Mississippi State University

Support for the Manufacturing Landscape

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Support for the Mississippi Manufacturing Landscape

- Learning
- Service
- Research
Bagley College of Engineering

- Approximately 3,778 students (Fall 2014)
  - 3,190 Undergraduate students – 453 degrees
  - 588 Graduate students – 142 graduates
- BCoE-Learning provides the ability to pursue advanced degrees remotely. Ranked #21 nationally by U.S. News and World Reports.
  - 203 Students (129 MS; 74 PhD)
- Gulf Coast Engineering Degree with GCCC
- Petroleum Engineering Program
College of Business

- 587 Undergraduate degrees in 2014
- 176 MBAs or MS Tax or Accounting
- 7 Doctorates
- 166 Entrepreneurs
- Best Online Graduate MBA Programs 2015 (#18) by U.S. News & World Report
MSU’s Career Center

- Hosted 762 different employers
- Arranged 4,351 campus interviews
- Held 14 career fairs
- Maintained over 750 students in Co-op and Internship programs
NSPARC Workforce Assistance

NSPARC conducts research issues and applies the knowledge generated in innovative ways to give Mississippi a competitive advantage in education, economic, and workforce development.

Two examples of NSPARC programs are MS Grad Jobs and Mississippi Works developed in partnership with the Mississippi Department of Employment Security.

**MS Grad Jobs** connects college grads with employment opportunities in Mississippi suitable for their majors. It also makes it easy for Mississippi university grads living outside the state to look for a dream job in the state. Mississippi State’s career center was the pilot for this, and now the program is statewide.

**Mississippi Works** connects job seekers with employers through an award-winning online portal and mobile apps. Employers can post job openings and search for candidates, and job seekers can apply for job openings. Mississippi Works won the 2014 Digital Government Achievement Award.
National Champion
Engineering Student Design Teams

National UAS competition

SEC Robotics competition

Formula 1 Design competition

International Remote Sensing & Data Fusion competitions

Eco Car Competition

Solar powered vehicle competition
Economic Development & Industry Support

- Provide educational opportunities for workforce development (short courses, workshops, distance learning programs)
- Assist companies with green field launches (e.g. provide simulations of manufacturing processes, robotics layouts and designs, etc)
- Assist companies with on-site engineering projects (e.g. lean manufacturing, etc)
- Provide companies support by assessing their energy consumption and provide strategies for reduction
- Incubate engineering and R&D companies
- Launch spin-off companies
- Work closely with MDA and local economic developers

Note: In all cases, the engineering college utilizes soft-funded research faculty and staff for quick response to industry, as well as academic faculty when specific expertise is needed.
CAVS Extension Center
Canton, MS

Economic Impact: $5,804,892,852*

• Amount reported from January 1, 2006 to March 31, 2014;
• Number of companies surveyed… 262

Jobs Saved: 1,784
Jobs Created: 2,025
Cost Savings: $27,539,701
Increased Sales: $5,327,791,521
Retained Sales: $272,805,031
Investment Created: $169,380,399

*Economic Impact amounts are collected through third party surveys of completed projects. These surveys are conducted on behalf of the U.S. Department of Commerce.
# Workforce Development

## Six Sigma & Lean Workshops

- Six Sigma Methodology
- Lean Certificate Class
- Lean Transformation in the Furniture Industry
- Measurement Systems Analysis (Gage R&R)
- Introduction to Minitab
- ASQ Exam Prep: Certified Six Sigma Black Belt
- Experiment Design - Statistical Process Control
- Rapid Problem Solving

## Engineering Engagement

- Simulation Modeling and Analysis with Flexsim
- Logistics and Supply Chain Management
- Ergonomics Essentials
- Fundamentals of Welding for Engineers
- Introduction to Solid Modeling
- Introduction to Finite Element Analysis
- Introduction to Metrology
- Geometric Dimensioning and Tolerancing
- ASQ Exam Prep: Certified Quality Engineer

### 25 Workshop Offerings
CITE Armored: R&D Project “Idle Reduction”

- **Client:** CITE Armored – small manufacturer (~100 employees) in Holly Springs, MS without an R&D capability.
- **Background:** Initial relationship started with lean and six sigma type engagements … resulting in a true R&D project which leveraged CAVS infrastructure and capabilities.
- **Project Description:** Idle reduction technology allows operators to refrain from long duration idling of the engine by providing vehicle utilities (e.g., electricity, heat, A/C) through an alternative energy system.
- **Results:** installation complete on pilot vehicles (Dodge and Navistar) … pilot vehicles in testing. Plans to be in production during 2015.
- **Team:** Glenn Dennis (CAVS-E), Mike Mazolla, Matthew Doude graduate students (CAVS).
Client: Baxter – medical device manufacturer located in Cleveland, MS.

Background: Initial relationship participants in our Six Sigma Green Belt Class.

Project Description: Simulation project focused on improving line performance to achieve ~40% increase in volume. This includes associated capital investment.

Results: Phase I has been completed and starting on phase II. Target completed by June 2015.

Team: Travis Hill, Robbie Holt, Chase Saunders (CAVS-E).
Toyota: Manual Dolly Push Force Reduction

- **Client**: Toyota Motor Manufacturing in Blue Springs, MS.

- **Background**: Initial relationship began with meetings several years ago with plant management. Currently, this is one of several projects that we are working on with Toyota.

- **Project Description**: Material handling cart with a need for ergonomic improvement. The project requires the application of the “kari kuri” principles to achieve the target results. This principle focuses on the use of gravity, levers and gears to effect inertia and momentum to reduce the required applied horizontal push force.

- **Results**: Project has just started, targeting completion in June 2015.

- **Team**: Tonya McCall, Glenn Dennis (CAVS-E)
Tower/System Electro Coating Expansion Analysis

Client: Tower Automotive, Systems Electro Coating (Madison, MS)

Background: Supporting the launch of the Nissan Frontier and Xterra frame production.

Project Description: Evaluate proposed plant expansions, capital expenditures and labor requirements for Tower Automotive and Systems Electro Coating (SEC) in Madison, MS to incorporate Nissan Frontier and Xterra frame production. Developed a simulation model of the joint facility to analyze the impacts of changes and minimize capital expenditures required.

Results: determined required amount of storage space for frames, determined labor requirement increase, determined which major capital expenditures where needed.

Economic Impact: Impact: Tower Expansion (70,000 sq. ft) and 40 jobs created.

Team: Travis Hill, Robbie Holt, Chase Saunders
CAVS
Extension –
Distribution of
Clients (2014)
CAVS Extension: Client Impacts (2013-2014)
CAVS Extension: 
Service Delivery Hours
(2014)
Make it in America Challenge ....

“Make it in Mississippi

- 2013 Federal Initiative to grow U.S. manufacturing through reshoring
- Four federal funding agencies (EDA, ETA, NIST-MEP, DRA)
- Winning proposal: “Reshoring Advanced Manufacturing Jobs in Mississippi: Enhancing Skills and Building Competitiveness”
- Three-year program; One of 10 such awards nationally
“Make it in Mississippi”

Building Competitiveness …

Annual Reshoring Summit
Innovation Supply Chain Collaboratory

EDA (MSU, MDA)
NIST/MEP (InnovateMEP Mississippi)

Impacts: $40 million in Private Investment and economic impact, 750 jobs created or saved. (MEP Survey)

Enhancing Skills …

Opportunity, Scouting: (Existing OEMs & SMEs)
Reshoring “Tiger Team”
Developing SMEs through Technical Assistance
Partnering to Build Workforce Capacity in Critical, High Demand Skill Sets

NIST/MEP (Innovate Mississippi)
EDA (MSU, MDA, Innovate Mississippi)
EDA (MSU, MDA)
DRA (MSU)
ETA (Miss. Partnership WIA, Delta WIA) ICC, EMCC, MDCC, Holmes CC, MSU

Longitudinal Tracking of Career Advancement:
276 “Advancement Maintenance Internships” with 85% placement, 50% advancement of incumbent workers trained. (nSPARC)
Industrial Assessment Center

IAC, established in 1994 as part of the U. S. DOE’s Industrial Technologies Program, provides energy assessments to small- and medium-sized manufacturing facilities.

IAC has assisted more than 330 companies via site visits and energy consumption assessments and energy reduction plans (e.g. heat recovery, energy-efficient lighting retrofit, HVAC controls, power quality, combustion efficiency, etc.)

$10+ Million in Recommended Energy Savings
$5+ Million in Recommended Waste Savings
$10+ Million in Recommended Productivity Savings

Assessment teams consist of 4-6 engineering students, staff engineer, and engineering faculty
MSU High Voltage Laboratory

• Largest university facility in North America
• Capabilities include:
  − 3,000 kV impulse generator
  − 1,000 kV ac test transformer
  − 1,050 kV dc test system
Emerging Materials Research Lab

Vapor-phase growth of semiconductors and nano-structures

Laser spectroscopy for characterization of semiconductor and nano-electronics materials and devices

SiC semiconductor Nano-wires and Nano-needles fabricated at MSU for photovoltaics and bio-medical sensing applications

Cross-sectional Scanning Electron Microscopy image of a SiC Transistor mesa selectively grown in SiO₂ window at 1300°C.
Institute for Imaging and Analytical Technologies

State-of-the-art research and service provision in the areas of:

- Materials science & engineering
- Materials characterization
- Biological imaging
- Cognitive neuroscience
- Biomedical engineering
- Veterinary medicine

Catalyst for University/Industry Partnerships

Magnet for high-tech industries and federally funded research projects
## Matching Capability to Industry Application

<table>
<thead>
<tr>
<th>Characterization Type</th>
<th>Instrument</th>
<th>Related Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imaging &amp; Particle/Grain Distribution</td>
<td>Scanning Electron Microscope (SEM) with Back Scatter Detector</td>
<td>Imaging Surface Defects</td>
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<tr>
<td></td>
<td>Transmission Electron Microscope (TEM)</td>
<td>High Resolution Imaging, Diffraction and Interface Strain Analysis</td>
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<tr>
<td>Elemental &amp; Structural</td>
<td>Atomic Force Microscope (AFM)</td>
<td>Surface Imaging</td>
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<tr>
<td></td>
<td>Energy Dispersive Spectroscopy (EDS) on SEM &amp; TEM</td>
<td>Elemental Analysis</td>
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<tr>
<td></td>
<td>X-ray Diffraction (XRD)</td>
<td>Crystalline Quality Determination</td>
</tr>
<tr>
<td>Chemical</td>
<td>Electron Backscatter Diffraction (EBSD) on SEM</td>
<td>Crystalline Structure and Phase Mapping</td>
</tr>
<tr>
<td></td>
<td>Spectromax, Fourier Transform Infrared Spectroscopy (FTIR) and Raman Spectroscopy</td>
<td>Chemical Analysis</td>
</tr>
<tr>
<td>Thermal</td>
<td>Differential Scanning Calorimetry (DSC) and Thermal Gravimetric Analysis (TGA)</td>
<td>Thermal Analysis</td>
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<tr>
<td>Electrical</td>
<td>Four Point Probe Stand and IV Meter</td>
<td>Resistivity Measurement</td>
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<tr>
<td>Mechanical</td>
<td>Dynamic Mechanical Analysis (DMA)</td>
<td>Mechanical Stiffness and Damping</td>
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<tr>
<td></td>
<td>Compression/Tension/Torsion and Hardness Tester</td>
<td>Modulus Analysis</td>
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<tr>
<td></td>
<td>Atomic Force Microscope (AFM)</td>
<td>Nano-scale Modulus, Adhesion, Deformation, Dissipation Analysis</td>
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<td>Q-Fog</td>
<td>Corrosion Simulation</td>
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<td></td>
<td>Hysteresis, Tribometer LECO LM300AT</td>
<td>Nano Indentation, Hardness/Modulus</td>
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<td></td>
<td>X-ray CT</td>
<td>Internal Defect Imaging</td>
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Institute for Imaging & Analytical Technologies; ¹ Chemical Engineering; ² CAVS; ³ Electrical Engineering
What we have relevant to industry: The I2AT provides infrastructure, resources, and expertise to image and analyse at the nano-to-macro scale. See a list of capabilities and applications relevant to industry applications in the chart presented here.

gtm4, 3/9/2015

Resources and expertise enable, facilitate and add value to product research and development, characterization, quality assurance and training aspects of industry.

gtm7, 3/10/2015
## Matching Capability to Industry Application

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<td>Cognitive Neuroscience; Medical Imaging; Veterinary Imaging</td>
<td>3T Magnetic Resonance Imaging</td>
<td>Structural Imaging; Functional Brain Imaging</td>
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<td></td>
<td>Electroencephalogram (ERP Lab)</td>
<td>Event-Related Potential; Temporal Brain Activity</td>
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<td></td>
<td>64-Slice CT Scanner</td>
<td>Anatomical Scans; Non-destructive 3D X-ray Imaging</td>
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<td>4D Ultrasound</td>
<td>Medical Imaging</td>
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<td></td>
<td>Linear Accelerator (IMRT, IGRT, SRS, SBRT)</td>
<td>Onboard 3D Imaging; Cancer Therapy; Site-specific Radiation</td>
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<td>Blast-Induced Trauma Device</td>
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**Matching Capability to Industry Application**

**Instrument Related Applications**

- **Structural Imaging:**
  - 3T Magnetic Resonance Imaging
  - Electroencephalogram (ERP Lab)
  - 64-Slice CT Scanner
  - 4D Ultrasound
  - Linear Accelerator (IMRT, IGRT, SRS, SBRT)
  - Blast-Induced Trauma Device

- **Functional Brain Imaging:**
  - Event-Related Potential; Temporal Brain Activity

- **Non-destructive 3D X-ray Imaging:**
  - Anatomical Scans; Non-destructive 3D X-ray Imaging

- **Medical Imaging:**
  - Medical Imaging

- **Onboard 3D Imaging:**
  - Onboard 3D Imaging; Cancer Therapy; Site-specific Radiation

- **Cancer Therapy:**
  - Onboard 3D Imaging; Cancer Therapy; Site-specific Radiation

- **Site-specific Radiation:**
  - Onboard 3D Imaging; Cancer Therapy; Site-specific Radiation
Additional resources accessible at the I2AT and through clinical partnerships.

gt24, 3/10/2015
MSU Business Incubation

- Aurora Flight Sciences
- GE Aviation
- Stark Aerospace
- Honda Aerospace
- Camgian Microsystems
- II-VI, Inc.
- Airbus Helicopter
Thad Cochran Research, Technology and Economic Development Park

Bomgar Corporation
Camgian Microsystems
Center for Advanced Vehicular Systems
High Performance Computing Collaboratory
II-VI Incorporated
The Energy Institute
HBM nCode Federal LLC
nSPARC
Sitel
Social Science Research Center
Tennessee Valley Authority
Yokohama Tire Corporation

Nine buildings, 1,500 employees
Expansion underway
Characteristics of MSU Research

• Interdisciplinary flavor
• Largest research efforts focused around traditional strengths in agriculture and engineering.
• Strong focus on research problems of relevance to Mississippi
• Strong partnerships between state agencies, federal governments, and regional industry.
• Significant research partnerships with other MRC institutions.
MSU Research

- Research expenditures exceed $200 million a year

- Carnegie classification is now RU/VH
  - One of 108 cited for “very high research activity”
  - One of 40 public universities with RU/VH and “Community Engagement” classifications

- MSU ranks 60th among public universities for R&D expenditures
  - 6th in agricultural sciences
  - 31st in computer sciences
  - 35th in engineering research
  - 39th in social sciences
Research Centers & Institutes

Center for Advanced Vehicular Systems
Geosystems Research Institute
Center for Computer Security Research
High Performance Computing Collaboratory
High Voltage Laboratory
Raaspet Flight Research Laboratory
Energy Institute
Social Sciences Research Center
Early Childhood Institute
Institute for Imaging and Analytical Technologies
Center for Computational Sciences
Research Curriculum Unit
Northern Gulf Institute
Institute for Genomics, Biocomputing, and Biotechnology
Entrepreneurship Center
Stennis Institute for Government
National Strategic Planning and Analysis Research Center
Water Resources Research Institute
MSU Research

Institute for Computational Research for Engineering and Science (ICRES)

Starkville  Canton  Vicksburg

Center for Advanced Vehicular Systems
CAVS EXTENSION
ISER
ISER Charter Summary Objectives

• Collaborative effort between Mississippi State University and ERDC.

• To research systems engineering concepts and design of tools to facilitate DoD systems development and decision making processes;

• To enhance strategic and operational analysis for ERDC and MSU programs and efforts; and

• To leverage existing capabilities and expertise previously developed at MSU and ERDC to establish a national center of excellence in systems engineering.
ISER Industry Focus

- Provide a new level of systems engineering solutions to industries.
- Hire systems engineer analysts with an emphasis on manufacturing, product life cycle, logistics, and transportation.
- New systems analysis methods and tools to address a wide range of system architecture and design drivers.
  - Early concept systems engineering techniques.
- Advanced systems architecture and design analysis techniques and tools for accelerated system modeling and assessment.
  - New approaches to systems analysis and testing, which interweave design processes with computational and physical testing and analysis.
  - Methods and tools which foster more robust systems designs when untrusted components may be included.
  - Advance and adaptive systems engineering algorithms and methodologies.
ISER Opportunities

- Leverage ERDC's strengths in high performance computing and military systems engineering
- Provides opportunity to access existing ERDC developed software products
- Provides opportunity to access ERDC HPC systems for problem solutions
ISER - 21st Century Acquisition Challenges

Risk Mitigation
Confidence in Engineering & Design Decisions
Managing knowledge and decision-making across communities and functions

Adaptability
Rapid Response to Emerging Threat
Ability to respond to threat as needed – rapid prototyping, upgrades, reconfiguration...

Affordability
Highest Value to the Department
Time and Cost commensurate with the Department’s Mission and Goals
Success!

MSU listed as one of the Top 10 universities in the South that *drive* economic development.

Starkville listed as one of the Top 10 Places in the South for *emerging growth industries.*