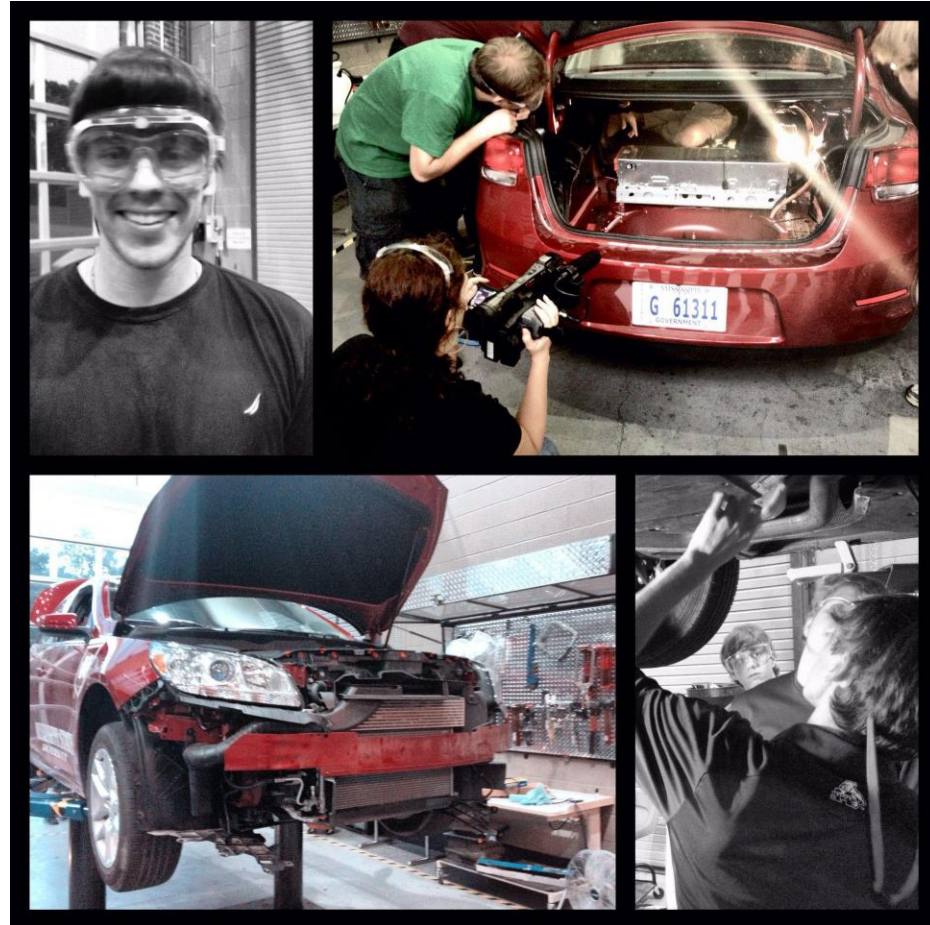
- A 4 year competition that challenged students to re-engineer a 2005 GM Equinox to minimize energy consumption and emissions while maintaining or exceeding stock vehicle performance.
- ***First Place overall in Years 3 & 4: National Champions!***

- **EcoCAR**

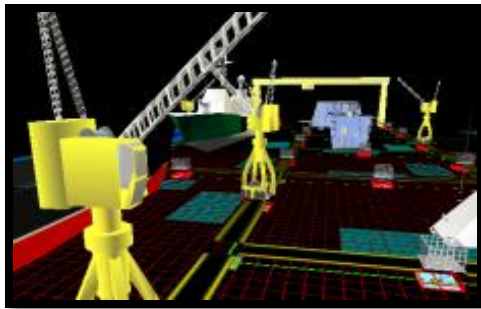
- A 3 year competition where students re-engineered a 2009 Saturn Vue by minimizing energy consumption and reducing greenhouse gas emissions while maintaining its utility, safety, and performance.
- The MSU team chose their architecture as a plug-in, extended range hybrid that runs on B20 biodiesel!
- ***First Place overall in Year 2***

- **EcoCAR2**

- A 3 year competition where students are re-engineering a 2013 Chevrolet Malibu.
- The MSU team chose their architecture as a Parallel-Series Plug-In Hybrid Electric Vehicle.
- ***First Place overall in Year 1***



Overview CAVS Extension



Making a Difference

(NIST-MEP Client Surveys)

- **Economic Impact: \$5.5 Billion**
- **3,300 jobs created or retained**

Through ...

On site Projects and Professional Development Workshops (e.g., Lean Six Sigma, Problem Solving, Kaizen Events, Simulation Modeling, Solid Modeling, Finite Element Analysis ...)

Recent Successes

Prototype to Full Scale production (9 mo.)

80% Improvement in Plant Quality

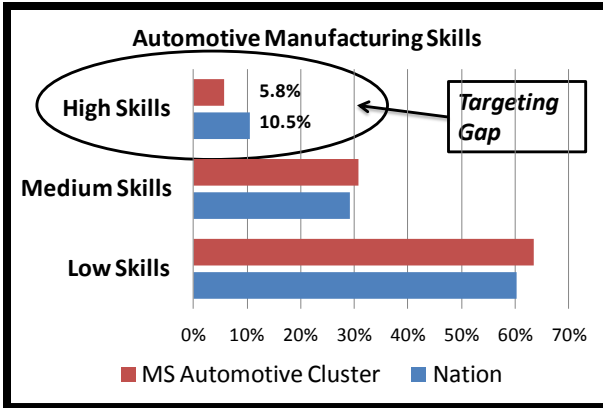
400% Increase in Plant Throughput (3 mo.)

2010 Recipient of University Economic Development Award of Excellence

Southern Growth Policy Board Innovation Award for Mississippi (2012)



Supporting Professional Development Training ... "Enhancing On-the-Job Problem Solving"



Program Highlights

- Automotive & High Growth Industries
- 27 Prof. Development Courses / 71 Classes; 654 Participants
- 100 Industry-University Projects + Coaching
- Benefits \$2M / year

Team Building

- Leadership
- Communications
- Coaching
- Resolving Conflict
- Supporting Change



Manufacturers (42)

- | | |
|----------------------|--------------------|
| Nissan North America | PPG |
| SEC Electro Coating | PKUSA |
| Tower Automotive | Northrop Grumman |
| Hunter Engineering | Cox MPH |
| Hol-Mac Corporation | Ergon Refining |
| IMS Autrans | Peavey Electronics |
| M-Tek | T & L Specialty |
| Anel | PFG |
| Harrison Mfging | Precision Optics |
| Johnson Controls | Thyssenkrupp |
| Bad Boy Enterprises | DTI |
| Martin Rea | ABB Kuhlman |
| Calsonic Kansei | Howard Industries |
| Unipres Southeast | Viking Range |
| Shiloh Industries | Milwaukee Tools |
| Hagemeyer NA | Eaton Aerospace |
| Yates Services LLC | Parker Hannifin |
| PACCAR Engine Co | GECOM |
| Minact Logistical | JMAA |

Problem Solving Methodologies

- Rapid Problem Solving
- Statistical Process Control
- Lean Certificate
- Fundamentals of Welding
- Introduction to Gage R&R
- Simulation Modeling
- Ergonomics Essentials
- Introduction to Minitab

Instrumentation & Diagnostics

- Vehicle Communications & Diagnostics
- Fundamentals of Mechanical Drive Systems
- Vehicle Dynamics and Safety
- Testing & Instrumentation I & II
- Sound & Vibration Diagnostics



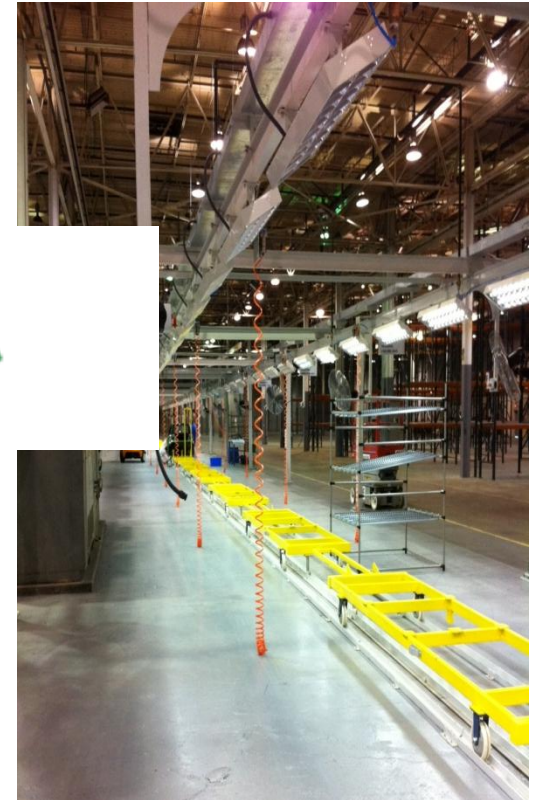
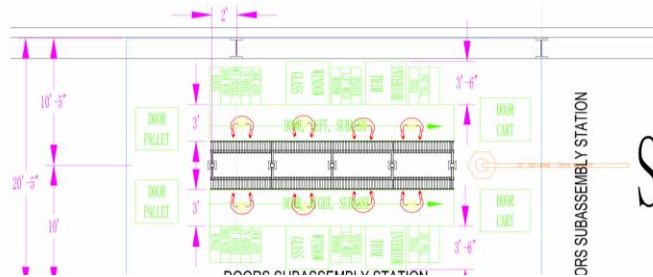
Supporting Electric Car Start-Up ...

Company Background:

- “Start-up” electric car manufacturer located in Horn Lake, MS.
- Targeting initial creation of 150+ jobs

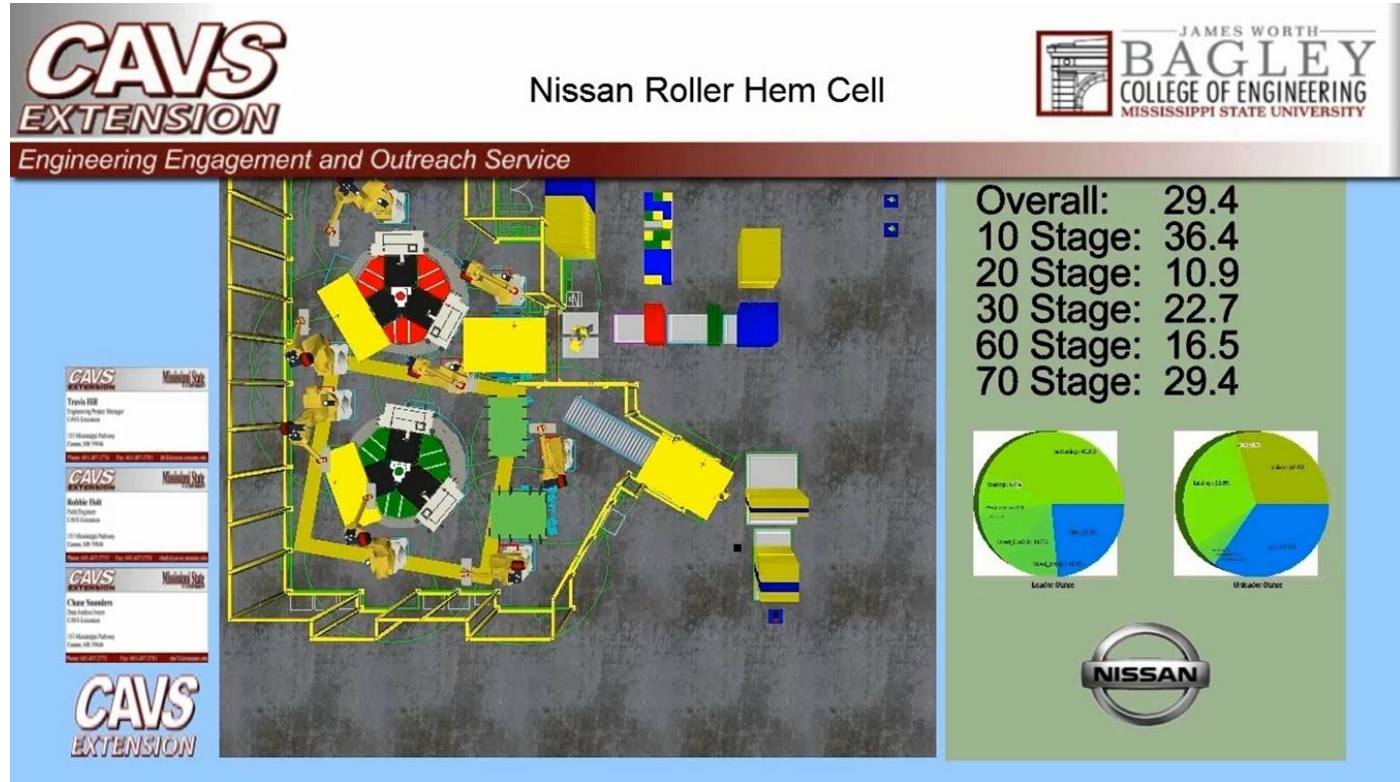
Project Results

- CAVS Research team – efforts focused on battery testing; and collaborations on next generation vehicles.
- CAVS Extension team – responsible for the design of the assembly line and other support processes.
- Targeting production “kick-off” of “MyCar” in late 2012.



Supporting Launches of New Models ...


- Over 20 different simulation models have been developed by our CAVS Extension team in collaboration with Nissan and Tier 1 suppliers over the last 2 years.
- Supporting the growth in the Central Mississippi automotive Cluster (NV, Xterra, Frontier).



Support for Ground Vehicles Navistar

- Publication of “First Ever” MEP “National Case Study”
- MSU played a major role in the launch of Navistar Defense’s armored vehicle plant in West Point, MS. Key activities included design and implementation of the manufacturing processes and overall production system. Major vehicle launches have included the KBR armored cab, multiple MRAP versions, and TACOM vehicle. Supplier development involving over 12 Mississippi Small manufacturers.
- From **prototype** to **full-scale production** peak employment **1,050** at the plant. ... average employment over **500** employees across 5 years.
- **Total Impact from all of CAVS Extension’s work ... over \$4B in economic impact (3rd party survey reported by MEP).** Documented **savings of dozens of lives** in Iraq due to increased protection from the threat of IED’s


Saving Lives and Creating Jobs
Rapid Commercialization and Manufacturing of Military Vehicles at Navistar Defense in West Point, MS



MaxPro version of the Navistar MRAP

Information compiled by:
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MEP • MANUFACTURING
 EXTENSION PARTNERSHIP
 April 2011



OVERVIEW

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Across the nation the Hollings Manufacturing Extension Program works with over 30,000 manufacturers each year. This case study describes the important role of the Manufacturing Extension Partnership of Mississippi (MEP.mis) Center at Mississippi State University’s CAVS Extension in the support of product design, testing, plant layout, facilitation, manufacturing planning and operations at Navistar Defense’s plant in West Point, Mississippi. As a result, twelve different vehicles were launched, over 1,000 people were employed at peak production, a strong supply chain of local and regional small and mid-sized manufacturers was developed and nurtured, and the lives of hundreds of U.S. troops and contractors were saved.



Governor Barbour with Senator Walker and Staff of the MEP.mis Center at MSU-CAVS-E at the Navistar Dedication.

“Public-private partnerships like the one between Navistar Defense in West Point and the Manufacturing Extension Partnership of Mississippi at Mississippi State University are the key to advancing our state’s economy while providing support to quality manufacturers.”

MEP.mis is just one example of how Mississippi universities are helping companies excel. Building a strong workforce takes a combination of innovative job training programs and tapping into our state’s universities to put bright minds to work on industry needs.”

Haley Barbour—Governor of Mississippi



WWW.NIST.GOV/MEP • 1-800-MEP-4MFG

U.S. DEPARTMENT OF COMMERCE • NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY • MANUFACTURING EXTENSION PARTNERSHIP



Student Technology Exchange Program (STEP)



Nissan

- **K-12 Outreach** ... Introduces high school students to critical technologies used in the automotive industry (e.g., Robotics and PLCs).

- Students have regular access to Nissan's Training Center.
- STEP provides Pre-college Admission opportunities & tours of manufacturing facilities (e.g., Tower, JCI, and SEC).

- **Participants:** Students are drawn from the following school districts - Canton City, Jackson Public Schools, Madison County, and Leake County.

- **Results:** After 5 years 210 students have "graduated";

- 100% High School Graduation vs. 72% statewide
- 84% of students have continued education in university/community college/military

- **Community Support:** Numerous businesses & community organizations have supported the program (e.g., Nissan, Entergy, ...)

- Sponsors have given over \$32K in grants and scholarships.
- Developing Summer Student Internships within automotive industry.



Entergy

