

# MATRIX III: Campus STEM Research Priorities Report

## Categories Aligned with FIRST Louisiana High Growth Target Industries

### Materials & Chemicals - DRAFT

	Research Priorities Aligned with High Growth Target Industries	Specific Research Foci/Strengths
<b>LSU AG</b>	<ul style="list-style-type: none"> <li>Materials &amp; Chemicals – from Biobased Materials</li> </ul>	<ul style="list-style-type: none"> <li>One-of-a-kind pilot plant for strategic research and development of liquid fuels and specialty chemicals from cellulose biomass and syrups (sugars) derived from biomass crops (energy cane, sweet sorghum) in the southern U.S.</li> <li>Tiger Bullets – plastic and wood composite that prevents lost circulation in oil-drilling wells</li> <li>Food additives – chemical components and constituents for food product development</li> <li>Success Stories               <ul style="list-style-type: none"> <li>Louisiana Institute for Biofuels and Bioprocessing \$17.2 million award to build the foundation for a biomass-based fuels and chemicals sector in the State</li> <li>Numerous industry partners working with LSU Ag Center to test proprietary technologies using Louisiana feedstocks</li> <li>Discovery of a compound which blocks bitter and astringent flavors in food and beverages &amp; development of a sports recovery drink that provides high levels of potassium, calcium, and modest levels of sodium</li> <li>Louisiana Institute for Biofuels and Bioprocessing \$17.2 million award to build the foundation for a biomass-based fuels and chemicals sector in the State</li> <li>Numerous industry partners working with LSU Ag Center to test proprietary technologies using Louisiana feedstocks</li> </ul> </li> </ul>
<b>LSUBR</b>	<ul style="list-style-type: none"> <li>Conventional &amp; Renewable Energy</li> <li>Materials Science &amp; Engineering</li> </ul>	<ul style="list-style-type: none"> <li>Effort to bring together scientific, engineering, economic &amp; social dimensions</li> <li>\$12.5 million Energy Frontier Research Center (DoE)</li> <li>Turbine Innovation Energy Research unit</li> <li>Center for Energy Studies (policy analysis)</li> <li>Petroleum Engineering Research &amp; Technology (PERTT) Lab unique in the country</li> <li>Off- and on-shore activities are the core of several high-profile research programs</li> <li>Success Stories               <ul style="list-style-type: none"> <li>Research cluster studying multiphase flow in chemical process modeling includes major private-sector participation</li> <li>Center for Atomic Level Catalyst Design supported by a \$12.5 million DoE grant</li> </ul> </li> <li>Leadership of Dr. Ward Plummer</li> <li>New 85,000 SF Chemistry and Materials building</li> <li>Plan to facilitate a self-sustaining instrumentation facility</li> <li>Working toward establishment of an Institute for Advanced Materials</li> <li>Success Stories               <ul style="list-style-type: none"> <li>Center for Advanced Microstructures and Devices (CAMD) \$1.26 million research equipment award to purchase and install a superconducting multi-pole wiggler at the CAMD synchrotron ring</li> <li>Renology, a solar-solution start-up company, founded by Yi Li, a PhD student in Physics &amp; Astronomy</li> </ul> </li> </ul>
<b>LA Tech</b>	<ul style="list-style-type: none"> <li>Science &amp; Engineering for Health &amp; Quality of Life</li> </ul>	<ul style="list-style-type: none"> <li>Application of fundamentals from engineering, basic sciences, medical sciences, and mathematics to solve problems in medicine and biology and to understand, modify or control biological systems</li> <li>Center for Biomedical Engineering and Rehabilitation Science</li> <li>School of Biological Sciences</li> <li>LA Tech Speech and Hearing Center</li> <li>Professional Development and Research Institute on Blindness</li> <li>Success Stories:               <ul style="list-style-type: none"> <li>NIH Award for brain imaging studies</li> <li>Zero-gravity flight test for experimental prototype</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>Infrastructure, Energy &amp; Environmental Systems</li> <li>Matter, Materials &amp; Multiscale Systems</li> <li>STEM Education, Entrepreneurship &amp; Innovation</li> </ul>	<ul style="list-style-type: none"> <li>Disciplines of engineering, fundamental science, and applied sciences to develop solutions for infrastructure, energy &amp; environmental challenges</li> <li>Research agenda includes advanced materials for sustainable infrastructure, energy harvesting, alternative energy, transportation systems, water and coastal modeling and support</li> <li>Trenchless Technology Center</li> <li>Institute for Micromanufacturing</li> <li>Success Stories: <ul style="list-style-type: none"> <li>Louisiana Technology Product of the Year (Erez Allouche: “green” concrete technology)</li> <li>NSF CAREER Award (Dr. Niel Crews: “Thermal Gradient Microflow Calorimetry using Anisotropic Temperature Sensors”)</li> </ul> </li> <li>Disciplines of engineering, computer science, chemistry, physics &amp; mathematics</li> <li>Research topics include micro/nanotechnology for energy, security, and sustainability applications, microfabrication and materials characterization, nuclear and high energy physics, computational electromagnetics and metamaterials, computational materials science &amp; advanced materials and manufacturing</li> <li>Institute for Micromanufacturing</li> <li>Center for Applied Physics Studies</li> <li>Louisiana Alliance for Simulation-Guided Materials Applications (LA-SiGMA)</li> <li>Success Stories: <ul style="list-style-type: none"> <li>NSF CAREER Award (Dr. Leland Weiss: new methods to capture and use solar thermal energy using small-scale devices)</li> <li>Particle Physics image (a summary figure of “inclusive jet production”) selected as international standard</li> </ul> </li> <li>Support FIRST LA framework as a whole by educating post-secondary and post-graduate students in all foundational sciences</li> <li>Facilitate innovations in core domains, and ultimately contribute to all target industries</li> <li>Integrated STEM Education Research Center</li> <li>Science and Technology Education Center</li> <li>Center for Entrepreneurship and Information Technology</li> <li>Proof of Concept Center</li> <li>Success Stories <ul style="list-style-type: none"> <li>US Department of Homeland Security funding for Cyber Discovery Camp</li> <li>US Economic Development Administration funding for “i6 green energy challenge”</li> </ul> </li> </ul>
<b>Loyola</b>	<ul style="list-style-type: none"> <li>Environmental Biology &amp; Chemistry</li> <li>Materials Science and Spectroscopic Analysis</li> </ul>	<ul style="list-style-type: none"> <li>Includes ecology, conservation, natural history, population genetics, mathematical biology, atmospheric chemistry &amp; green chemistry</li> <li>Animal studies/surveys</li> <li>Plant studies</li> <li>Microbial studies</li> <li>Atmospheric chemistry</li> <li>Green chemistry</li> <li>Summer Collaborative Outreach and Research Experience</li> <li>Center for Environmental Communication</li> <li>Center for Environmental Law &amp; Land Use</li> <li>Success Stories: <ul style="list-style-type: none"> <li>Dr. Patricia Dorn keynote address at the Second International Workshop on Chagas Disease</li> <li>Dr. Aimee Thomas and Dr. Kristy Halverson NSF award to adopt an innovative environmental science training program</li> </ul> </li> <li>Includes systems and novel analysis of systems</li> <li>Novel measurement of transport properties</li> <li>Crystallography of isometric organic cations with extraordinary structures</li> <li>Cavity ring-down spectroscopy</li> <li>Success Stories <ul style="list-style-type: none"> <li>Dr. Patrick Garrity discovered a way to decouple heat flow from electrical currents and apply the technique to thermoelectric power generation</li> <li>Dr. Lynn Koplitz published five articles on the crystallography of compounds containing isomeric organic cations</li> </ul> </li> </ul>

PBRC		
<b>SUBR</b>	<ul style="list-style-type: none"> <li>Advanced Materials &amp; Nanotechnology</li> <li>Energy, Ecosystems &amp; the Environment</li> </ul>	<ul style="list-style-type: none"> <li>Vision: to build materials research center; to develop methods and tools to study and design nanoscale systems; to reach the control of electrons and photons inside nanostructures for new nanoelectric and nanophotonic devices; to develop functionally graded materials, morphing structures based on shape memory polymers, carbon nanotubes based on gas/chemical/bio sensors, solar cells, and other devices containing sensors and active materials</li> <li>Neutrino Physics</li> <li>Advanced Materials &amp; Energy Production</li> <li>Electron Transport &amp; Magnetic Properties of Materials</li> <li>Superconductivity of Materials</li> <li>Surface Science &amp; Solid State Ionics</li> <li>Neutrino Physics</li> <li>SU Computer Automated Virtual Environment (CAVE)</li> <li>Success Stories               <ul style="list-style-type: none"> <li>IceCube South Pole Neutrino Observatory (SU partnership)</li> <li>Next Generations CREST Composite Center</li> </ul> </li> <li>Vision: To build on current sustainable energy-oriented research strengths and to develop new, technically significant research programs; to understand mechanisms driving, and to develop potential solutions for, alternative energy materials, carbon emissions and climate change problems</li> <li>Success Stories               <ul style="list-style-type: none"> <li>Next Generations CREST Composite Center</li> <li>Research Project: Developing Biofuels from Sustainable Alternative Non-Food Feedstocks in Louisiana</li> </ul> </li> </ul>
<b>Tulane</b>	<ul style="list-style-type: none"> <li>Materials Science</li> <li>Health-Related Research</li> <li>Energy &amp; Environmental Science</li> </ul>	<ul style="list-style-type: none"> <li>Internationally recognized programs in nanotechnology, polymer science and engineering, electronic materials, energy storage &amp; materials simulations</li> <li>Major focus areas of microemulsion systems, polymer physics, polymeric drug carriers, thin films and coating &amp; nanomanufacturing</li> <li>Center for Computational Science</li> <li>Coordinated Instrumentation Facility</li> <li>Polymer Reaction Monitoring &amp; Characterization (PolyRMC)</li> <li>Louisiana Alliance for Simulation-Guided Materials (LASiGMA)</li> <li>Success Stories: Dr. Vijay John (materials/nanomaterials); Dr. Wayne Reed (polymer physics &amp; biophysics); Dr. Doug Chrisey (advanced materials); Dr. Scott Grayson (polymers)</li> <li>Internationally recognized programs in gene and drug delivery, tissue regeneration</li> <li>Major focus areas of tissue engineering &amp; protein folding</li> <li>Center for Computational Science</li> <li>Coordinated Instrumentation Facility</li> <li>Louisiana Alliance for Simulation-Guided Materials (LASiGMA)</li> <li>Success Stories: Dr. Don Gaver (biomedical engineering/biofluid mechanics); Dr. Ken Muneoka (limb regeneration); Dr. Anne Robinson (fundamental interactions between molecules)</li> <li>Internationally recognized programs in energy sources, energy management &amp; environmental sciences</li> <li>Major focus areas of biofuels, sedimentology, sea-level change &amp; energy supply chain economics</li> <li>Tulane Energy Institute</li> <li>Tulane University Biodiversity Research Center</li> <li>Clean Power and Energy Research Consortium (multi-institutional collaboration)</li> <li>DOE National Institute for Climate Change Research (multi-institutional collaboration)</li> <li>Success Stories: Dr. Geoff Parker (markets and supply chains); Dr. Tor Tornqvist (evolution of rivers, oceans and shallow oceans); Dr. David Mullin (alternative fuels/liquid fuels); Dr. Henry Bart (taxonomic/ecological diversity and environmental adaptation)</li> </ul>

<b>ULL</b>	<ul style="list-style-type: none"> <li>• Energy &amp; Sustainability</li> <li>• Advanced Materials &amp; Manufacturing</li> </ul>	<ul style="list-style-type: none"> <li>• Research agenda: alternative energy, geological research, sustainable design, petroleum research, unconventional natural gas &amp; energy efficiency</li> <li>• Energy Institute</li> <li>• Marine Survival Training Center (MSTC)</li> <li>• Success Stories <ul style="list-style-type: none"> <li>• ULL/CLECO Partnership for Alternative Energy Research</li> <li>• Architecture leader in sustainable design (faculty &amp; student activities)</li> <li>• MSTC is a global leader in marine safety</li> <li>• Major collaborations with industrial partners</li> </ul> </li> <li>• Interdisciplinary research in structure, process, property &amp; performance of advanced and specialized materials</li> <li>• Developing improved manufacturing processes and improving manufacturing production through the use of lean and agile engineering, design, and production supply chains</li> <li>• Performing applied research through materials development, demonstration, training, prototyping and innovation engineering efforts with manufacturing companies</li> <li>• Working with industry to perform feasibility studies of proposed and existing production models, systems and processes</li> <li>• Institute for Materials Research &amp; Innovation</li> <li>• Manufacturing Extension Partnership of Louisiana (MEPoL)</li> <li>• Success Stories <ul style="list-style-type: none"> <li>• MEPoL's impact on manufacturing in Louisiana</li> <li>• Development of hybrid luminescent tracer ammunition</li> <li>• Developments in preparation magnetic nanostructures</li> </ul> </li> </ul>
<b>ULM</b>	<ul style="list-style-type: none"> <li>• Agricultural, Biological &amp; Environmental Advancements</li> </ul>	<ul style="list-style-type: none"> <li>• Agricultural, ecological &amp; environmental research to maximize safe and effective use of natural resources</li> <li>• Success stories <ul style="list-style-type: none"> <li>• Researchers study the popular chloracetanilide herbicides (toxicity)</li> <li>• Researchers test natural antimicrobials to inhibit the growth of food toxins</li> <li>• Faculty and students pioneered a novel way to determine impact of pollutants on amphibian resistance to pathogens</li> </ul> </li> </ul>
<b>UNO</b>	<ul style="list-style-type: none"> <li>• Advanced Materials</li> <li>• Naval Architecture &amp; Marine Engineering</li> </ul>	<ul style="list-style-type: none"> <li>• Advanced Materials Research Institute</li> <li>• Success Stories</li> <li>• Dr. Gabriel Caruntu NSF CAREER Award</li> <li>• AMRI Summer Research Program</li> <li>• Nationally and internationally recognized faculty working on advanced ship and autonomous vehicle design and construction, including titanium alloy materials</li> <li>• Success Stories</li> <li>• UNO awarded a \$3 million contract as one of three American university partners on a South Korean shipbuilding research project</li> <li>• Office of Naval Research grant (\$4.8M) to advance the science and technology of titanium shipbuilding</li> </ul>
<b>Xavier</b>	<ul style="list-style-type: none"> <li>• Materials Science</li> </ul>	<ul style="list-style-type: none"> <li>• Partnerships for Research &amp; Education in Materials (PREM): \$3.5M NSF grant</li> <li>• Louisiana Alliance for Simulation-Guided Materials Applications (LA-SiGMA)</li> <li>• Success Story <ul style="list-style-type: none"> <li>• PREM partners with Excellatron Solid State INC – provides new capabilities in testing anode materials in a solid-state environment</li> </ul> </li> </ul>