Mississippi State University

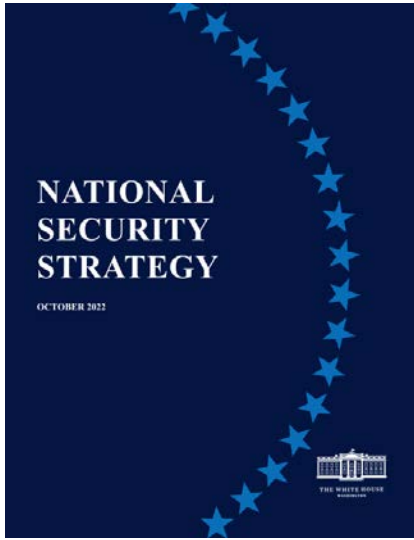**Jim Martin**

Associate Vice President

**Office of Research & Economic Development**

National Security Elements

- Economic security
- Energy security
- Physical security
- Environmental security
- Food security
- Border security
- Cyber security

DoD Focus Areas

- Readiness - Training, Sustainment, Infrastructure, Fitness
- People – Economics, Families, Health
- Industrial Base and Supply Chain
- Autonomy, AI, Microelectronics
- Casting & Forging, Advanced Materials
- Alternative Energy, Renewable Energy
- Cyber

- Advanced Computing
- Machine Learning
- Directed Energy
- Hypersonics
- Integrated Sensing
- Space Technology
- Quantum Science
- Biotechnology
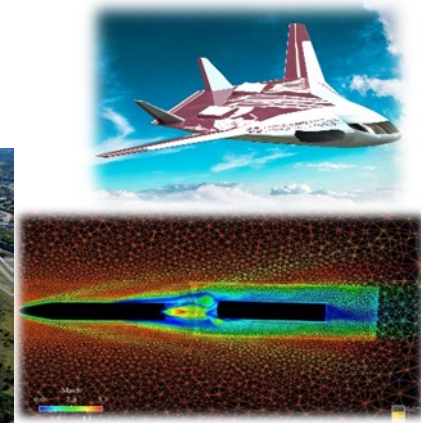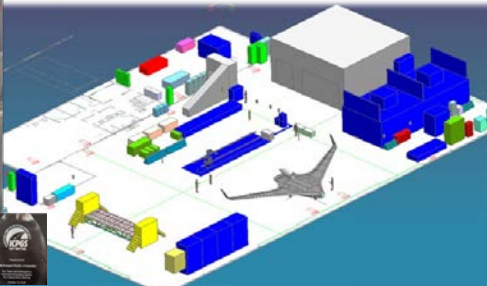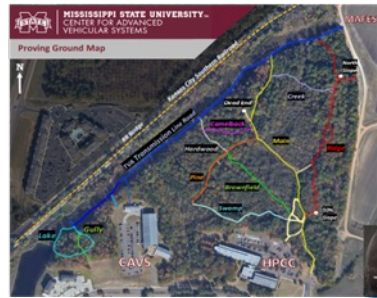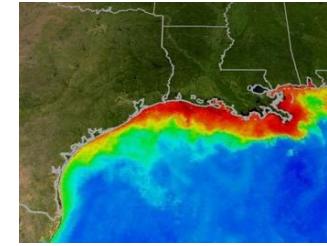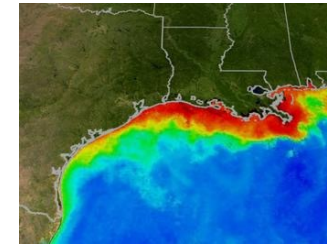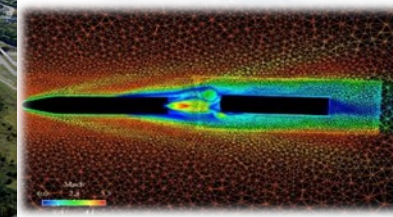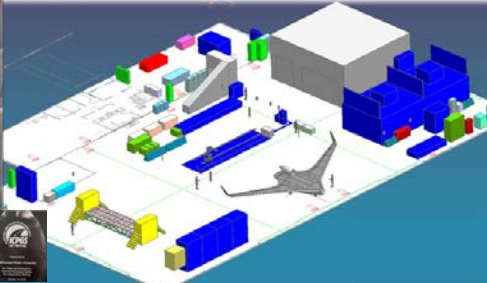

MISSISSIPPI STATE UNIVERSITY™

Taking Care of What Matters

DHS
Focus Areas

- Artificial Intelligence
- Border Security
- Chemical, Biological and Explosive Defense R&D
- Counter Terrorist
- Cybersecurity/Information Analysis R&D
- First Responder / Community and Infrastructure Resilience
- Food and Agriculture Defense
- Physical Security and Critical Infrastructure Resilience

MSU Research Impact

❑ **Carnegie Foundation R1**: Doctoral Universities-Very High Research Activity

❑ **Highest-ranked** in Mississippi by **NSF…No. 65** among public universities

❑ Record of **$303.4M+** in R&D expenditures…over **half** of state's total

❑ **$506.2M** research economic impact…**$1.8B** MSU economic impact

❑ **No. 11 in Agricultural; Social Sciences, No. 28** — #3 in SEC

❑ **Engineering: Top 25 rankings** for Aerospace, Industrial & Manufacturing, and Mechanical Engineering

❑ **Nationally recognized Centers and Institutes**

❑ **Research culture** embraces **problem solving,** and values and builds **productive partnerships**

❑ **Ecosystem built to generate the next generation of innovators, inventors, and leaders**

FY23 Awards by Federal Agency ($252.2M)

- Treasury 1%
- USAID 3%
- NASA 1%
- Transportation 4%
- Education 3%
- Interior 1%
- Labor 3%
- NIH 2%
- NSF 7%
- Commerce 7%
- Energy 4%
- Health & Human Services 15%
- Defense 13%
- USDA 29%
- Other 7%
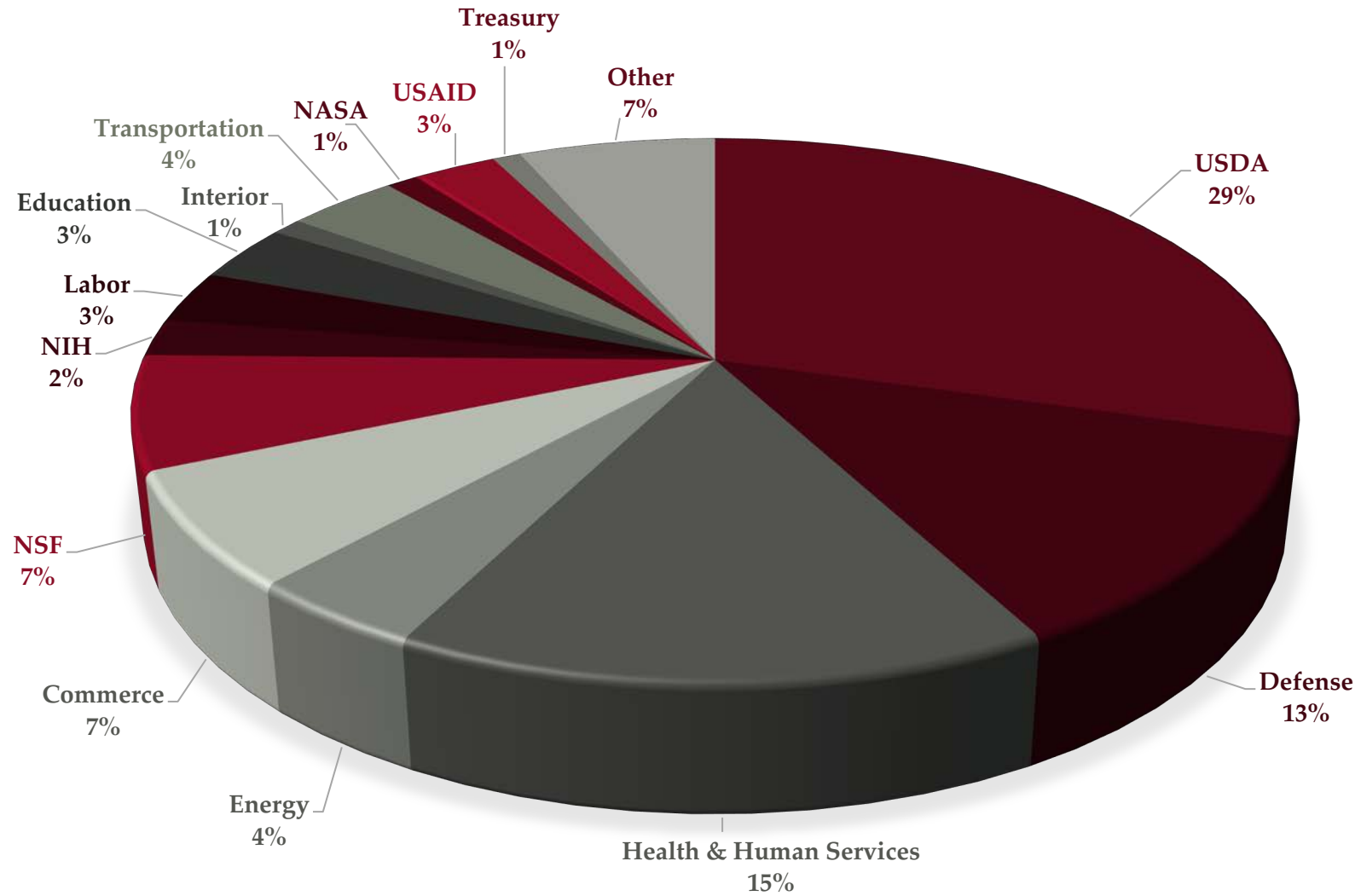
Total FY23 Awards (all sources)

$278.4M

MISSISSIPPI STATE UNIVERSITY™
OFFICE OF RESEARCH AND ECONOMIC DEVELOPMENT

Mississippi State University offers undergraduate and graduate degrees in eight different colleges:

College of Agriculture and Life Sciences

College of Architecture, Art, and Design

College of Business

College of Education

College of Arts and Sciences

College of Forest Resources

College of Engineering

College of Veterinary Medicine

Associate Deans for Research (ADRs)

- College of Agriculture and Life Sciences/MAFES
  - ✓ Dr. Jamie Larson
- College of Architecture, Art, and Design
  - ✓ Dr. Bimal Balakrishnan
- College of Arts and Sciences
  - ✓ Dr. Giselle Munn
- College of Business
  - ✓ Dr. Kevin Rogers
- College of Education
  - ✓ Dr. Dan Gadke

- College of Engineering
  - ✓ Dr. Kari Babski-Reeves
- College of Forest Resources/FWRC
  - ✓ Dr. Steve Bullard
- College of Veterinary Medicine
  - ✓ Dr. David Smith
- MSU Libraries
  - ✓ Dr. Deborah Lee
- Honors College
  - ✓ Dr. Anastasia Elder

Research Centers & Institutes

- Center for Advanced Vehicular Systems (CAVS)
- Center for Cyber Innovation (CCI)
- High Performance Computing Collaboratory (HPC^2)
- Southern Rural Development Center (SRDC)
- Center for Entrepreneurship and Outreach
- T.K. Martin Center for Technology and Disabilities
- Gulf Coast Community Design Institute
- Northern Gulf Institute (NGI)
- Geosystems Research Institute (GRI)
- Raspet Flight Research Laboratory
- Alliance for System Safety of UAS through Research Excellence
- Research and Curriculum Unit
- Cobb Institute of Archaeology
- Center for Environmental Health Sciences
- Center of Biomedical Research Excellence
- Feed the Future Innovation Lab for Fish (FIL)
- Institute for Genomics, Biocomputing and Biotechnology (IGBB)
- National Strategic Planning & Analysis Research Center (NSPARC)
- Mississippi Water Resources Research Institute (WRRI)
- Social Science Research Center (SSRC)

Thad Cochran Research, Technology & Economic Development Park

- 272 acres (Total Phase I & Phase II)
- 11 Buildings
- ~1,200 employees
- $110M investment in infrastructure
  - Redundant Fiber
  - Redundant Electricity
- $125M in private capital investment
- 43 acres for building sites (Phase II)
- 2 Multi-Tenant Office Buildings
- Business Incubator
- SMART Shuttle System
- Bulldog Affiliate Program

https://www.cochranresearchpark.com/

Research Park Tenants

MSU
- nSparc Data Center
- Malcolm A. Portera High Performance Computing Center
- Center for Cyber Innovations
- Social Science Research Center
- MSU Small Business Dev. Center
- Boots to Business Revenue Ready
- Office of Technology Management
- Veterans Business Outreach Center
- MSU Research & Technology Corp
- Institute for Clean Energy Technology
- Center for Advanced Vehicular Systems
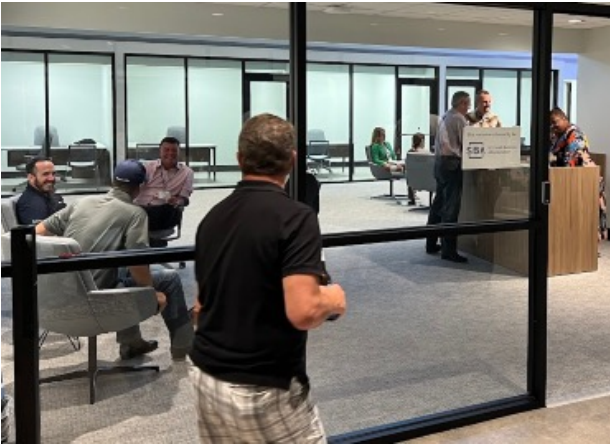

Home to Other Partners:
- II-VI
- WTVA
- Martin Federal Cyber @ The Hub
- C Spire Data Center
- Camgian Microsystems
- Tennessee Valley Authority
- Babel Street @ The Hub
- Hottinger Bruel & Kjaer Solutions
- John C. Stennis for Public Service

"The Hub" Downtown

High Performance Computing Collaboratory

- **Home to Orion: 6th fastest academic system** in the US, was #62 worldwide
  - **5 quadrillion computations per second = 5,000 trillion**
- **HPC² - centers/institutes applying high performance computing**
  - **Alliance for System Safety of UAS through Research Excellence (ASSURE)**
  - **Center for Cyber Innovation (CCI)**
  - **Center for Computational Sciences (CCS)**
  - **Geosystems Research Institute (GRI)**
  - **Institute for Computational Research in Engineering and Science (ICRES)**
    - **Center for Advanced Vehicular Systems (CAVS)**
    - **CAVS Extension (CAVS-E)**
    - **Institute for Imaging & Analytical Technologies (I²AT)**
    - **Institute for Systems Engineering Research (ISER)**
  - **Institute for Genomics, Biocomputing & Biotechnology (IGBB)**
  - **Northern Gulf Institute (NGI)**
- **$45M data center designed for HPC operations**
  - **10,000SF data hall, 20 MW of power and 6K tons of cooling**
  - **Ground broken April 2023; ~ completion late-Spring 2025**
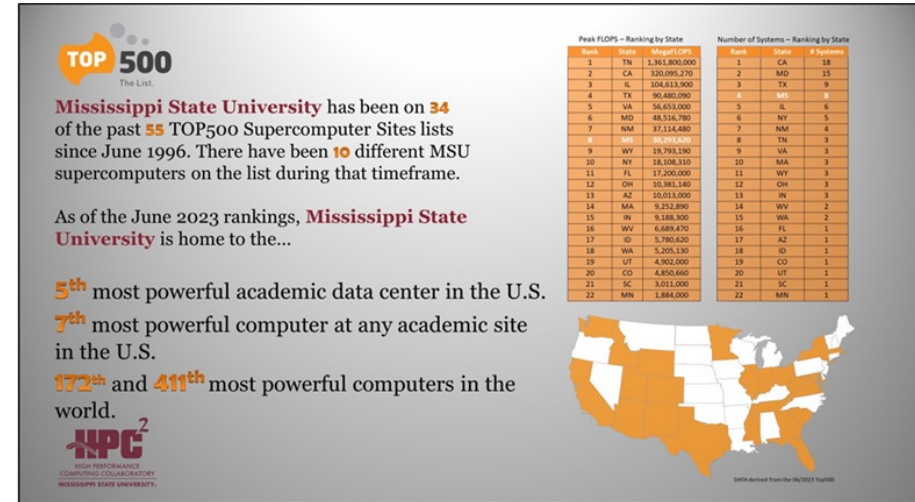
Division of Agriculture, Forestry and Veterinary Medicine

- The National Science Foundation ranks MSU **13th** nationally for natural resources and conservation research funding and 11th for agricultural research**.**

- In FY22, DAFVM recorded a record to $116.7M in grants and contracts

- DAFVM also serves more than **34,000 farmers** in the state, **125,000 forest landowners**, almost **70,000 4-H Club members**, thousands of **agribusiness** firms, and thousands of **families** across **Mississippi**

- Training to county officials in all **82** counties

- Training for city officials in all **299** municipalities

MISSISSIPPI STATE
UNIVERSITY™

Northern Gulf Institute

NGI is a NOAA Cooperative Institute that collaborates with many universities, federal and state agencies, and non-governmental organizations (NGOs) to conduct research focused on the Gulf of Mexico

Robert Moorhead

Director

rjm@ngi.msstate.edu

Paul Mickle

Co-Director

pmickle@ngi.msstate.edu

NorthernGulfInstitute.org

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Geosystems Research Institute
Northern Gulf Institute

Geosystems Research Institute

- Engages faculty from across the University
  - Tenured and tenure-track faculty
  - Research faculty

- Supports MSU's land-grant mission
  - Acquires and disseminates knowledge about earth and its systems,
  - Integrates geosciences and engineering,
  - Translates geospatial technologies and skills into useful tools, and
  - Transitions science and technology into practice to support our stakeholders and improve policy and public awareness

- Integrates domain knowledge of specific scientific disciplines, observational science, and computational science to provide an optimized and integrated solution

MISSISSIPPI STATE UNIVERSITY™

Geosystems Research Institute
Northern Gulf Institute

NGI Research Program

- Research themes:
  - Climate Change and Climate Variability Effects on Regional Ecosystems
  - Coastal Hazards
  - Ecosystem Management
  - Effective and Efficient Data Management Systems Supporting a Data-driven Economy
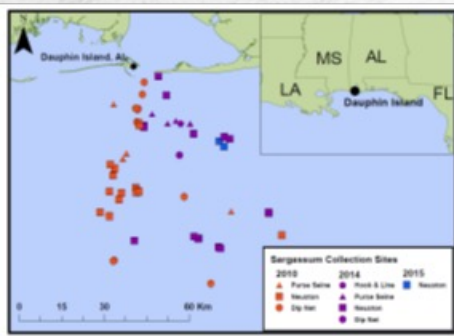
GRI & NGI Disciplines and Personnel

- Disciplines
  - Geosciences
  - Electrical Engineering
  - Agricultural Engineering
  - Computer Engineering
  - Plant and Soil Science
  - Wildlife, Fisheries, and Aquaculture
  - Forestry
  - Civil Engineering
  - Environmental Engineering
  - Biology
  - Computer Science

- Personnel
  - Research Faculty
  - Research Fellows
  - Research Staff
  - Students
  - HPC2 Staff

ASSURE FAA UAS Center of Excellence

- **Alliance of 29 universities** and ~100 industry partners
- Focused on how to **safely integrate unmanned aircraft** into the National Airspace
- **Research Focus Areas**
  - Air Traffic Integration
  - Airworthiness
  - Control and Communication
  - Detect and Avoid
  - Human Factors
  - Low Altitude Operations Safety
  - Training
  - Cyber Security
  - Disaster Response
  - eCommerce
- **Developing Training, Certification, Standards, and Credentialing First Responder UAS Program**
- **UAS economic potential in the billions**

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https://www.assureuas.org/

Raspet Flight Research Lab

- National Lead for FAA's ASSURE UAS Center of Excellence

- FAA's Designated UAS Safety Research Facility

- National Lead for DHS's Common UAS Test Site

- 100,000 ft² of climate-controlled laboratory, test & hangar facilities…at capacity…renovation required for growth

- Manned & Unmanned Aircraft Fleets (largest inventory in academia)

- On-site airfield access with UAS Control Tower

- 60,000+ sq. mi. of FAA COA Airspace…unique to MS

- Future All-Weather UAS Test Facility
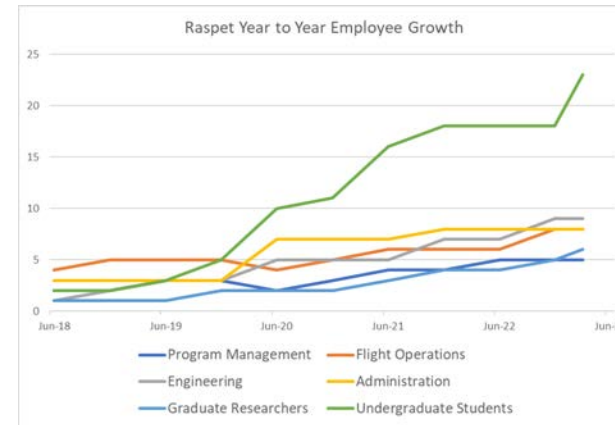
Raspet Flight Research Lab

Advanced Composites Institute

*Driving **high-utility** innovation in composites technology from concept to design, execution and technology transfer via collaborative partnerships with industry and government partners and pioneering technical experts.*

Ideation »» *Engineering* »» *Fabrication* »» *Scale-up* »» *Analysis*

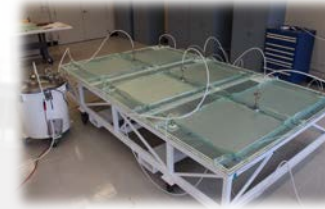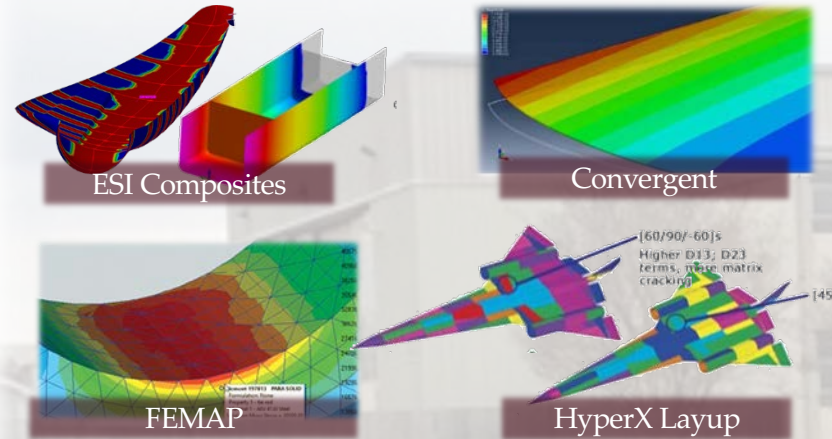|	
50,000 ft² Facility	$13M Equipment
~50 ACI Personnel	175+ yrs experience
>40 Active Clients	~2500 K12+ outreach
AS9100 Certified	Export Controlled

Primary Technologies

Target Industries

MISSISSIPPI STATE UNIVERSITY™
OFFICE OF RESEARCH AND
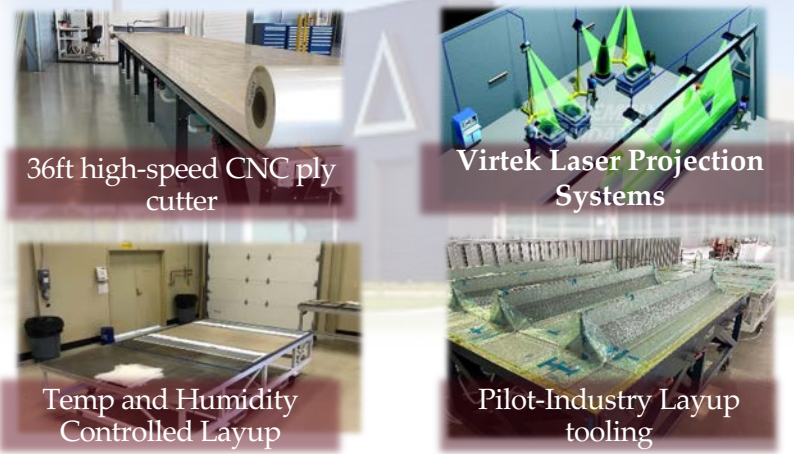ECONOMIC DEVELOPMENT
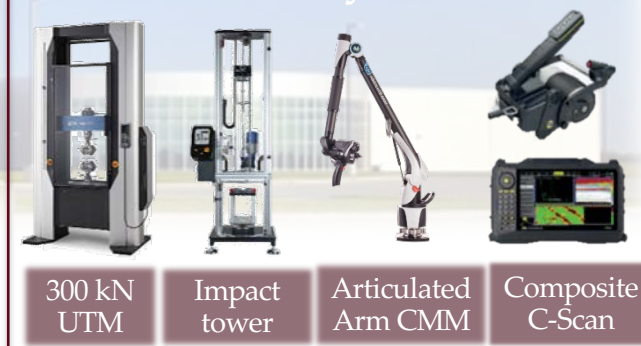
Advanced Composites Institute Capabilities

AS9100D CERTIFIED ISO 9001

Simulation

ESI Composites

Convergent

FEMAP

[60/90/-60]s
Higher D13, D23 terms, more matrix cracking

[45/-45/0/90]s

HyperX Layup

Layup

36ft high-speed CNC ply cutter

Virtek Laser Projection Systems

Temp and Humidity Controlled Layup

Pilot-Industry Layup tooling

Processing

60-gal infusion

Curing Oven 50x20x10 ft, 450°F

High Temp Curing oven 10x10x8 ft, 650°F

4ftx6ft RTM press, 650°F

40ft x 8ft travel Stitching

3'x5' ASC Autoclave

2'x2' 100 Ton Press

Isojet 25 gal. Auto infusion

A.M./Tooling

RAM — The Thermoset Difference with Reactive Additive Manufacturing

Thermoset 8'x4'x4'

1m³ TP

12'x6'x40" CNC router

Analysis

300 kN UTM

Impact tower

Articulated Arm CMM

Composite C-Scan

Mississippi Advanced Composites Training Center

Mission: Provide advanced classroom and hands-on composites training in an industrial environment, at industrial scale, with industrial equipment to deliver engineers and technicians prepared to contribute on day-one at manufacturing sites

K-12 Engagement

Tours & Demonstrations
Paid Internships
Senior Projects
Laboratory Class Sessions

Post-Secondary

Hands-on Training
Opportunity Elucidation
Industry Internships
Industrial Experience

Current/Re-entry WF

Sustainable Advanced Composites Manufacturing Pipeline

MAC Training Academy Curricula

- ✓ Composite Manufacturing for Technicians
- ✓ Compositee Assembly for Technicians/Engineers
- ✓ Composite Manufacturing for Engineers
- ✓ Advanced Composite Design for Engineers
- ✓ Hi-Rate Resin Infused Manufacturing (HiRIM)
- ✓ Advanced Composite Tooling (Thermoset AM)
- ✓ K-12 Introduction to Composites Manufacturing
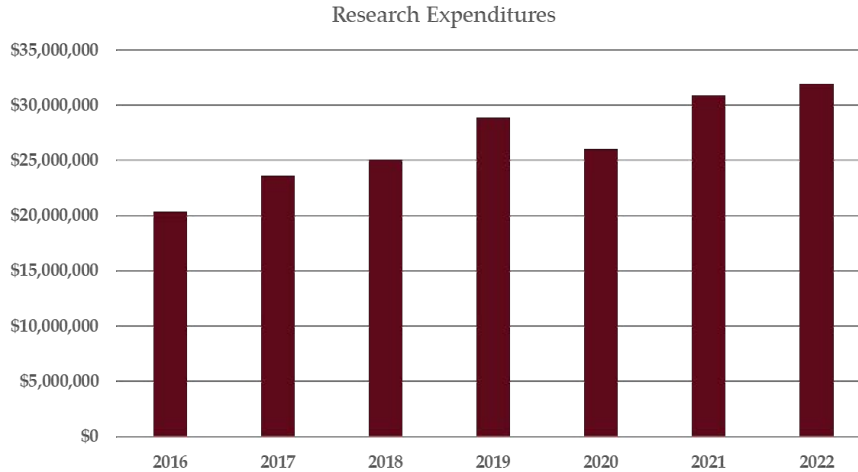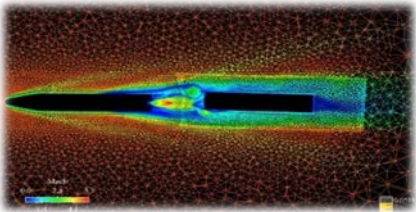- ✓ Post-Secondary Intro to Composites Design & Manf.

MISSISSIPPI STATE UNIVERSITY™
OFFICE OF RESEARCH AND ECONOMIC DEVELOPMENT

Center for Advanced Vehicular Systems (CAVS)

Research Expenditures

Highlighted Research Areas:

- Steel Research
- Autonomy, AI, Machine Learning
- HPC for Modeling and Simulation
- Materials Experimentation
- Materials Modeling
- Autonomous Vehicles, Off-Road
- Athletic Engineering
- MSU Autonomous Vehicle Simulator (MAVS)
- Additive Manufacturing
- Hybrid & Electric Vehicles
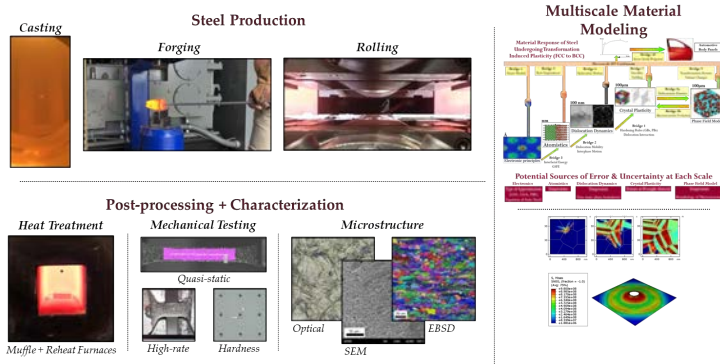- Computational Fluid Dynamics

Center for Advanced Vehicular Systems (CAVS) Initiatives

Steel Research & Development Capabilities
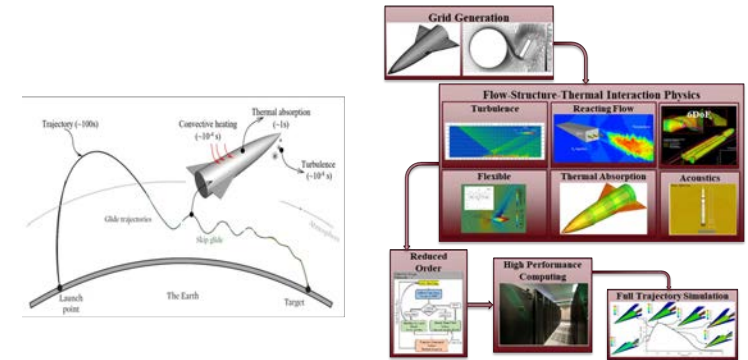

Additive Manufacturing

In-situ Process Monitoring and Control • Data Analytics • Microstructural Modification

Alloy Development • Thermomechanical Modeling • Functional Grading • Machine Learning

Hypersonic Trajectory Design & Analysis Tool (Loci-Chem)

Member: University Consortium for Applied Hypersonics.

Off-Road Proving Ground

Lunar Terrain Vehicle Proposal

Electric Vehicles

MISSISSIPPI STATE UNIVERSITY

https://www.cavs.msstate.edu/

MISSISSIPPI STATE UNIVERSITY™
AGRICULTURAL AUTONOMY INSTITUTE

- Agricultural Autonomy is the **automation** of traditional agricultural practices through the **adoption of multi-domain autonomous vehicle systems** such as drones, driverless tractors, and uncrewed maritime vessels.

- These autonomous vehicle systems have demonstrated tremendous potential to modernize 21st century agricultural **production**, **processing**, and **research**.

Tour the nation's first and only
AGRICULTURAL AUTONOMY INSTITUTE

save the date

Thursday, October 26
10 a.m. - noon
Pace Building
650 Stone Blvd.
Mississippi State University

additional details forthcoming

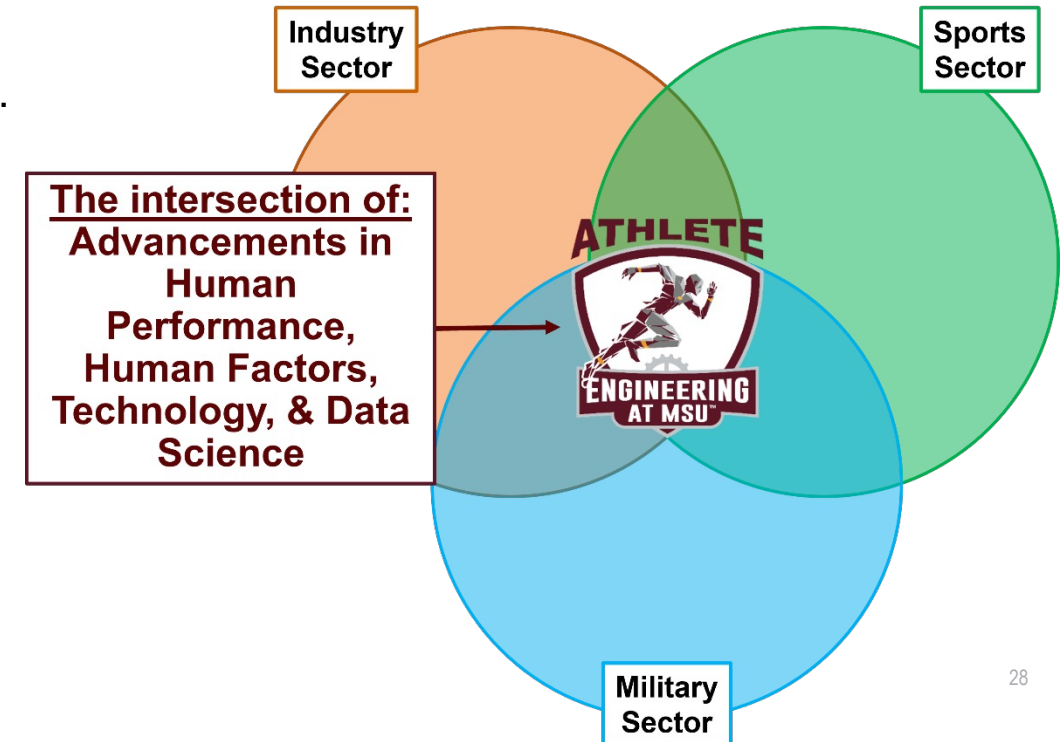MISSISSIPPI STATE UNIVERSITY™
AGRICULTURAL AUTONOMY INSTITUTE

Athlete Engineering Research

1. **Industrial Athlete:** the repetitive motion task worker in manufacturing, warehousing, logistics, and other service-oriented industries.

2. **Tactical Athlete:** military personnel, the warfighter, and the emergency responder.

3. **At-Risk Athlete:** the clinical patients in rehabilitation, recovery as well as telehealth and tele-rehab.

4. **Sports Athlete:** the student and professional athletes in competition.

- **Active "Athlete" Projects:**
  - MS-SHIPS: Ingalls Heat Mitigation Wearable Prototyping
  - Toyota Paint-Liquid Wire Wearable Integration
  - ABB Motors Human Wearable Performance Assessment
  - Cover-2TM Wearable Bioimpedance Measurements Hydration Study
  - Movement Disorders and Cognitive Impairments from SARS-CoV-2 Infection in Older Adults
  - The Smart Health Sock App: Improving Fall Detection to Reduce Injuries
  - Acquisition of Biomechanical Movement and Body Volumetric Baselining Technology Suite for Motion Capture Improvement and Sensor-based Validation of Lower Body Characteristics

Industry Sector

Sports Sector

The intersection of: **Advancements in Human Performance, Human Factors, Technology, & Data Science**

ATHLETE
ENGINEERING AT MSU

Military Sector

Athlete Engineering Summit: April 16-17, 2024
Building a Human Performance Culture

www.athleteengineeringsummit.com

Advancements in Manufacturing Upskilling Program (AiM UP)

Collaborative Robots

Fully Automated Materials & Production Line

Autonomous Mobile Robots

- **Active AiM UP Projects:**
  - Advancements in Manufacturing Upskilling Program (AiM UP): emphasis curriculum development
  - Advancements in Manufacturing Upskilling Program (AiM UP): location expansion to MGCCC
  - Collaborative Robot Training and Skills Accelerator Program
  - Automotive Ground Vehicles and Virtual Conveyor Systems Training and Skills Accelerator Program
  - Industry 4.0 Skills Accelerator

Cyber Security

- MSU is **one of only 10 universities** designated as a Center of Academic Excellence by NSA in Cyber Operations, Defense, & Research
- Selected to host the NSA Cyber Operations Community of Practice and lead bottom-up overhaul of national cyber operations curriculum
- NSF Cyber Corps at MSU--**4th largest program nationally**
- Key MSU Cyber Operations strengths
  - Reverse Engineering
  - Wireless Security
  - Cyber Physical Systems (SCADA)
- DoD 8140 – Compliant 8570 Cyber Certification Training
  - Certified Information Security System Professional (CISSP)
  - Certified Ethical Hacker (CEH)
  - Certified Hacker Forensic Investigator (CHFI)
  - Certified Information Security Manager (CISM)
  - Cyber Security Analyst (CySA+)
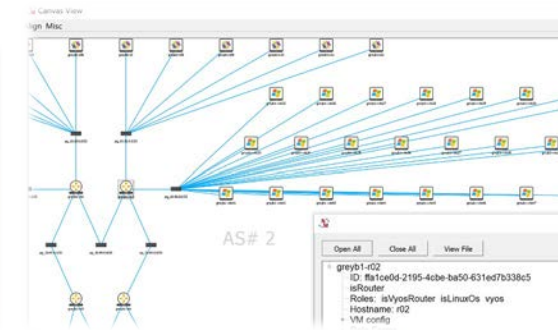
MISSISSIPPI STATE UNIVERSITY™
CENTER FOR CYBER EDUCATION

Preparing the cyber workforce from kindergarten through career!

What we do...

- Conduct cybersecurity awareness training for small businesses
- Host cybersecurity certification training to grow and strengthen the cybersecurity workforce
- Provide remote internship opportunities for MSU students
- Lead K-12 computer science standards development and maintenance
- Provide computer science professional development for K-12 teachers
- Develop and maintain K-12 computer science curricula
- Host computer science camps and outreach events for K-12 students
- Develop industry partnerships to build stronger pipelines into the workforce
- Promote diversity in computer science education and occupations

MISSISSIPPI STATE UNIVERSITY® WORKFORCE SCHOLARS INITIATIVE

{CS4MS}

GenCyber

VICEROY

CYBER DEFENDERS

Mississippi Cyber Initiative (MCI)

- Purpose: Create a statewide ecosystem to address cybersecurity issues
- Success based on strong partnerships and collaboration among stakeholders
  - Leveraging expertise among academia, state, federal, and local government, law enforcement, DoD, MS National Guard, and Industry Partners
- MCI focus:
  - Collaboration – Identifying capabilities, vulnerabilities, and find solutions
  - K-12 Education, Training, Workforce Development
  - Compliance, Awareness, Prevention
  - Protection of Critical Infrastructure
  - Cyber/Digital Forensics, Cybersecurity
  - Attract Innovative Cyber and Advanced Technology Industries
  - Research, Innovation, and Economic Development
  - Support the cybersecurity training needs at Keesler AFB, the MS National Guard, and all stakeholders

Mississippi Cyber & Technology Center

- Selected as the winning proposal; now negotiating Enhanced Use Lease terms with the Air Force

- Will serve as MCI headquarters, on Keesler AFB

- Provide a facility where cyber experts from across the state, region, and nation can gather to collaborate on how best to meet cybersecurity demands that impact federal, state, private, and public entities

- Will serve as a technology center for private sector development in innovation and cybersecurity

- Will house coordination efforts for all relevant state agencies in cybersecurity

- Houses a Secured/Controlled space to hold sensitive information, conduct advanced training and education, and allow collaboration on the most current cyber fields and threats

- Managed by MSU Research and Technology Corporation, a 501(c)(3) non-profit corporation

- 100K sq ft facility @ 25K sq ft per floor
- 70K of leasable square footage @ $22 sq/ft
- Event, conference, classroom space for rent
- Two floors dedicated to Industry leases
- Secured space for cyber ecosystem, digital forensics labs, St and Federal agencies

Funding Opportunities

Weekly Grant Opportunities Update
Mississippi State University
June 20, 2023

DEFENSE WERX Programs

- **ERDCWERX**
- **AFWERX**
- **SOFWERX**
- **SPACEWERX**
- **DEFENSEWERX**
- **HSWERX (Homeland Security)**
- **Doolittle Institute (AFRL-RW)**
- **Cyber Fusion Innovation Center (CFIC)**
- **Nautilus NAVALX**
- **LANDWERX – Agricultural Innovation for Farming**

ORED Research Support Units

- Office of Research Compliance and Security
- Office of Sponsored Projects
- Office of Research Development
- Office of Technology Management

QUESTIONS?

Jim Martin

Associate Vice President

Office of Research & Economic Development

jimmartin@research.msstate.edu