

ACCELERATE ALABAMA 2.0

MADE IN
ALABAMA



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Introduction

In July 2011 the Alabama Economic Development Alliance (Alliance) was created by Executive Order of Governor Robert Bentley. The Alliance engaged Boyette Strategic Advisors (BSA), an economic development consulting firm, to facilitate the development of the Accelerate Alabama economic development strategic plan. Accelerate Alabama, which was delivered in January 2012, included identification of 11 targeted business sectors, as well as recommendations and related tactics focused on three economic development drivers: Recruitment, Retention and Renewal. Accelerate Alabama was meant to provide direction for the state's economic development efforts over a three-year period. The Alliance diligently followed through with the implementation of the Accelerate Alabama plan.

BSA was engaged to work with the Alliance to develop Accelerate Alabama 2.0, an update of the 2012 Accelerate Alabama plan, which will provide direction related to the economic development efforts of the state over the next three to five years. BSA, working closely with the Alliance, conducted the following six-step process in developing Accelerate Alabama 2.0.



Accelerate Alabama 2.0 includes the identification of targeted business sectors for Alabama to focus its efforts, as well as recommendations or accelerators, and related tactics, centered on three economic development drivers: Recruitment, Retention and Renewal. The targets and accelerators were identified based on extensive research, as well as input from

the Alliance members and other stakeholders who participated in the process.

This Accelerate Alabama 2.0 version was updated in November 2016 to incorporate the Alabama Experimental Program to Stimulate Competitive Research (ALEPSCoR) Science and Technology (S&T) Plan. The S&T Plan, which is attached as Appendix A, addresses support for statewide Renewal of industry through the growth of innovation and research and development activities that are directly related to the expertise and strength of Alabama's universities and laboratories. This Plan also makes recommendations for enhancing and expanding Alabama's infrastructure and lists resources needed to "Accelerate Alabama" and ensure that the state is nationally and internationally competitive.

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ALABAMA EXPERIMENTAL PROGRAM TO STIMULATE COMPETITIVE RESEARCH (ALEPSCoR)

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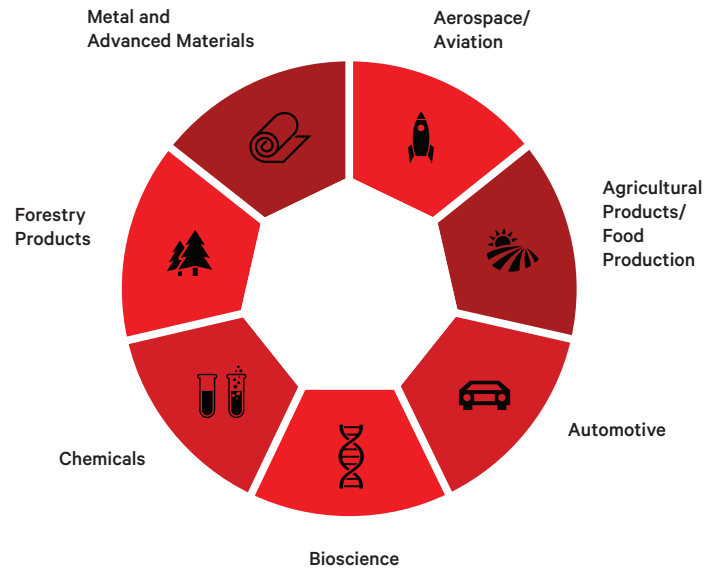
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Targeted Business Sectors



Seven targeted business sectors, each with areas of focus, along with six foundational targets, have been updated/refined for the State of Alabama to focus its recruitment, retention and renewal efforts over the next three years. Foundational targets may be defined as sectors that are intrinsic to the core competencies of a wide range of industries and provide operational processes and services to other sectors the state may target.

The determination of these targets involved the review of the current business/industry base in Alabama, current targeted sectors of the state, regional and local economic development organizations in Alabama, as well as the various power providers, recent project activity, and other emerging sectors that have shown growth at the national, state and possibly local level. The strengths of Alabama related to each sector were also considered. The targeted sectors, foundational targets and areas of focus are outlined below and further defined in this section.

Advanced Manufacturing

Advanced manufacturing involves new ways to manufacture existing products and the emerging products resulting from new technologies. The process of advanced manufacturing may include use of information, automation, computation, software and networking. Additionally, advanced manufacturing may use nanotechnology, chemistry or biology. ¹

The McKinsey Global Institute identified 12 disruptive technologies, which are advances that will transform life, business, and the global economy, as it relates to advanced manufacturing. One of the disruptive technologies identified is additive manufacturing, or 3D printing, which has been mostly used to produce prototypes. As the technology improves and additional materials can be used, the price for the materials and printers is expected to rapidly decline, creating an increase in the use of this process. Robotics has also seen higher adoption rates as robots become more intelligent and agile, allowing them to work safely alongside the human labor force. ²

In the U.S. more than 12 million workers are employed in the manufacturing industry, and in Alabama there are more than a quarter of a million, or nearly 13 percent of all jobs in the state and more than eight percent of jobs in the U.S. Average earnings for the manufacturing industry are \$77,995 in the U.S. and \$65,045 in Alabama. Earnings in manufacturing are 20 percent higher than the average for all industries in the state and the U.S. ³

TARGETED SECTORS:	
AEROSPACE/ AVIATION	CHEMICALS
AGRICULTURAL/ FOOD PRODUCTION	FORESTRY PRODUCTS
AUTOMOTIVE	METAL AND ADVANCED MATERIALS

Aerospace/ Aviation

Growth Opportunity and Trends

Military spending and air travel drive demand in the aerospace and aviation industry.⁴ Revenue for the U.S. air transportation industry is expected to increase at a compound annual rate of 4 percent between 2015 and 2019.⁵ Military spending is unlikely to increase in the coming years, but funding remains for development of new aircraft, including the F-35 Joint Strike Fighter. It is projected that demand for unmanned aerial vehicles will increase.

Boeing has projected a demand of more than 36,000 airplanes between 2014 and 2033. It is estimated that 40 percent of this demand will replace older aircraft, while the balance is a result of fleet expansion.⁶ Air cargo traffic is expected to see growth at a higher rate than passenger traffic. Projected growth of the global freighter fleet is expected to increase 150 percent by 2025.⁷

U.S. aircraft manufacturers consider China a significant opportunity for expansion. China's air traffic is projected to increase seven percent each year over the next 20 years, and air cargo traffic in China is projected to increase 6 percent each year over the same time period.⁸

Aircraft production has seen an increase in the use of composite components made of plastics and fibers, replacing steel and metal. Additive manufacturing, or 3D printing, has been adopted by aircraft engine and parts makers and allows them to produce complex parts with little waste.⁹

The U.S. has the largest space program in the world and includes both private and government organizations. The global space economy grew four percent between 2012 and 2013 to reach \$314.17 billion. Commercial space products and activities revenue saw an increase of seven percent between 2012 and 2013.¹⁰ Of the 81 orbital launch attempts in 2013, 23 were commercial, and six of those were conducted in the U.S. The space industry in the U.S. is concentrated in the following states: California, Texas, Florida, New Mexico, Colorado and Alabama.¹¹ Micro to heavy-duty satellites serve commercial and military purposes, ranging from communication to navigation.¹²

AREAS OF FOCUS

MAINTENANCE, REPAIR & OVERHAUL

Includes scheduled or unscheduled maintenance and repair of mechanical, plumbing or electrical components

COMMERCIAL SPACE PRODUCTS

Private sector investment in production of goods or services for use in space, including satellite televisions/radio and fixed satellites that transmit data, Internet services and voice

SUPPLY CHAIN

Companies that manufacture, market and deliver parts for the aerospace/aviation sector

UNMANNED SYSTEMS

Powered aerial vehicles typically guided without an onboard crew that are often used for surveillance and reconnaissance for military operations



Airbus is ramping up production at its \$600 million manufacturing facility in Mobile, following the first customer-deliveries of Alabama-made aircraft.



Boeing is building on a longstanding Alabama presence with a new research center in Huntsville that is exploring new technologies for the aerospace giant.

Alabama Advantages

The aviation and aerospace industry represents nearly 16,000 jobs in Alabama, 59 percent higher than the U.S., and is projected to see job growth of 5 percent between 2014 and 2019.¹³ Nearly 13 percent of jobs in Alabama are manufacturing, the second highest industry by employment in the state, representing more than 250,000 of Alabama’s labor force of 2.1 million.^{14 15} In addition, nearly 30 percent of residents over the age of 25 hold an Associate’s degree or higher.¹⁶

Airbus’ A320 Family final assembly line in Mobile began incremental production in 2015 and delivered its first assembled aircraft in April 2016.¹⁷ Alabama is also home to Boeing, Lockheed Martin, GE Aviation, Raytheon, United Launch Alliance, Vector Aerospace, GKN Aerospace, and scores of other aerospace/aviation companies.¹⁸

LOCATION ASSETS	
	AFFORDABLE, AVAILABLE WORKFORCE
	PROXIMITY TO CUSTOMERS
	INTERMODAL TRANSPORTATION INFRASTRUCTURE

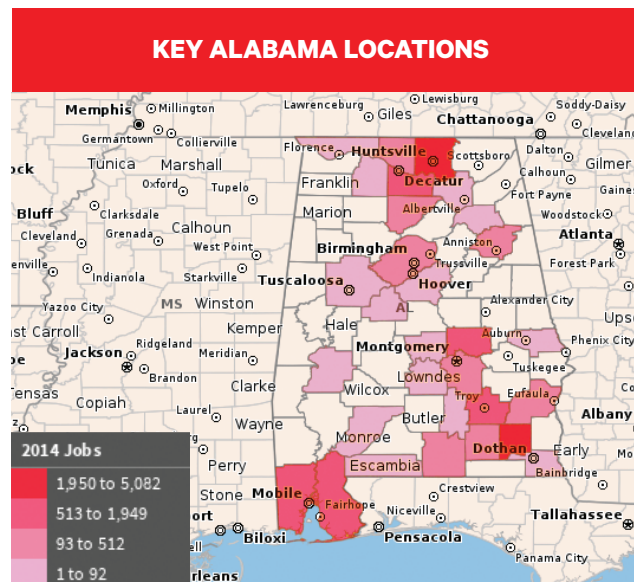
In addition to private companies, Alabama also has a strong military aerospace/aviation presence. The Army Aviation Center at Fort Rucker is located in the southeast corner of the state and is focused on the development of the aviation force for its worldwide mission.¹⁹

NASA’s Marshall Space Flight Center and the U.S. Army’s Redstone Arsenal are both located in Huntsville. Redstone Arsenal is a major federal research, development, test and engineering center that houses the United States Army’s missile, missile defense and aviation programs, the Missile Defense Agency, the Defense Intelligence Agency, and NATO’s MEADS. The facility also performs missile and helicopter research for the U.S. Army.²⁰ Also located at Redstone Arsenal is the Marshall Space Flight Center, one of NASA’s largest and most important field centers. It manages key programs involving the International Space Station, Payload Operation Center, space science and Space Launch System (SLS).²¹ The Propulsion and Structural Test Facility at the Marshall Space Flight Center develops and matures

propulsion technologies, including boost, upper-stage, and in-space applications for current and future space transportation and science missions.²²

The Robotics Technology Park near Decatur offers three specialized training centers, including the Robotics Maintenance Training Center. The Robotics Maintenance Training Center provides workforce training for robotics, advanced manufacturing, manual weld and robotic safety.²³ The Alabama Aviation Center, located at the Mobile Aeroplex at Brookely, offers an aviation maintenance program with hands-on training in airframe and powerplant training.²⁴

Alabama has a strong intermodal transportation system with six interstate highways, including Interstate 10, which runs east-west from Florida to California; Interstate 20, which runs east-west from South Carolina to Texas; Interstate 59, which runs diagonally from Tennessee to Louisiana; Interstate 65, which runs north-south from Illinois to Alabama; Interstate 22, which runs from Birmingham to Memphis; and Interstate 85, which runs diagonally from Virginia to Alabama.²⁵ The state is also home to more than 3,700 miles of track and five Class I railroad companies, including BNSF Railway Company, Canadian National Railway Company, CSX Transportation, Kansas City Southern Railway Company, and Norfolk Southern Corporation.²⁶ The Port of Mobile is a deep-water port of 45 feet that is located along the Mobile River, where it meets Mobile Bay. The port can handle containerized, bulk, break bulk, roll-on/roll-off, and heavy-lift cargoes served by 100 overseas shipping lines, all five Class I railroads in Alabama, and Interstates 10 and 65.²⁷



Agricultural Products/Food Production

Growth Opportunity and Trends

U.S. food manufacturers are projected to see revenue growth at a 4 percent annual compound rate between 2015 and 2019. The consumer price for food increased 3 percent in February of 2015 compared to February of 2014.²⁸ Large food processors are considering expansion into emerging markets, including Latin America and Asia. Other trends in food manufacturing include increasing consumer preference for healthier options with ingredients like organic wheat flour, cane sugar, rice syrup, and cornstarch.²⁹

Crop production trends show an increase of larger farms led by enterprises. Use of genetically modified crops has also seen an increase, despite international trade bans. Genetically modified seeds represent 90 percent of planted corn and cotton and 95 percent of soybeans. At the same time the industry has increased use of genetically modified seeds, organic and heirloom produce has seen growing interest. Organic food sales total \$35 billion annually and continue to grow. The 2014 Farm Bill provided funding for \$20 million annually toward research around organic farming methods and increased crop insurance protection for organic farmers.³⁰

Increased use of technology can be found in agricultural production. This includes increased automation at the equipment manufacturing facility to the use of autonomous vehicles in farm production. This robotic equipment could be controlled remotely or by software and can lead to reduced labor costs. At a much lower cost, farmers are able to use GPS in an economic, practical way on large farms, and most equipment sold has GPS as an optional upgrade.³¹

Alabama Advantages

Alabama is the second largest producer of broilers and fourth largest producer of poultry and eggs in the U.S. Alabama is ranked in the top 10 for production of cotton, aquaculture, quail, and pullets for laying flock replacement.³² Agricultural exports exceed \$1 billion annually. More than 48,500 farms in Alabama account for 9 million acres of farmland in the state.³³

AREAS OF FOCUS

AGRICULTURAL PRODUCTS

Includes production of crops and animals for food-processing operation, as well as the manufacturing of agricultural and machinery equipment

FOOD PRODUCTION

Manufacture and processing of food, including meat, seafood, dairy products, fruits and vegetables, milled grains and oilseeds, baked goods, and candy

Food production facilities located in Alabama are within one day's drive of half the U.S. population, providing proximity to markets required by this sector.³⁴

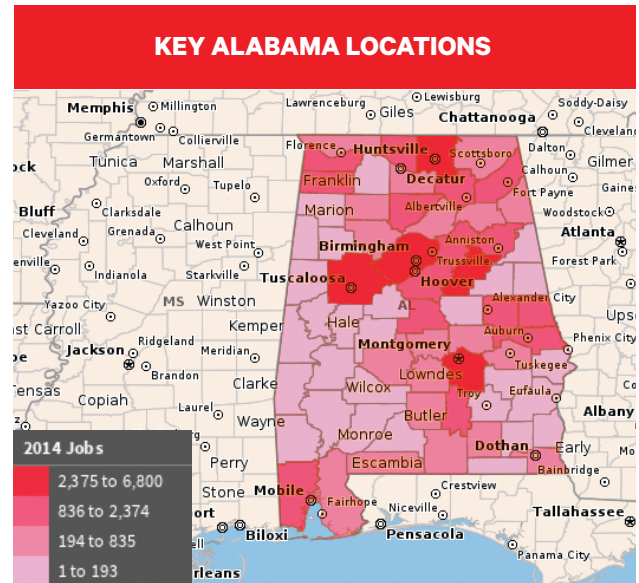
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Interstate 22, which runs from Birmingham to Memphis; and Interstate 85, which runs diagonally from Virginia to Alabama. ³⁵ The state is also home to more than 3,700 miles of track and five Class I railroad companies, including BNSF Railway Company, Canadian National Railway Company, CSX Transportation, Kansas City Southern Railway Company, and Norfolk Southern Corporation. ³⁶ The Port of Mobile is a deep-water port of 45 feet that is located along the Mobile River, where it meets Mobile Bay. The port can handle containerized, bulk, break bulk, roll-on/roll-off, and heavy-lift cargoes served by 100 overseas shipping lines, all five Class I railroads in Alabama, and Interstates 10 and 65. ³⁷

Agricultural products and food manufacturing represent more than 34,000 jobs in Alabama, and employment is projected to remain stable for the next five years. Meat and poultry processing, retail and commercial bakeries, and animal food manufacturing are the largest subsectors in the state. ³⁸

Nearly 13 percent of jobs in Alabama are manufacturing, the second highest industry by employment in the state, representing more than 250,000 of Alabama’s labor force of 2.1 million. ^{39 40}

flex lab. In addition, Auburn has a meat processing facility along with a USDA lab as part of a pilot processing facility. Additional areas of research regarding food systems at Auburn include food safety and environmental sustainability. ⁴⁴



LOCATION ASSETS

- ☀️ AVAILABILITY OF RAW MATERIALS
- 🏭 PROXIMITY TO MARKETS
- 🚚 INTERMODAL TRANSPORTATION INFRASTRUCTURE
- 👥 EDUCATION AND TRAINING RESOURCES

More than half a million jobs are generated by the agriculture industry. ⁴¹ In addition, nearly 30 percent of residents over the age of 25 hold an Associate’s degree or higher. ⁴²

Auburn University Food Systems Institute provides research as well as industry training on all aspects of the food system from “farm to table.” ⁴³ Facilities at the institute include multipurpose lab, cold lab and a



Automotive

Growth Opportunity and Trends

Automotive manufacturing revenue is projected to increase at a compound annual rate of 4 percent between 2015 and 2019 in the U.S. Retail sales for automotive and parts dealers increased 7.9 percent for the first two months of 2015 when compared to the same time period in 2014.⁴⁵

Automotive manufacturers are increasing production of environmentally friendly vehicles as a result of consumer demand and legislation. Consumer demand for hybrid vehicles has exceeded production at times. Eight states have adopted rules requiring 15 percent of all new cars sold be zero-emission vehicles by 2025. To reach this goal, these states are purchasing zero-emission vehicles for public fleets and offering financial incentives for zero-emission vehicles.⁴⁶ Other trends in automotive manufacturing include the integration of wireless devices to a vehicle's infotainment system and increased safety.⁴⁷

Suppliers of automotive manufacturers are increasing their role in research and development. Technologies likely to become standard in vehicles include electronically operated systems for transmissions, suspensions and safety systems. Suppliers are also working to develop new technologies that will improve fuel efficiency, including smaller, turbocharged engines and advanced combustion models.⁴⁸

Automotive parts manufacturers are seeing an increase in demand as Americans own vehicles longer, with the average light vehicle on the road for more than 11 years old.⁴⁹

AREAS OF FOCUS

ORIGINAL EQUIPMENT MANUFACTURERS

Includes companies that produce cars and light trucks, as well as chassis for those vehicles

SUPPLIERS

Produce parts for automobiles, including transmission and power train components, engines and engine parts, electronics and steering, and suspension

Research and development expenditures for the automotive industry in the U.S. are \$18 billion annually. Increasing technology in vehicles and innovative manufacturing processes, which often include robotics, are two reasons the automotive industry represents 16 percent of global research and development funding among all industries.⁵⁰ Automotive manufacturers are reducing the overall weight of vehicles to increase fuel efficiency. One way this is being achieved is the use of carbon fiber in place of steel. The material is lightweight and durable.⁵¹ Additive manufacturing, or 3D printing, has been used by automotive manufacturers for prototyping purposes for more than a decade. The next phase for additive manufacturing in the automotive industry is rapid manufacturing and tooling, which will produce end-use products. Early adopters of this production method include companies in the performance motorsports and racing industry.⁵²

Alabama Advantages

Employment in the automotive manufacturing sector represents nearly 57,000 jobs in the State of Alabama and is projected to increase nearly 13 percent between 2014 to 2019, compared to 0.7 percent in the U.S. during the same time period. Nearly 13 percent of jobs in Alabama are manufacturing, the second highest industry by employment in the state, representing more than 250,000 of Alabama’s labor force of 2.1 million.^{53 54} In addition, nearly 30 percent of residents over the age of 25 hold an Associate’s degree or higher.⁵⁵

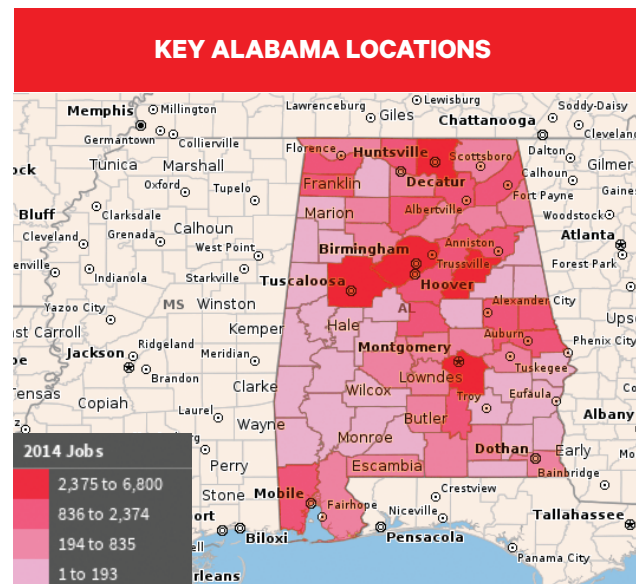
The Consortium for Alabama’s Regional Center for Automotive Manufacturing (CARCAM) provides next-generation manufacturing employees with training in automated control systems, robotics and mechatronics. The program also offers an automotive manufacturing technology degree.⁵⁶ The Robotics Technology Park near Decatur offers three specialized training centers, including the Robotics Maintenance Training Center, which provides workforce training for robotics, advanced manufacturing, manual weld and robotic safety.⁵⁷

The Center for Advanced Vehicle Technologies, a University of Alabama Research Center, is focused on closer collaboration with industry partners. This has been demonstrated by the hiring of former Daimler Vice President Dr. Bhar at Balasubramanian as executive director.⁵⁸ The Center provides interdisciplinary research and education in the following areas: electronics, energy storage and fuel cells, materials and manufacturing, and powertrains.⁵⁹



The Southern Alliance for Advanced Vehicle Manufacturing is a consortium of Auburn University, University of Alabama at Huntsville and Tennessee Tech University. This Industry/University Cooperative Research Center Center aims to provide a clear research contribution to the automotive sector by addressing challenges faced by the industry.⁶⁰

Automobiles are Alabama’s No. 1 export as a result of four original equipment manufacturers being located in the state. Honda, Hyundai, Toyota and Mercedes-Benz all contributed to the production of more than 1 million vehicles and 1.7 million engines in 2016.⁶¹ There are also more than 450 automotive suppliers in the state.⁶²



Alabama has a strong intermodal transportation system with six interstate highways, including Interstate 10, which runs east-west from Florida to California; Interstate 20, which runs east-west from South Carolina to Texas; Interstate 59, which runs diagonally from Tennessee to Louisiana; Interstate 65, which runs north-south from Illinois to Alabama; Interstate 22, which runs from Birmingham to Memphis; and Interstate 85, which runs diagonally from Virginia to Alabama.⁶³ The state is also home to more than 3,700 miles of track and five Class I railroad companies, including BNSF Railway Company, Canadian National Railway Company, CSX Transportation, Kansas City Southern Railway Company, and Norfolk Southern Corporation.⁶⁴ The Port of Mobile is a deep-water port of 45 feet that is located along the Mobile River, where it meets Mobile Bay. The port can handle containerized, bulk, break bulk, roll-on/roll-off, and heavy-lift cargoes served by 100 overseas shipping lines, all five Class I railroads in Alabama, and Interstates 10 and 65.⁶⁵



Chemicals

Growth Opportunity and Trends

Revenue for the U.S. chemical manufacturing industry is projected to increase at an annual compound rate of 5 percent between 2015 and 2019. The increase in natural gas production used for energy and feedstock has stimulated growth in the chemical manufacturing sector.⁶⁶

Global revenue for chemicals more than doubled over the last 10 years, reaching \$5.2 trillion in 2013; and much of this growth can be attributed to emerging markets, especially China. Basic chemicals make up two-thirds of that growth.⁶⁷

Chemical manufacturing companies are following the global trend of energy-efficiency. Examples of the adoption of these trends include using lighter-weight plastic in packaging and using renewable energy sources to power facilities.⁶⁸ Another trend in chemical manufacturing is the increased use of technology and automation as part of their production and supply chain.⁶⁹

This growth of additive manufacturing, or 3D printing, may create an opportunity for chemical manufacturers. This process will require modified properties or completely new materials as new products are created.⁷⁰

Agricultural chemicals are one subsector of the industry that is seeing increased specialization. As industrial farms become more scientific, fertilizers and pesticides can be matched to soil conditions and growing cycles. Additionally, insect-specific

pesticides can be used in place of broad-spectrum products.⁷¹

Alabama Advantages

Chemical manufacturing represents more than 12,000 jobs in Alabama, and employment is projected to remain stable for the next five years. Nearly 13 percent of jobs in Alabama are in manufacturing, the second highest industry by employment in the state, representing more than 250,000 of Alabama's labor force of 2.1 million.^{72 73} Of that workforce, nearly 30 percent over the age of 25 hold an Associate's degree or higher.⁷⁴

AREA OF FOCUS

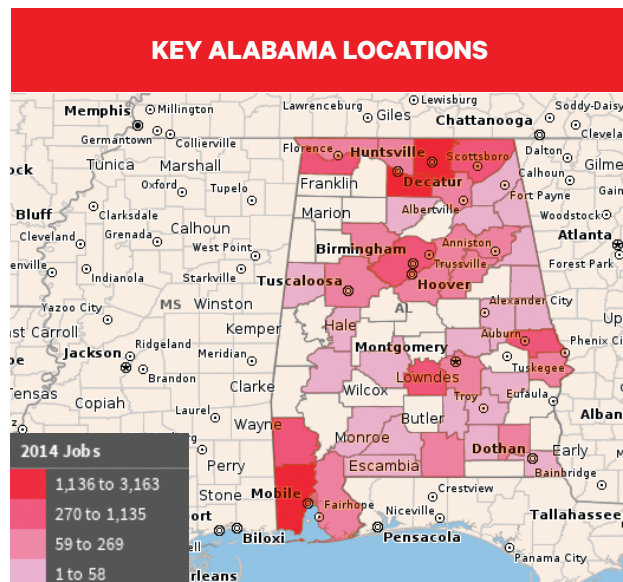
CHEMICAL MANUFACTURING

Creates products by transforming organic and inorganic materials by a chemical process

More than 200 chemical companies call Alabama home, including DuPont, Sabic Innovative Plastics, 3M Company, Olin Corporation, BASF, BP Decatur, Evonik Industries, Ascend Performance Materials and Daikin.⁷⁵ The Alabama Gulf Coast Chemical Corridor is comprised of 25 companies, stretching 60 miles throughout the Mobile Area from Theodore to McIntosh.⁷⁶ Evonik Industries announced an

expansion in Theodore, Alabama, in 2014 that involved a \$114 million investment and 72 new jobs. Evonik plans to transform its property within the Theodore Industrial Park into a chemical park, which would focus on enticing other chemical manufacturers that supply materials to Evonik, as well as their customers, to colocate production facilities of their own in the chemical park, resulting in increased efficiencies, as well as capitalizing on the infrastructure benefits colocation provides, such as reduced transportation costs.⁷⁷

In addition to the strong cluster of chemical companies in the state, universities in Alabama that offer degrees and research opportunities in chemical engineering include the University of Alabama, Auburn University, the University of Alabama at Huntsville, and the University of South Alabama. The College of Engineering at the University of Alabama Department of Chemical and Biological Engineering conducts research regarding biotechnology, computational, polymers and soft materials, electronic materials and devices, and energy and the environment.⁷⁸



LOCATION ASSETS

- 
AFFORDABLE, AVAILABLE WORKFORCE
- 
PROXIMITY TO CUSTOMERS
- 
INTERMODAL TRANSPORTATION INFRASTRUCTURE

Alabama also has a strong intermodal transportation system with six interstate highways, including Interstate 10, which runs east-west from Florida to California; Interstate 20, which runs east-west from South Carolina to Texas; Interstate 59, which runs diagonally from Tennessee to Louisiana; Interstate 65, which runs north-south from Illinois to Alabama; Interstate 22, which runs between Birmingham and Memphis; and Interstate 85, which runs diagonally from Virginia to Alabama.⁷⁹ The state is also home to more than 3,700 miles of track and five Class I railroad companies, including BNSF Railway Company, Canadian National Railway Company, CSX Transportation, Kansas City Southern Railway Company, and Norfolk Southern Corporation.⁸⁰ The Port of Mobile is a deep-water port of 45 feet that is located along the Mobile River, where it meets Mobile Bay. The port can handle containerized, bulk, break bulk, roll-on/roll-off, and heavy-lift cargoes served by 100 overseas shipping lines, all five Class I railroads in Alabama, and Interstates 10 and 65.⁸¹



Forestry Products

Growth Opportunity and Trends

Public and private spending on construction in the U.S. is expected to increase at a compound annual rate of 7 percent between 2015 and 2019.⁸² Residential construction has rebounded since the recession, and demand for single-family housing is projected to increase more than 25 percent in 2015 when compared to 2014, with a 35 percent increase projected for 2016.⁸³

The southern U.S. has become a favorable location for harvesting trees. The flat terrain combined with warm temperatures and lower fuel prices have made the South more desirable than the Pacific Northwest for these operations.⁸⁴

AREA OF FOCUS

CONSTRUCTION AND BUILDING MATERIALS

Used to produce or construct building components, including doors, windows and flooring

Engineered wood product is the process of gluing smaller wood pieces together to create a structural element that is oftentimes stronger than solid wood. This process allows the use of smaller trees to be used in lumber operations that would otherwise have only been appropriate for a pulp mill. Another engineered wood product, oriented strandboard, has seen an increase in use because it is equal to plywood for structural strength but less expensive for production.⁸⁵

Consumers are becoming more interested in environmentally sustainable products. This has led to an increase in forestry companies obtaining certification for their forests and additional sustainably sourced product offerings.⁸⁶

Alabama Advantages

Timberland covers more than 22 million acres in the State of Alabama and is recognized as the third-largest commercial forestland in the nation. It is estimated that 94 percent of Alabama’s timberland is privately owned. Almost half of the forests are hardwood stands.⁸⁷

Alabama is also the second-largest producer of pulp and paper in the U.S. and ranks seventh for lumber production and eighth for wood panel production. In 2013 an estimated 28 wood products companies announced new locations or expansions in Alabama.⁸⁸

Notably, Alabama saw 9 percent growth in construction industry employment between 2013 and 2014. Alabama was ranked eighth in the United States in increased construction jobs from 2013 to 2014.⁹⁰

Forestry products facilities located in Alabama are within one day’s drive of half the U.S. population, including major cities such as Chicago and Kansas City.⁹¹ The state has a strong intermodal transportation system with six interstate highways, including Interstate 10, which runs east-west from Florida to California; Interstate 20, which runs east-west from South Carolina to Texas; Interstate 59, which runs diagonally from Tennessee to Louisiana;

Interstate 65, which runs north-south from Illinois to Alabama; Interstate 22, which runs from Birmingham to Memphis; and Interstate 85, which runs diagonally from Virginia to Alabama.⁹² The state is also home to more than 3,700 miles of track and five Class I railroad companies, including BNSF Railway Company, Canadian National Railway Company, CSX Transportation, Kansas City Southern Railway Company, and Norfolk Southern Corporation.⁹³ The Port of Mobile is a deep-water port of 45 feet that is located along the Mobile River, where it meets Mobile Bay. The port can handle containerized, bulk, break bulk, roll-on/roll-off, and heavy-lift cargoes served by 100 overseas shipping lines, all five Class I railroads in Alabama, and Interstates 10 and 65.⁹⁴

The forestry products sector represents 18,000 jobs in

LOCATION ASSETS	
	AVAILABILITY OF RAW MATERIALS
	PROXIMITY TO MARKETS
	AFFORDABLE, AVAILABLE WORKFORCE

Alabama. Wood container and pallet manufacturing, wood kitchen cabinet and countertop manufacturing, and prefabricated wood building manufacturing are expected to see an increase of nearly 1,300 jobs between 2014 and 2019.⁹⁵

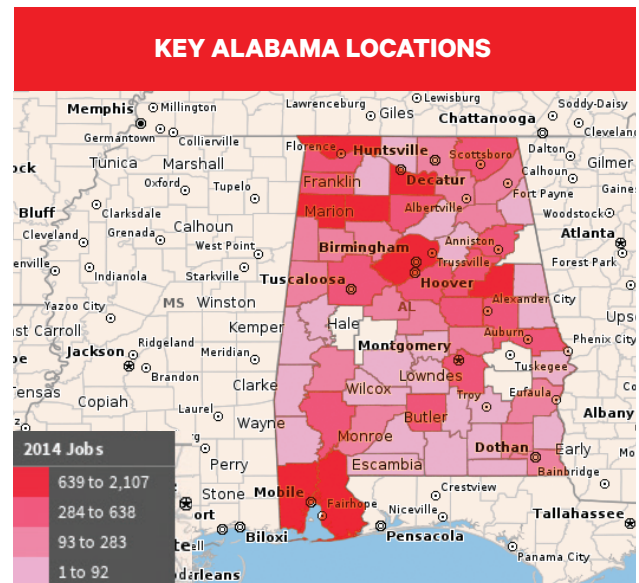
Nearly 13 percent of jobs in Alabama are manufacturing, the second-highest industry by employment in the state, representing more than 250,000 of Alabama’s labor force of 2.1 million.^{96,97}

Nearly 30 percent of residents over the age of 25 hold an Associate’s degree or higher.⁹⁸

Alabama also has key advantages related to education and research opportunities for the forestry products market. The School of Forestry and Wildlife Sciences at Auburn University offers Bachelor’s, Master’s, and Doctorate degrees in several areas, including Forestry and Forest Engineering.⁹⁹ The Forest Products Development Center, which is part of the School of Forestry, supports forest-based economic development in Alabama. The center can assist with services related to forest resource studies, economic feasibility studies, capital project investment analyses,

project financing opportunities, technical training, and others.¹⁰⁰

The Alabama Consortium on Forestry Education and Research at Tuskegee University is a collaboration of Alabama A&M University, Auburn University and Tuskegee University. Research of the consortium is focused on understanding the role of forests on rural economics, forest management, and the social and economic importance of the industry.¹⁰¹



Primary Metals and Advanced Materials

Growth Opportunity and Trends

AREAS OF FOCUS	
<p>STEEL MANUFACTURING</p> <p>Companies in this industry engage in converting pig iron to steel, making steel, and manufacturing steel shapes, pipes, and tubes</p>	<p>FABRICATED METAL PRODUCTS MANUFACTURING</p> <p>Companies in this industry transform purchased metals into intermediate or end-use products by forging, stamping, bending, forming, welding, machining, and assembly</p>
<p>ADDITIVE MANUFACTURING, OR "3-D" PRINTING</p> <p>Describes the technologies that build 3D objects by adding layer-upon-layer of material, whether the material is plastic, metal, or concrete</p>	<p>CARBON FIBER COMPOSITES</p> <p>Strong, lightweight material used in aircraft and automotive manufacturing</p>

Companies in the primary metals sector engage in smelting and refining of ferrous and nonferrous metals, including iron and steel mills, rolled steel shape manufacturers, aluminum producers, and copper foundries. Major U.S.-based companies include Alcoa, Nucor, and US Steel. The industry includes

about 3,800 companies with combined annual sales of \$270 billion.¹⁰²

Advanced materials can be defined as any materials that are considered advanced over traditional materials and early in their technology or product lifecycle.¹⁰³ Examples of advanced materials include light metals such as titanium, magnesium and aluminum, and composites such as carbon fiber and metal laminates. Certain types of steel are also considered to be advanced materials.¹⁰⁴

An alloy is an advanced material comprised of at least two different chemical elements, one of which is a metal, to make them stronger, harder, lighter, or better in some way. Alloys may be found in the fillings in our teeth to the alloy wheels on our cars.¹⁰⁵ Aluminum and other specialty alloys are in high demand in the aerospace/aviation, automotive and other sectors due to their light weight.

Demand for steel depends largely on the health of the U.S. manufacturing sector, in particular; the demand for motor vehicles; fabricated metal products and machinery; as well as commercial construction activity.¹⁰⁶ The global steel industry produces an estimated 1,600 million metric tons of steel per year, and China is the largest steel maker in the world, followed by Japan, the U.S., India, South Korea, Russia, and Germany.¹⁰⁷ The U.S. steel industry includes an estimated 250 companies, with combined annual revenues of more than \$110 billion. Domestic demand for steel products is forecasted to grow at an annual compounded rate of 5 percent between 2015 and 2019.¹⁰⁸

Fabricated metal product manufacturing is the second step in the steel product lifecycle, as it transforms purchased metals, typically coiled or flat-rolled steel, by forging, stamping, bending, forming, welding or machining. Examples of the types of products produced by a fabricated metal product manufacturer include cans, fixtures, plumbing, tanks, tools, and vents, as well as structural components such as doors, towers and windows.¹⁰⁹

Increasing demand for end-use products such as automobiles, aerospace equipment and parts, and machinery is driving demand for many types of fabricated metal products. The U.S., China, Japan, Germany, Italy and Canada are top producers.¹¹⁰ The U.S. fabricated metal product manufacturing sector includes an estimated 55,000 companies, with combined annual revenue of \$340 billion. The sector is projected to grow at a 4 percent annual compound rate between 2015 and 2019.¹¹¹

LOCATION ASSETS	
	AFFORDABLE, AVAILABLE WORKFORCE
	PROXIMITY TO CUSTOMERS
	INTERMODAL TRANSPORTATION INFRASTRUCTURE

Closely intertwined within the steel/metal product manufacturing sector is the architectural and structural metals manufacturing sector. Emerging markets and urbanization across the globe have led to the expansion of this industry, and the demand for these types of products is driven from commercial and industrial construction. Additionally, this sector is seeing an evolution of product design as green-building trends grow among new construction.¹¹² Job growth in this sector in Alabama is projected to increase by 9 percent by 2019.¹¹³

Remarkably, the shipbuilding industry is projected to experience 28 percent job growth by 2019 in Alabama.¹¹⁴ While annual revenue in this industry is \$25 billion, the United States Department of Defense is the largest buyer of military vessels. Austal USA's shipyard in Mobile produces two vessels for the U.S. Navy. The increased use of U.S. inland waterways has also increased demand for new ships.¹¹⁵

Global revenue for the carbon fiber market in 2013 was \$1.77 billion. The industry has seen an annual

growth rate of 8.1 percent since 2008. North America accounts for 30 percent of global production capacity of carbon fiber. The aerospace and defense industry is the largest consumer of carbon fiber, representing 30 percent of production. Alabama is home to two major players in carbon fiber production – Toray and Hexcel.

Alabama Advantages

Employment in the steel/metal products sector represents nearly 52,000 jobs in the State of Alabama and is projected to increase by nearly 6 percent between 2014 to 2019, compared to 0 percent in the U.S. during the same time period. Nearly 13 percent of jobs in Alabama are manufacturing, the second-highest industry by employment in the state, representing more than 250,000 of Alabama's labor force of 2.1 million.^{116 117} In addition, nearly 30 percent of residents over the age of 25 hold an Associate's degree or higher.¹¹⁸

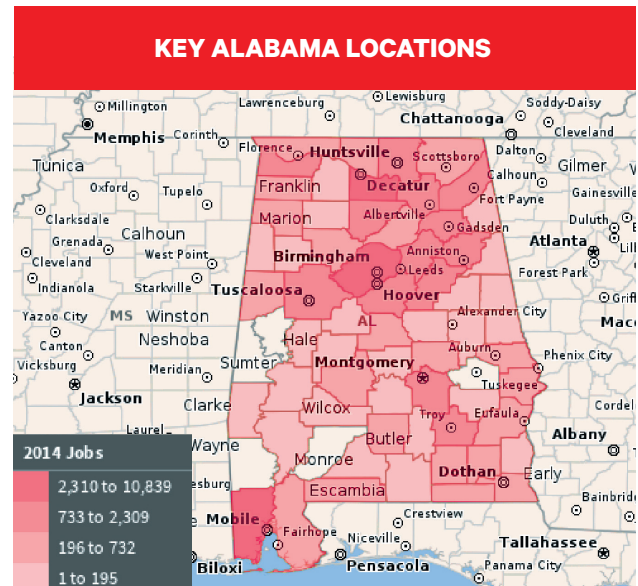
The University of Alabama's Metallurgical and Materials Engineering program grants bachelor's, master's and doctorate degrees. Faculty and students in the programs are also involved in research in the areas of metal matrix composites, mechanical properties of materials and metals, and physical modeling of materials-processing operations such as solidification and steel making, foundry methods, and metal casting.¹¹⁹

Auburn University and 20 partners worked to establish the Consortium for Industrialized Additive Manufacturing, which focuses on identifying and addressing the barriers to high-volume additive manufacturing of metals. The consortium is led by major aerospace end-users of additive manufacturing such as GE Aviation, Aerojet Rocketdyne, Pall Corporation, Air Force Research Lab, and NASA Marshall Space Flight Center, along with suppliers to the industry. In July 2014, GE Aviation announced plans to add high-volume additive manufacturing to its facility in Auburn, resulting in the first facility of its kind to mass-produce additive components for the jet propulsion industry.¹²⁰

The steel/metal products sector is largely driven by the construction industry. Notably, Alabama saw 9 percent growth in construction industry employment between 2013 and 2014.¹²¹ Alabama ranked eighth in the United States in increased construction jobs from 2013 to 2014.¹²²

Alabama has numerous advantages in attracting the Metal and Advanced Materials industry, including its transportation resources, especially the Port of Mobile. The port is currently ranked as twelfth in the U.S. in terms of total volume (54.9 million tons) and can handle containerized, bulk, break bulk, roll-on/roll-off, and heavy-lift cargoes.¹²³ It includes 41 ship berths, more than four million square feet of warehouse and open yard space, and handled approximately 29.1 million tons of freight in fiscal year 2014. Additionally, the State of Alabama has a high concentration in the steel industry in areas such as Mobile, Tuscaloosa, Birmingham and Decatur, as seen in the map on the previous page.

Alabama also has a strong transportation system with six interstate highways, including Interstate 10, which runs east-west from Florida to California; Interstate 20, which runs east-west from South Carolina to Texas; Interstate 59, which runs diagonally from Tennessee to Louisiana; Interstate 65, which runs north-south from Illinois to Alabama; Interstate 22, which runs from Birmingham to Memphis; and Interstate 85, which runs diagonally from Virginia to Alabama.¹²⁴ The state is also home to more than 3,700 miles of track and five Class I railroad companies, including BNSF Railway Company, Canadian National Railway Company, CSX Transportation, Kansas City Southern Railway Company, and Norfolk Southern Corporation.¹²⁵





Bioscience

Growth Opportunity and Trends

Revenue for scientific research in the U.S. is expected to increase at a compound annual rate of 7 percent between 2015 and 2019.¹²⁶ Bioinformatics uses biological databases to identify similar processes and develop hypothesis about how cells and genetic material are affected by certain products. Increased availability of Big Data for scientific research has created a need for researchers to have data analysis and management skills in addition to traditional research skills.¹²⁷

AREAS OF FOCUS

MEDICAL EQUIPMENT & SUPPLIES

Manufacture of surgical and medical instruments, dental equipment and surgical appliances

PHARMACEUTICALS

Process and manufacture of medicine used to treat illness

BIOTECHNOLOGY

The use of biological processes, organisms, or systems to manufacture products intended to improve the quality of human life

The medical equipment and supplies manufacturing industry is projected to see revenue growth at an annual compound rate of 4 percent between 2015

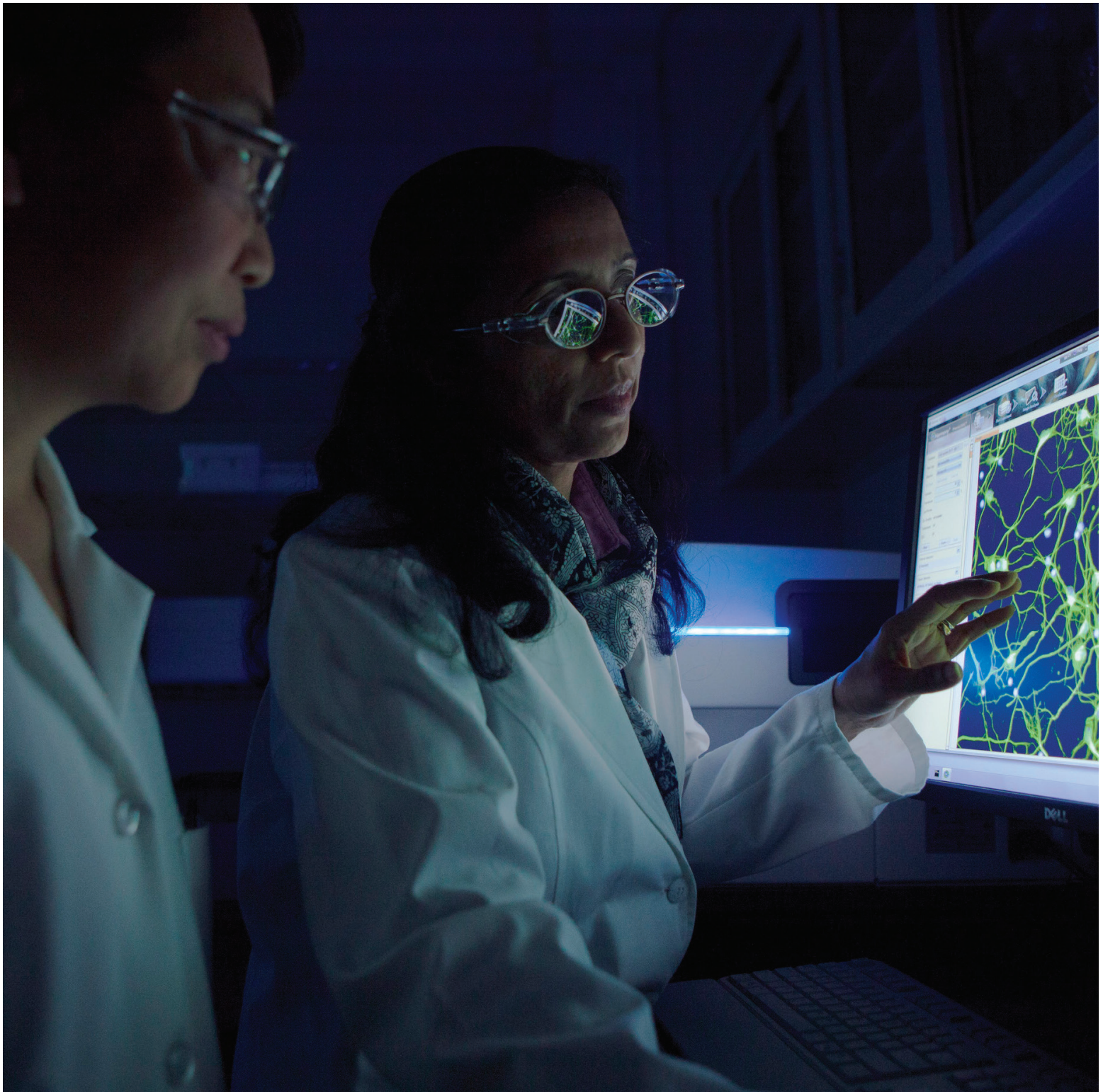
and 2019.¹²⁸ One driver of demand for medical equipment and supplies is the aging population of the U.S. Over the next ten years, those aged 65 and older is projected to increase by 38 percent.¹²⁹ Additional demand is expected to come from the improving healthcare infrastructure in developing countries, especially Asia and Latin America. Lower regulatory standards in these countries also make them attractive to medical equipment and supplies companies.¹³⁰

Pharmaceutical manufacturing is expected to see increased demand. At the same time, managed care organizations are discouraging the use of brand-name drugs.¹³¹

Alabama Advantages

Science and technology represents more than 17,000 jobs in Alabama and is projected to grow nationally by 4.7 percent between 2014 and 2019. According to the National Science Foundation, Alabama had a total of more than \$820 million in research and development (R&D) expenditures at colleges and universities in 2013.¹³² In addition, nearly 30 percent of Alabama residents over the age of 25 hold an Associate's degree or higher.¹³³

The HudsonAlpha Institute for Biotechnology (HudsonAlpha) is a nonprofit genomic science and applications organization. It produces a high volume of genomic data for thousands of academic, clinical and commercial clients.¹³⁴ HudsonAlpha is located in Cummings Research Park in Huntsville, the second-largest research park in the U.S.¹³⁵ Researchers and entrepreneurs are clustered in HudsonAlpha, as well



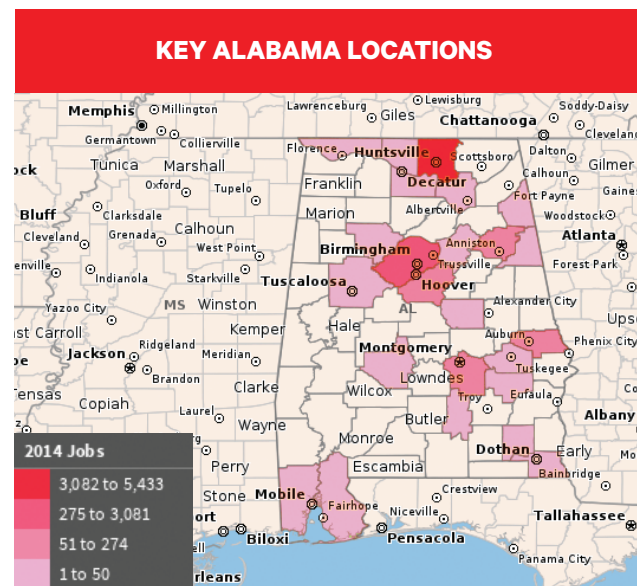
Birmingham's Southern Research has discovered seven FDA-approved anticancer drugs and has developed a pipeline of potential new treatments for a wide range of diseases.

as the Innovation Depot in Birmingham, the Auburn Research Park in Auburn, and the University of South Alabama’s Biotechnical Research Unit in Mobile.¹³⁶

The University of Alabama in Birmingham (UAB) has more than \$433 million in research funding, much of which goes to the life sciences, and ranks among the top 20 institutions to receive federal research funding.¹³⁷ UAB is also home to the Center for Nanoscale Materials and Biointegration, whose research crosses physics, chemistry, cell biology, materials, mechanical, and biomedical engineering disciplines.¹³⁸ UAB also has a Graduate Biomedical Sciences program with eight interdisciplinary themes: biochemistry, structural and stem cell biology; cancer biology; cell, molecular and developmental biology; genetics, genomics and bioinformatics; immunology; microbiology; neuroscience; and pathobiology and molecular medicine.¹³⁹

The College of Engineering Department of Chemical and Biological at the University of Alabama conducts research regarding biotechnology, computational, polymers and soft materials; electronic materials and devices, and energy and the environment.¹⁴⁰

Jefferson Metropolitan Lakeshore Industrial Park. The company cited the employment base and support of the universities as assets of the area.¹⁴⁵ Other bioscience companies located in the state include Evonik Corp., which announced plans to open its first Innovation Center for research and development of medical devices and technology at the company’s Birmingham facility, and Baxter International, which announced an investment of nearly \$300 million to expand its plant in Opelika, where it produces dialyzers, an important component in the treatment of advanced kidney disease.¹⁴⁶



Southern Research in Birmingham is another leading research organization. This organization’s life sciences research focuses on cancer, infectious and neuro/CNS diseases, and it has discovered seven FDA-approved anticancer drugs, with other potential treatments in a discovery pipeline in a partnership with UAB called the Alabama Drug Discovery Alliance.¹⁴¹¹⁴² Other bioscience organizations located in the state include USA Mitchell Cancer Center and Discovery BioMed.¹⁴³

The State of Alabama is home to more than 800 bioscience companies.¹⁴⁴ In November of 2014, Oxford Pharmaceuticals announced that its new manufacturing facility will be located in Birmingham. The \$29 million project will be located at the

Foundational Targets

As part of the process of identifying targets for Alabama, it was determined that some sectors that present strong opportunities for the state are more than just a vertical, stand-alone industry. Instead, these sectors are intrinsic to the core competencies of a wide range of industries and provide operational processes and services to other sectors the state may target.

Additionally, these support sectors, which are embedded in various other industries, play a critical role in the recruitment of those sectors that rely on the infrastructure they provide. With the understanding that these sectors cross a variety of others and serve, in a sense, as a foundation for them, BSA has categorized a group of targets as Foundational Targets.

FOUNDATIONAL TARGETS:	
CORPORATE OPERATIONS	DISTRIBUTION/ LOGISTICS
CYBERSECURITY	INFORMATION TECHNOLOGY
DATA CENTERS	RESEARCH AND DEVELOPMENT

Corporate Operations

Growth Opportunity and Trends

Corporate operations include not only the corporate and/or regional headquarters of an organization, but also operations centers that provide support functions to the business. A corporate headquarters is generally the central hub of corporate governance and operations for a business and may include marketing, financial, legal, administrative, and human resources functions.

AREAS OF FOCUS

CUSTOMER CONTACT CENTER

Utilize voice, web and data applications to interact with and provide support to customers, including technical assistance

OPERATIONS CENTERS

Include functions such as information technology, accounting, human resources and customer support and are generally located away from the corporate headquarters

REGIONAL HEADQUARTERS

House corporate functions similar to a corporate headquarters, with a focus on a specific area or region

A variety of factors impact a company's decision to relocate its corporate or regional headquarters or expand its corporate operations, including regional economic growth and stability, local infrastructure, availability of a skilled workforce, and the overall business climate.¹⁴⁷ Many recent corporate operations

location projects have cited cost-saving opportunities and talent recruitment as key factors. Additionally, changing work space needs have reduced space requirements, with the average square feet per employee dropping from 250 square feet to as little as 125 square feet in the last 10 years. Companies are also considering moving to collaborate work environments in urban core areas in an effort to attract and retain talented young workers.¹⁴⁸

Another trend currently impacting the corporate operations sector involves the importance of risk management. Many companies are exploring new business models that reflect increased transparency and consideration of risks involved in key functions and transactions. Maximizing vast data tools and understanding how "big data" can assist corporations in making more sound business decisions are also a key to corporate strategy, marketing, entrepreneurship, supply chain and accounting departments.¹⁴⁹

Alabama Advantages

In addition to the presence of key headquarters operations for companies such as Regions Financial Corp., HealthSouth, BBVA Compass, and Books-A-Million, the State of Alabama has also seen recent expansions in the corporate operations sector. AT&T has created additional jobs in the state to support Project Velocity IP, an expansion of its wired and wireless broad band network.¹⁵⁰ Additionally, Verizon Wireless has expanded its customer contact center in Huntsville.¹⁵¹

The corporate operations sector currently employs approximately 28,000 people in the state, with projected growth of almost 12 percent through 2019. Average annual earnings for the sector in Alabama are more than \$71,000.¹⁵²

The business climate in Alabama is also very conducive to corporate operations. According to CNBC’s 2014 Top States for Business, Alabama has the fourth lowest cost of doing business and seventh lowest cost of living in the United States.¹⁵³

The State of Alabama has 14 public four-year universities, seven of which have Doctoral research programs. Those universities are Alabama A&M University, Alabama State University, Auburn University, University of Alabama, University of Alabama in Birmingham, University of Alabama at Huntsville and University of South Alabama.¹⁵⁴



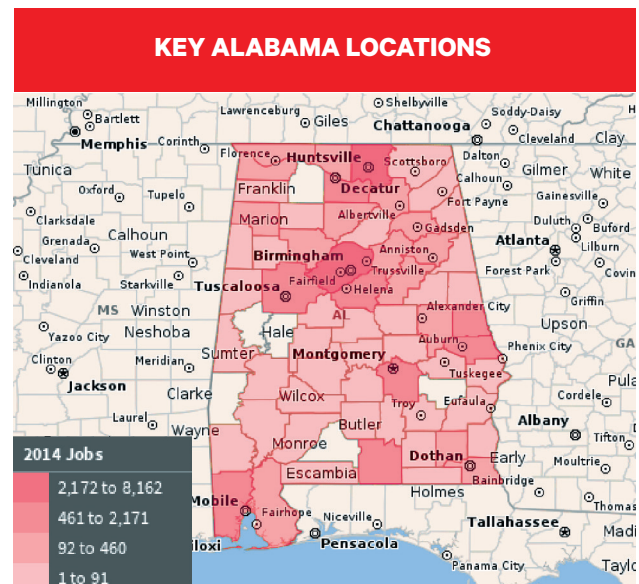
The University of Alabama is the largest four-year public university in the state and offers bachelor’s, master’s and doctoral degree programs. Colleges and professional schools at the University of Alabama include College of Arts and Sciences, Culverhouse College of Commerce, College of Communication and Information Sciences, College of Community Health Sciences, College of Continuing Studies, College of Education, College of Engineering, Honors College, College of Human Environmental Sciences, School of Law, Capstone College of Nursing, School of Social Work and the Graduate School.¹⁵⁵ Also, a part of the University of Alabama System includes the University of Alabama in Birmingham and the University of Alabama in Huntsville.

Auburn University is the second largest public four-year university in the state. Colleges include the College of Agriculture; College of Architecture, Design and Construction; College of Business; College of Education; Samuel Ginn College of Engineering; School of Forestry and Wildlife Sciences; Graduate School; Honors College; College of Human Sciences; College of Liberal Arts; School of Nursing; Harrison School of Pharmacy; College of Sciences and Mathematics; and the College of Veterinary Medicine.¹⁵⁶

The State of Alabama is served by seven commercial airports, including Birmingham-Shuttlesworth International Airport, Huntsville International Airport, Dothan Regional Airport, Mobile Regional Airport, Montgomery Regional Airport, Northwest Alabama Regional Airport, and Columbus Airport. A total of six major commercial airlines and several commuter airlines operate throughout the seven airports. The state also has 78 general aviation airports, many of which can also accommodate corporate jets.¹⁵⁷

The State of Alabama is home to four National Forests and 22 State Parks located throughout the state, which offer opportunities for boating, water sports, fishing, hiking, camping, and bicycling. The northern part of Alabama is home to the Alabama Mountain region, part of the southern foothills of the Appalachian Mountains. Mount Cheaha, located near the community of Delta, is the highest point in Alabama, and offers opportunities for hiking, rock climbing and mountain biking. Much of the southern border of Alabama is formed by the Gulf of Mexico and features beautiful, white sand beaches, plus opportunities for deep sea fishing.¹⁵⁸

Alabama is also home to the well-known Robert Trent Jones Golf Trail, which is the largest public golf system in the world and can be played year-round due to Alabama’s mild climate. Designed by Robert Trent Jones, Sr., the trail is comprised of 26 courses located at 11 sites throughout the state and includes 468 holes of golf. Courses are located in the communities of Greenville, Prattville, Opelika, Huntsville, Dothan, Point Clear, Mobile, Birmingham, Hoover, Anniston, and Muscle Shoals.¹⁵⁹



Cybersecurity

Growth Opportunity and Trends

Cyber attacks generally take aim at governments, including military, government agencies and figureheads, companies with sensitive or critical information, and the general public.¹⁶⁰ Defense companies are primed for growth and increased market share in this sector. These companies have either provided security technologies for a government in the past or are starting to look at acquiring companies to add value to their current government contract or services provided.¹⁶¹ With global military defense budgets shrinking, the focus on cybersecurity has increased through developing new technologies or new applications that can extend the life cycle of platforms or systems already in use.¹⁶² Another trend that will continue to increase cybersecurity applications is the growing online services, or e-government, provided by states and the federal government.¹⁶³

The cybersecurity market is categorized in three niche sectors, which include traditional security vendors, aerospace and defense companies such as Lockheed Martin or Symantec, or systems integrators like AT&T. The customer focus for both the security vendors and the aerospace and defense companies is predominantly fueled by government agencies and private-sector companies. Additionally, to become more marketable, these companies within the three niche sectors are projected to collaborate to combat state-versus-state conflict, espionage and crime.¹⁶⁵

Companies such as Boeing Co., Harris Corp. and Lockheed Martin are expecting significant growth

in the next three to five years. Lockheed Martin, the largest provider of information technology to the U.S. government, is expecting to see double-digit growth. Moreover, Lockheed Martin is seeing increased spending on cybersecurity from companies in many sectors, including utilities, oil and gas companies, chemical companies and financial firms.¹⁶⁵

CYBERSECURITY DEFINED:

Cybersecurity is the protection of digital infrastructure, information systems, general data and hardware from unauthorized access or direct attacks by various individuals

ALABAMA TARGETS SUPPORTED BY CYBERSECURITY SECTOR:

AEROSPACE/AVIATION	DATA CENTERS
BIOSCIENCE	INFORMATION
CORPORATE	TECHNOLOGY
OPERATIONS	

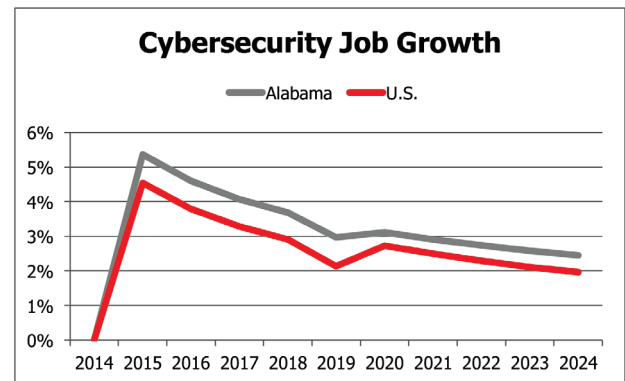
Alabama Advantages

Cybersecurity companies, much like general IT companies and government initiatives, have the opportunity to expand and enhance products and services in Alabama due to the strong base of research and education to support product development and

workforce needs. The Center for Materials for Information Technology at the University of Alabama performs research ranging from studies on materials for data storage to the application and technologies of industrial fields related to all types of information technology.¹⁶⁶ Additionally, the University of Alabama in Birmingham (UAB) offers a Master’s in Computer Forensics and Security Management, which focuses on critical infrastructure protection, privacy, identity and the safety of e-commerce. UAB also has a partnership with The Center for Information Assurance and Joint Forensics Research that provides the opportunity for students to train in a lab environment to work as cyber criminal investigators.¹⁶⁷

Cybersecurity-related industries in Alabama boast average wages of more than \$90,000 and accounted for more than 50,000 jobs in 2014. Within a five-year period from 2014 to 2019, job growth in Alabama in cybersecurity is expected to increase by 22 percent, which is higher than the national average as seen in the chart to the right.¹⁶⁸

Alabama is one of the nation’s recognized leaders in the development and application of modeling and simulation technologies. UAH’s Center for Modeling, Simulation, and Analysis (CMSA) conducts leading-edge research on modeling, simulation and systems engineering. Moreover, CMSA has 10 PhD-level scientists and engineers.¹⁷² The Alabama Modeling & Simulation Council is a non-profit organization focused on encouraging the growth and development of the industry in the state. Alabama’s collaborative efforts between the military, academia and private industry ensure its position as a location for growth.¹⁷³



LOCATION ASSETS	
	TECHNICALLY SKILLED WORKFORCE
	SOPHISTICATED INFRASTRUCTURE
	LOW COST OF DOING BUSINESS

For the past seven years, the Southeastern Cyber Security Summit has convened in Huntsville, Alabama. This conference brings together federal government, business leaders, and educators.¹⁶⁹ In addition, the University of Alabama at Huntsville (UAH) recently added a Master’s of Science in Information Assurance and Security, a Master’s degree in Cybersecurity, and a graduate certificate in Cybersecurity.¹⁷⁰

The University of South Alabama Center for Forensics, Information Technology and Security is involved in the study and application of digital forensics and information technology security and assurance. The National Security Agency (NSA) and the Department of Homeland Security (DHS) have designated the University of South Alabama as a National Center of Academic Excellence in Information Systems Security Education.¹⁷¹

Data Centers

Growth Opportunity and Trends

Once part of an IT department within a company consisting of a few servers, data centers have evolved into multiple physical locations housing various data services and enterprise components. With virtualization and cloud computing changing the industry, companies are looking to optimize their data storage needs.¹⁷⁴

As this industry changes, major data center operators and large Internet content providers are moving toward owning their own networks and dark fiber. This trend is removing the need for data centers to rely on commercial carriers and accounted for a large percentage of network interconnect capacity in 2015.¹⁷⁵ Additionally, telecommunications firms are expected to increase their current data centers by nearly double to account for more products and services offered.¹⁷⁶

The development and expansion of the Internet of Things (IoT) will push companies to invest more in data center operations as businesses will be extended into new markets and technologies. IoT is essentially the creation of a network of things to things, people to people, or people to things. From the ability to turn on your coffee pot by your smart phone or control a drill of an oil rig, the IoT is impacting consumers and industry. Gartner has projected that there will be more than 26 billion devices connected by 2020.¹⁷⁷ IoT will cause the big data center operators to consider possible consolidation or alliances with various companies.¹⁷⁸

The bigger data centers are projected to get bigger. Cloud computing saw a 70 percent increase in workloads being processed in the cloud by 2015. Because of this growing demand, companies are considering investing in mega data centers or multiple data centers on the same site.¹⁷⁹

DATA CENTERS DEFINED:

A centralized repository, either physical or virtual, for the storage, management, and dissemination of data and information organized around a particular body of knowledge or pertaining to a particular business

ALABAMA TARGETS SUPPORTED BY CYBERSECURITY SECTOR:

AEROSPACE/AVIATION	DISTRIBUTION/ LOGISTICS
AGRICULTURAL PRODUCTS/FOOD PRODUCTION	FORESTRY PRODUCTS
AUTOMOTIVE	INFORMATION TECHNOLOGY
BIOSCIENCE	METAL AND ADVANCED MATERIALS
CHEMICALS	
CYBERSECURITY	

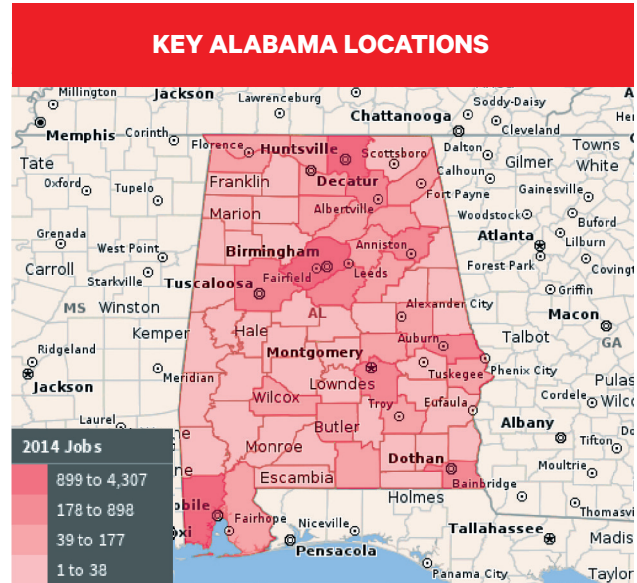
Alabama Advantages

Employment in Alabama in the data center sector represents nearly 25,000 jobs and is projected to increase nearly 14 percent between 2014 to 2019, compared to 10 percent in the U.S. during the same time period. Notably, Alabama has a higher projected job growth rate in the data center sector of all of its boarder states, including Georgia (8 percent), Tennessee (9 percent), Mississippi (12 percent) and Florida (12 percent).¹⁸⁰ In addition, nearly 30 percent of residents over the age of 25 in the State of Alabama hold an Associate’s degree or higher.¹⁸¹

LOCATION ASSETS	
	TECHNICALLY SKILLED WORKFORCE
	SOPHISTICATED INFRASTRUCTURE
	LOW COST OF DOING BUSINESS

Across the State of Alabama, education centers are providing training for data center management and engineering. Six universities, including Alabama A&M, Auburn University, Tuskegee University, University of Alabama, University of Alabama Birmingham, and University of South Alabama, offer an array of degrees, including computer science, software engineering, wireless engineering, information engineering and computer forensics, and security management.¹⁸² Additionally, a high concentration of data center occupations in Huntsville, Decatur, Birmingham, Montgomery and Mobile can be seen in the map to the right. Google’s decision to locate a \$600 million data center in Jackson County is expected to drive growth in the sector across the state.

Alabama has six sites that have been designated as Primary Data Center Sites by TVA. Such sites are located in the communities of Athens, Dutton, Florence, Guntersville, Hartselle, and Huntsville. Primary Data Center Sites have been certified by Deloitte Consulting as ready-for-development and meet the requirements to support a major data center. Selection criteria used in the certification process included accessibility, telecommunications infrastructure, electric power availability and reliability, and other characteristics beneficial to data center development.¹⁸³



Moreover, Alabama Power Co. has multiple sites, including Birmingham’s Jefferson Metropolitan Park Lakeshore and Grand River that have had fiber connectivity studies conducted. The fiber carriers present in these areas include Access Fiber, AT&T, CenturyTel, Intelefiber, KDL Windstream, Southern Telecom, Time Warner Telecom, Level 3, Qwest, Sprint, XO Communications and Verizon Wireless.¹⁸⁴

In 2012 the State of Alabama enacted the Data Processing Center Economic Incentive Act that provides tiered tax abatements for a period of up to 30 years to data center operations, depending upon the total capital investment of the project.¹⁸⁵



Distribution/ Logistics

Growth Opportunity and Trends

The distribution and logistics sector includes basic storage, freight transportation arrangement, inventory control, order processing, and pick-up and delivery services. The U.S. warehousing and storage industry includes approximately 7,000 companies, with annual revenue of almost \$30 billion, and approximately 70 percent of revenue from general warehousing services. Other services include refrigerated storage, farm products storage and records storage.¹⁸⁶ Logistics services companies provide supply chain management services, including planning, implementing and controlling the movement and storage of goods, in-process inventory management, quality control, and warehouse operations related to moving goods from the point of origin to the point of consumption.¹⁸⁷

Because the sector supports a wide variety of manufacturing and consumer sectors, its growth is generally tied to the state of the overall economy. With recent improvement in the U.S. economy, revenue for warehousing and storage services is projected to grow at an annual compound rate of four percent through 2019.¹⁸⁸ One driver of this growth is the increase in electronic commerce, which is a \$220 billion industry, with growth much greater than traditional brick-and-mortar retail stores.¹⁸⁹ While total U.S. retail growth is projected to be about 5.5 percent, e-commerce is expected to grow between 11 and 16.5 percent through 2018.¹⁹⁰

Technology is driving many of the trends in the distribution and logistics sector. New distribution facilities are larger, with one million square feet

being a common size. These facilities are managed by computer systems, with some having computer-guided forklifts. Additionally, robots, which were once viewed as too expensive and not mobile enough for distribution centers, are now seeing increased use. In addition to the computer-guided forklifts, robotic applications include mechanical systems equipped with computers to locate and lift items and shuttles that bring goods to workers. Improved tracking systems are being developed, with potential replacements for the Price Look-Up (PLU) code being explored. The GSI, formerly the Uniform Code Council, is developing a smaller bar code, while Radio Frequency Identification (RFID) tags are also being tested.¹⁹¹

DATA CENTERS DEFINED:

Distribution is the movement of goods from the source to the final customers. Logistics includes managing inventory throughout distribution channels

ALABAMA TARGETS SUPPORTED BY THE DISTRIBUTION/LOGISTICS SECTOR:

AEROSPACE/AVIATION
AGRICULTURAL
PRODUCTS/FOOD
PRODUCTION
AUTOMOTIVE

BIOSCIENCE
CHEMICALS
FORESTRY PRODUCTS

Alabama Advantages

Alabama is home to distribution facilities for such household names as Walmart, Target, Home Depot and Sysco. In addition, two distribution companies in the state – Atlas RFID Solutions and ARI Logistics – are listed on the Inc. Magazine list of the Fastest Growing Private Companies in 2014.¹⁹²

The sector currently employs almost 60,000 people in the state, with projected growth of 8 percent through 2019. Average annual earnings for the sector in Alabama are more than \$54,000.¹⁹³

In addition to existing distribution facilities, Alabama has a significant presence of major manufacturers that require a strong distribution network. Three automotive manufacturing facilities, a booming aerospace sector, a diverse biosciences industry, and agriculture and food production all are major distribution users.

The state's multi-modal transportation network is a key asset to distribution and logistics businesses. Alabama has six interstate highways: Interstate 10, which runs east-west from Florida to California; Interstate 20, which runs east-west from South Carolina to Texas; Interstate 59, which runs diagonally from Tennessee to Louisiana; Interstate 65, which runs north-south from Illinois to Alabama; Interstate 22, which runs from Birmingham to Memphis; and Interstate 85, which runs diagonally from Virginia to Alabama.¹⁹⁴

Alabama's rail infrastructure includes more than 3,700 miles of track and five Class I railroad companies, including BNSF Railway Company, Canadian National Railway Company, CSX Transportation, Kansas City Southern Railway Company, and Norfolk Southern Corporation.¹⁹⁵ The International Intermodal Center located in the Port of Huntsville Global Logistics Park is a single location specializing in receiving, transferring, storing, and distributing international and domestic cargo via air, rail, and highway. Air freight service is provided by FedEx, UPS, Cargolux and Panalpina, while rail service is provided by Norfolk Southern. The International Intermodal Center is located near Interstates 65 and 565.¹⁹⁶

Alabama also has one of the largest inland waterway systems in the United States, which includes six primary river systems, with a total of almost 1,300 miles of navigable waterways. Primary waterway

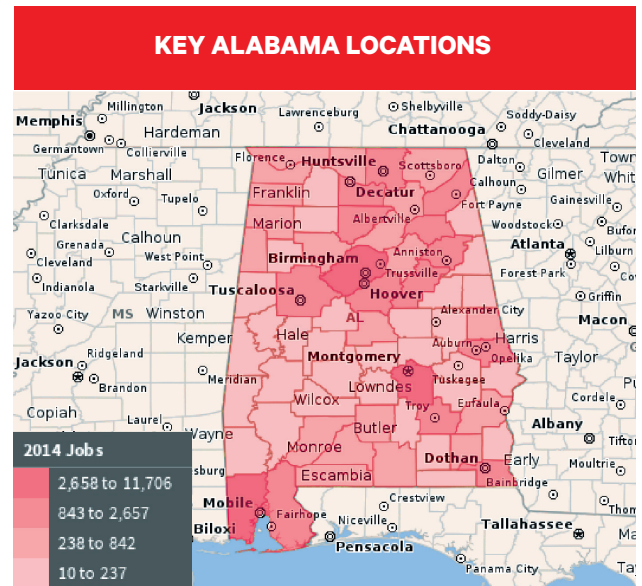
corridors include the Alabama-Coosa Waterway, the Chattahoochee-Apalachicola Waterway, the Gulf Intracoastal Waterway, the Tennessee Waterway, the Tennessee-Tombigbee Waterway, and the Warrior-Tombigbee Waterway.¹⁹⁷ The Port of Mobile is located along the Mobile River, where it meets Mobile Bay. The port is currently ranked as the ninth-largest seaport in the United States in terms of total volume and can handle containerized, bulk, break bulk, roll-on/roll-off, and heavy-lift cargoes.¹⁹⁸

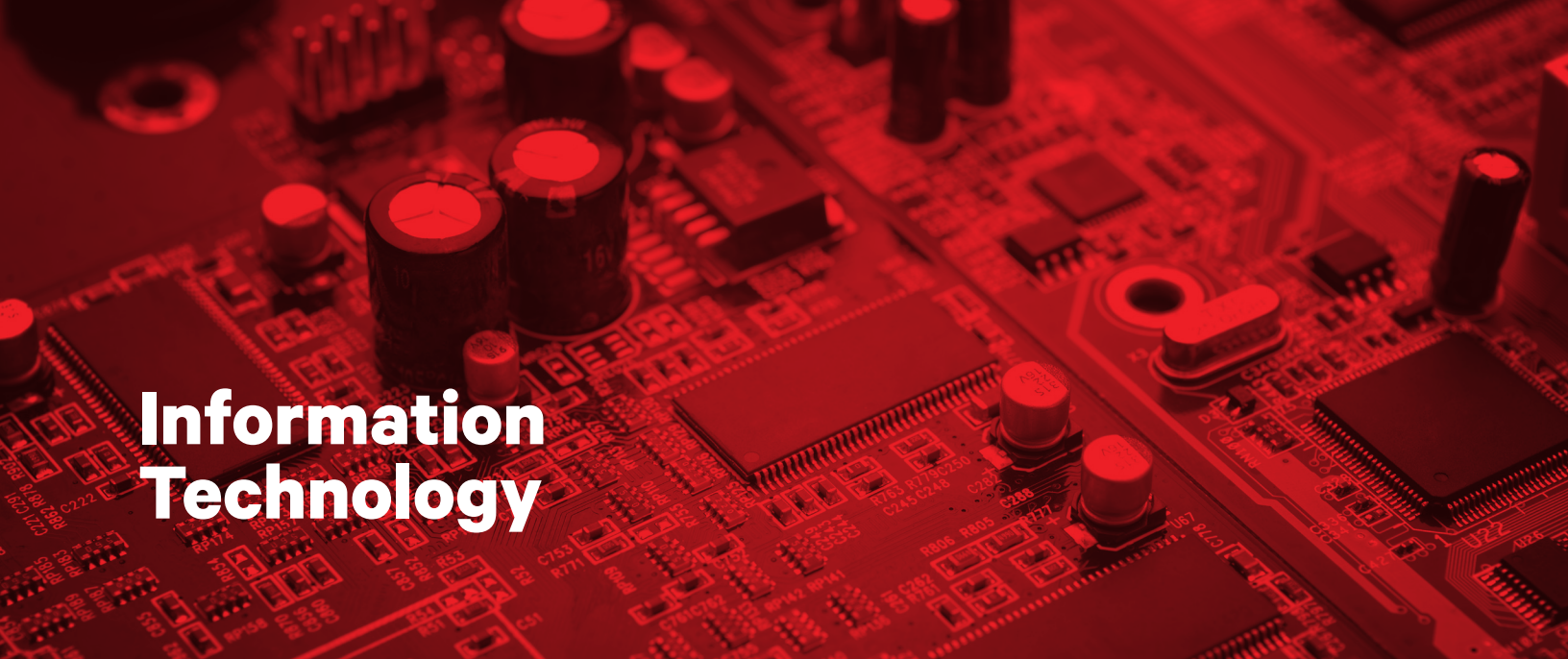
LOCATION ASSETS	
	INTERMODAL TRANSPORTATION INFRASTRUCTURE
	PROXIMITY TO MAJOR CUSTOMERS
	LOW COST OF DOING BUSINESS
	EDUCATION AND TRAINING RESOURCES

Auburn University (AU) offers a bachelor's degree in supply chain management within the Harbert College of Business and is establishing a research and resource center to facilitate industry engagement. The AU faculty has been ranked eighth globally for supply chain management research productivity by a leading industry journal.¹⁹⁹ The University of Alabama (UA) has both bachelor's and master's degree programs in Operations Management, which include logistics and supply chain management components, in addition to an MBA with a concentration in supply chain and operations management.²⁰⁰ In addition, both UA and UA-Huntsville offer certificate programs in supply chain management.²⁰¹

The business climate in Alabama is also very conducive to distribution and logistics businesses. According to CNBC's 2014 Top States for Business, Alabama has the fourth lowest cost of doing business and seventh lowest cost of living in the United States.²⁰² Additionally, Alabama imposes no inventory tax, which is a significant incentive for distribution facilities.²⁰³

The Robotics Technology Park, located in Tanner, Alabama, includes three individual training facilities focused on robotic maintenance; advanced technology research and development; and integration, entrepreneurship, and paint/dispense. The park represents a collaboration between the State of Alabama, the Alabama Community College System, AIDT and the robotics industry.²⁰⁴





Information Technology

Growth Opportunity and Trends

Hardwired in almost every industry and general consumer alike is the need for information technology (IT) infrastructure. From software design and support, sophisticated computer systems, data processing, information security, entertainment applications and customer service, the IT industry is growing at an exponential rate year over year.²⁰⁵

INFORMATION TECHNOLOGY DEFINED:

Refers to anything related to computing technology, such as networking, hardware, software, the Internet, or the people that work with these technologies. Many companies now have IT departments for managing the computers, networks, and other technical areas of their businesses

ALABAMA TARGETS SUPPORTED BY THE IT SECTOR:

AEROSPACE/AVIATION	DATA CENTERS
AUTOMOTIVE	DISTRIBUTION/LOGISTICS
BIOSCIENCE	RESEARCH AND DEVELOPMENT
CORPORATE OPERATIONS	
CYBERSECURITY	

While revenue generated by U.S. companies is estimated at \$315 billion, global spending on IT services is nearly \$4 trillion. The market is equally lucrative

for small and large businesses because of the ability for large companies to offer full, comprehensive services while small companies can fill niche markets.²⁰⁶

The growth of 3D printing in industrial, biomedical and consumer applications will aid in reducing costs for the IT sector. In addition, the continued growth of cloud computing services and mobile computing will allow for more processing and applications to become quickly scaleable. Notably, in a survey conducted by Information Age, nearly 70 percent of the businesses that participated stated that they had some data in the cloud.²⁰⁷ Additionally, applications designed for security or cybersecurity will continue to revolutionize the digital future.²⁰⁸

Due to recent information that was leaked by many companies, including Google, Sony and Apple, cybersecurity, which may be defined as “measures taken to protect a computer or computer system against unauthorized access or attack,” will be at the forefront as colleges and universities train students for IT careers.²⁰⁹ The Internet Security Systems Association has developed a framework to prepare students for a cybersecurity career.²¹⁰ Notably, attacks on healthcare systems, financial services provided by retailers, and mobile devices are projected to increase in 2015 and beyond.²¹¹

Alabama Advantages

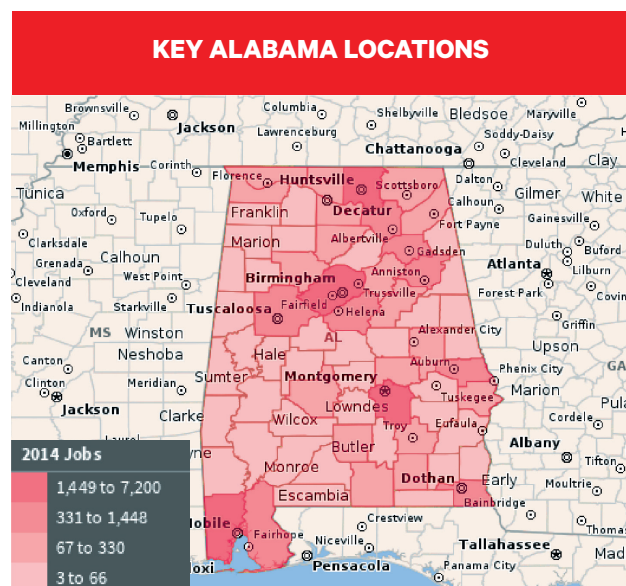
IT companies and government initiatives thrive in Alabama due to the strong base of research and education to support product development and workforce needs. The Center for Materials for

Information Technology at the University of Alabama performs research ranging from studies on materials for data storage to the application and technologies of industrial fields related to all types of information technology.²¹² In addition, the University of Alabama at Huntsville (UAH) recently added a master’s degree in Information Assurance and Security, a master’s degree in Cybersecurity, and a graduate certificate in Cybersecurity.²¹³ For the past seven years, the Southeastern Cyber Security Summit has convened in Huntsville, Alabama. This conference brings together federal government, business leaders, and educators.²¹⁴

providing expert contracting, acquisition and program management. The Directorate employs more than 2,200 across five states (Alabama, Texas, Utah, Ohio, and Massachusetts).²¹⁷

Hourly wages within this industry are nearly double that of the national average. Notably, the State of Alabama will see a projected 11 percent growth in this sector by 2019, resulting in nearly 55,000 new jobs.²¹⁸ The map to the right illustrates that a high concentration of IT jobs are currently in Huntsville, Birmingham, Montgomery, Mobile and Dothan.

LOCATION ASSETS	
	TECHNICALLY SKILLED WORKFORCE
	SOPHISTICATED INFRASTRUCTURE
	LOW COST OF DOING BUSINESS



The University of South Alabama Center for Forensics, Information Technology and Security is involved in the study and application of digital forensics and information technology security and assurance. The National Security Agency (NSA) and the Department of Homeland Security (DHS) have designated the University of South Alabama as a National Center of Academic Excellence in Information Systems Security Education.²¹⁵

Alabama is one of the nation’s recognized leaders in the development and application of modeling and simulation technologies. UAH’s Center for Modeling, Simulation, and Analysis (CMSA) conducts leading-edge research on modeling, simulation and systems engineering. Moreover, CMSA has 10 PhD-level scientists and engineers.²¹⁶ The Alabama Modeling & Simulation Council is a non-profit organization focused on encouraging the growth and development of the industry in the state. Alabama’s collaborative efforts between the military, academia and private industry ensure its position as a location for growth.

Gunter Annex is a United States Air Force installation located in Montgomery, under the administration of the 42d Air Base Wing at nearby Maxwell Air Force Base. The Business and Enterprise Systems Directorate, located at Gunter Annex, is the Information Technology (IT) leader for the Air Force community and Department of Defense (DoD), delivering comprehensive IT solutions and



Research & Development

Growth Opportunity and Trends

Research and innovation are key drivers of competitiveness and success in a wide variety of industry sectors. Development of new products and processes, as well as improvements to existing products, have both short- and long-term advantages for companies seeking to improve and expand their operations. In addition, research and development is a component of addressing societal challenges in the fields of health, energy, security, information, and manufacturing. Research and development activities are conducted by large corporations within certain sectors, as well as by private research companies and university research departments.²¹⁹ Revenue growth of seven percent annually is projected for U.S. scientific research and development services between 2015 and 2019.²²⁰

In the field of biotechnology, research is focused on agriculture/food production; medicine and science, driven by an expanding population; increasing food demand; and the need for alternative fuels.²²¹ Nanotechnology and cloud computing are also top research and development fields, in addition to healthcare diagnostics and development of new healthcare products resulting from changes in healthcare laws. Additionally, technology is increasingly being incorporated into medicine, with demand for new healthcare technology expected to continue growing.²²² With increasing use of data analytics, there is greater demand for research skills related to data management to assist researchers in processing large volumes of data. Data mining of biological information is also becoming an efficient

resource for scientists to identify processes and test hypotheses related to genetics and cell development.²²³

Suppliers of automotive manufacturers are increasing their role in research and development. Technologies likely to become standard in vehicles include electronically operated systems for transmissions, suspensions and safety systems. Suppliers are also working to develop new technologies that will improve fuel efficiency, including smaller, turbocharged engines and advanced combustion models.²²⁴

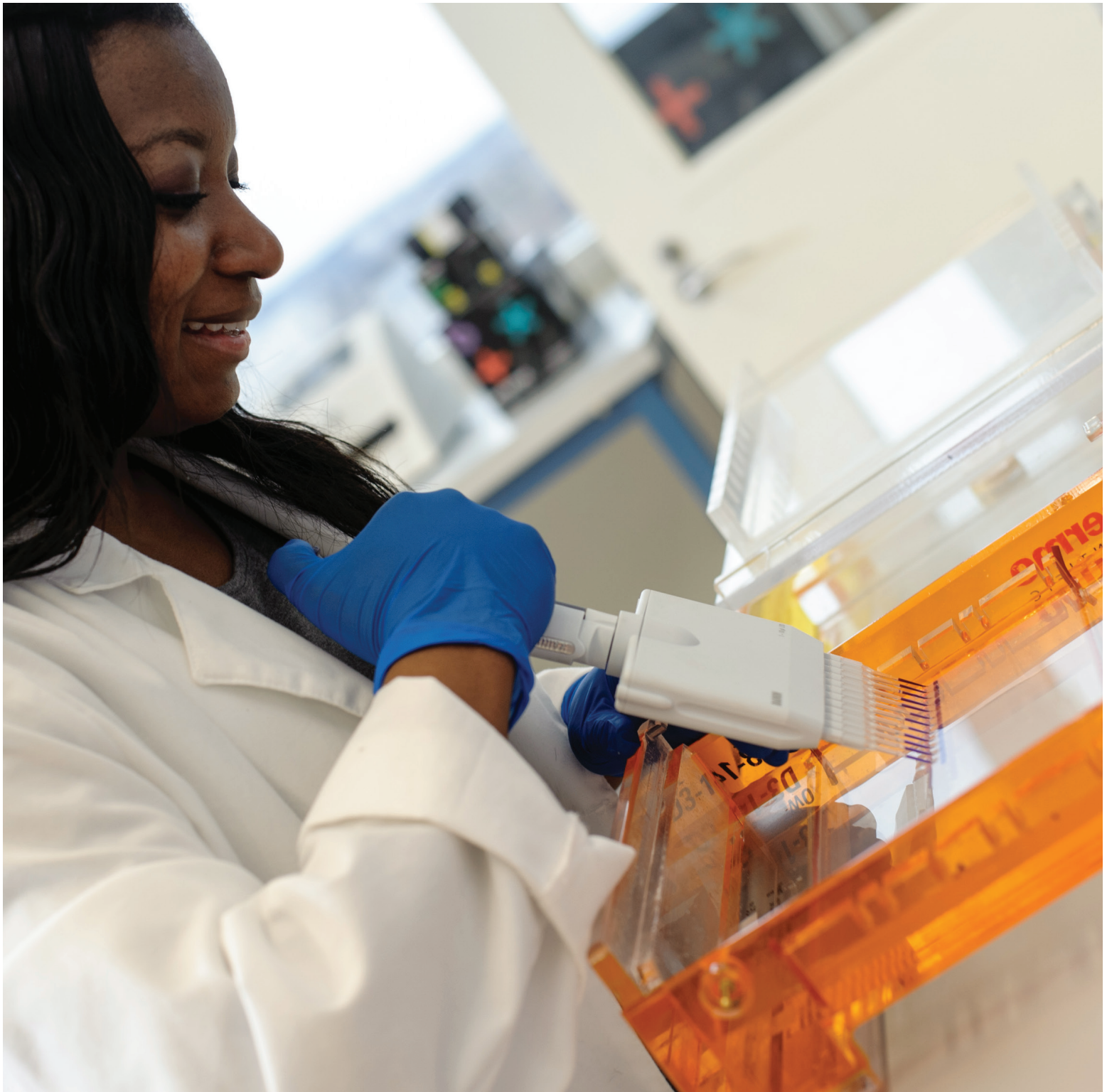
RESEARCH AND DEVELOPMENT DEFINED:

Investigate activities that a business or organization chooses to conduct with the intention of making a discovery that can either lead to the development of new products or procedures, or to improvement of existing products or procedures

ALABAMA TARGETS SUPPORTED BY THE RESEARCH & DEVELOPMENT SECTOR:

AEROSPACE/AVIATION
AGRICULTURAL PRODUCTS/FOOD PRODUCTION
AUTOMOTIVE
BIOSCIENCE
CHEMICALS
DATA CENTERS

DISTRIBUTION/LOGISTICS
FORESTRY PRODUCTS
INFORMATION TECHNOLOGY
METAL AND ADVANCED MATERIALS



The HudsonAlpha Institute of Biotechnology in Huntsville, a worldwide leader in genomics, has become a hot house of biotech economic development.

Alabama Advantages

Alabama has a significant and growing research and development sector that supports a large number of industries. In addition to more than 5,000 jobs in companies dedicated to research and development, additional positions are found in industry sectors such as automotive and aerospace, as well as at the state's research universities. According to the National Science Foundation, Alabama had a total of more than \$820 million in research and development (R&D) expenditures at colleges and universities in 2013.²²⁵

LOCATION ASSETS	
	UNIVERSITY EDUCATION & RESEARCH ASSETS
	PRESENCE OF BROAD-BASED R&D SECTOR
	BUSINESS CLIMATE

The HudsonAlpha Institute for Biotechnology (HudsonAlpha) is a nonprofit genomic science and applications organization. It produces a high volume of genomic data for thousands of academic, clinical and commercial clients.²²⁶ HudsonAlpha is located in Cummings Research Park in Huntsville, the second-largest research park in the U.S. Researchers and entrepreneurs are clustered in HudsonAlpha, as well as the Innovation Depot in Birmingham, the Auburn Research Park in Auburn, and the University of South Alabama's Biotechnical Research Unit in Mobile.²²⁷ Southern Research is another leading research organization. This organization focuses on cancer and infectious and neuro/CNS diseases and has discovered seven FDA-approved anticancer drugs.²²⁸ Other bioscience organizations located in the state include USA Mitchell Cancer Center and Discovery BioMed.²²⁹

The University of Alabama research programs include the Alabama Innovation and Mentoring of Entrepreneurs (AIME). AIME brings together a multifunctional, multidisciplinary research team, students for market research and business plan development, entrepreneurial training, as well as idea selection committee and support for the Bama Technology Incubator.²³⁰ The Central Analytical Facility, also located at the University of Alabama, is a user facility, housing major research instrumentation.²³¹ The College of Engineering Department of Chemical and Biological Engineering

at the University of Alabama conducts research regarding biotechnology, computational, polymers and soft materials, electronic materials and devices, and energy and the environment.²³²

The four major themes of research at Auburn University are environment and energy, security and commerce, health, and transportation.²³³ The Auburn University Huntsville Research Center matches Auburn's research capacities with the needs of Huntsville's agencies and industries.²³⁴

The University of Alabama in Birmingham (UAB) is home to the Center for Nanoscale Materials and Biointegration, whose research crosses physics, chemistry, cell biology, materials, mechanical, and biomedical engineering disciplines.²³⁵ UAB also has a Graduate Biomedical Sciences program with eight interdisciplinary themes: biochemistry, structural and stem cell biology; cancer biology; cell, molecular and developmental biology; genetics, genomics and bioinformatics; immunology; microbiology; neuroscience; and pathobiology and molecular medicine.²³⁶

NASA's Marshall Space Flight Center and the U.S. Army's Redstone Arsenal are both located in Huntsville. Redstone Arsenal is a major federal research, development, test and engineering center that houses the United States Army's missile, missile defense and aviation programs, the Missile Defense Agency, the Defense Intelligence Agency, and NATO's MEADS. The facility also performs missile and helicopter research for the U.S. Army.²³⁷ Also located at Redstone Arsenal is the Marshall Space Flight Center, one of NASA's largest and most important field centers. It manages key programs involving the International Space Station, Payload Operation Center, space science and Space Launch System (SLS).²³⁸ The Propulsion and Structural Test Facility at the Marshall Space Flight Center develops and matures propulsion technologies, including boost, upper-stage, and in-space applications for current and future space transportation and science missions.²³⁹

On the corporate side, Boeing opened a technology research center in Huntsville in 2015 that focuses on simulation and decision analytics. It employs 300 to 400 people.²⁴⁰

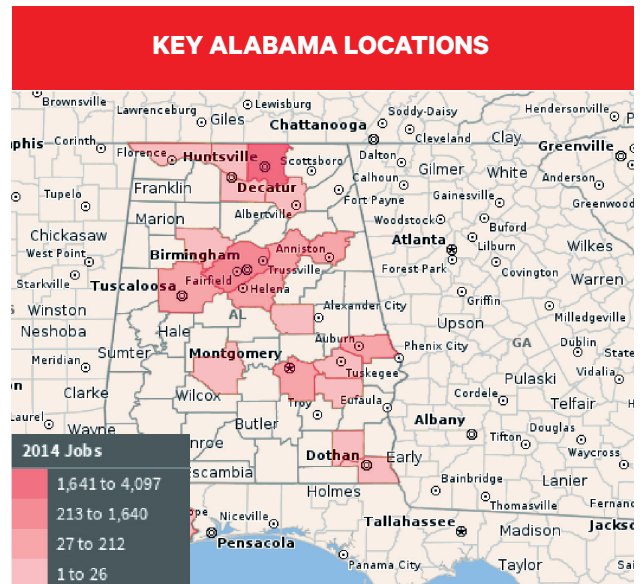
The Consortium for Alabama’s Regional Center for Automotive Manufacturing (CARCAM) provides next-generation manufacturing employees with training in automated control systems, robotics and mechatronics. The program also offers an automotive manufacturing technology degree.²⁴¹

REHAU, an automotive parts manufacturer, opened its first automotive technical center outside of Germany would be located in Cullman, Alabama, in September 2015. The \$3 million, 12,000-square-foot technical center provides an ultra-modern working space for 45 engineers and enables REHAU to bundle production, engineering and development capacities together in one location.²⁴²

Other recent R&D successes in Alabama include Evonik Corporation, which announced plans for its first Innovation Center in Birmingham near their current medical devices production facility. An additional 25 jobs will be created as part of this expansion.²⁴³

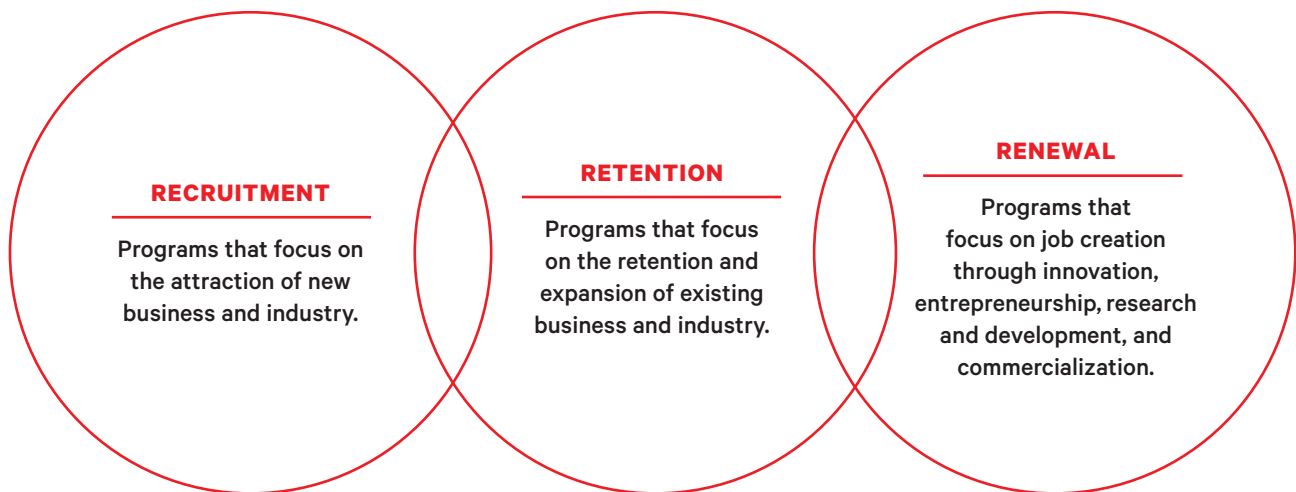
The State of Alabama is served by seven commercial airports, including Birmingham-Shuttlesworth International Airport, Huntsville International Airport, Dothan Regional Airport, Mobile Regional Airport, Montgomery Regional Airport, Northwest Alabama Regional Airport, and Columbus Airport. A total of six major commercial airlines and several commuter airlines operate throughout the seven airports. The state also has 78 general aviation airports, many of which can also accommodate corporate jets.²⁴⁴

The business climate in Alabama is also very conducive to research and development operations. According to CNBC’s 2014 Top States for Business, Alabama has the fourth lowest cost of doing business and seventh lowest cost of living in the United States.²⁴⁵



Economic Development Drivers

Three economic development drivers were identified during the development of the Accelerate Alabama plan, which will continue to be the focus in the update of that plan, Accelerate Alabama 2.0. Those economic development drivers are as follows:



The State of Alabama has had much success in the past three years in the Recruitment and Retention arena, with more than 75,000 announced jobs and \$20.2 billion in capital investment from 2012 to 2015.²⁴⁶ These announcements included expansions and new locations from across the spectrum of the targeted business sectors identified in 2012 and updated and refined as part of Accelerate Alabama 2.0. These successes also included the announcement in July 2012 that Airbus would construct a \$600 million aircraft assembly plant in Mobile, creating 1,000 new jobs, as well as more recent announcements by Boeing, the largest aerospace company in the state, that it would create a Research & Technology Center in

Huntsville; by Evonik Corp., which announced plans to open its first Innovation Center for R&D of medical devices and technology at its Birmingham facility; by Toyota Motor Manufacturing of Alabama, who announced the investment of \$150 million to increase its capacity at its Huntsville facility; by Baxter International, which is investing nearly \$300 million to expand its plant in Opelika; GE Aviation, which decided to launch a 3-D printing initiative at its Auburn plant, involving an investment of \$125 million and 300 new jobs; Remington Outdoor Company, the nation's oldest firearms manufacturer, which announced establishment of a new production site in Huntsville, creating 2,000 new jobs; and many others.²⁴⁷

During this time, the State of Alabama also launched its “Made in Alabama” campaign in 2013 through the Alabama Department of Commerce, with the goal to reach more people in the business community, sharing successes and encouraging them to locate in the state. Efforts included the launch of the new Made in Alabama website, use of earned media and social media, as well as other marketing efforts.

Other successes in the recruitment arena include the increase in the number of certified AdvantageSites during the last three years, as well as the passage of the Data Center Incentive; passage of Amendment 2, resulting in \$130 million in the Capital Improvement Trust Fund; and a significant portion of the Accelerate Alabama Jobs Incentives Package, which includes a withholding incentive.

Also in the area of Retention, related to workforce systems alignment, the Alabama State Department of Education (ALSDE) and the Alabama Community College System (ACCS) have engaged in further collaboration, and there has also been an alignment of K-12 programs and Regional Workforce Development Councils during the past three years. There has also been a formal alignment of workforce services with ACCS under the umbrella of the Alabama Workforce Training System (AWTS), and AWTS continues to focus on existing industry coordination. There were other programs implemented over the past three years related to training programs for Existing Business and Industry (TEBI) staff, a marketing campaign by ACCS, and other initiatives by ALSDE.

In the area of Renewal, the Alabama Launchpad Start-up Competition continued and resulted in increased investment in companies; the Alabama Launchpad Innovation and Entrepreneurship Conference continued to be held each year; and the Alabama Innovation Fund continues to be funded.

In order to continue to successfully compete for the jobs of the future in each of the updated and refined targeted business sectors, the State of Alabama must persist in diversifying its economic development efforts through a balanced emphasis on recruitment, retention and renewal. The recommendations or accelerators below are organized within the context of the three economic drivers, but most will require collaborative efforts across the full spectrum of Alabama’s economic development leadership and partners.

Below is a master list of acronyms of the organizations referenced in this section:

Alabama Community College System	ACCS
Alabama Department of Economic & Community Affairs	ADECA
Alabama Department of Commerce	DCOM
Alabama Experimental Program to Stimulate Competitive Research	ALEPSCoR
Alabama Industrial Development Training	AIDT
Alabama Research Alliance	ARA
Alabama State Department of Education	ALSDE
Economic Development Association of Alabama	EDAA
Economic Development Organizations	EDOs
Economic Development Partnership	EDPA

Economic Development Driver: Recruitment

OVERVIEW OF ACCELERATORS

1. Create a One-stop shop for economic development in Alabama
2. Increase DCOM capabilities in business intelligence activities
3. Build equity in the Made In Alabama brand among both internal and external audiences
4. Ensure workforce skills are aligned with refined targeted business sectors
5. Ensure sites and infrastructure are available to meet the needs of the refined targeted business sectors
6. Align Alabama tax policy and financial assistance programs with refined targets
7. Continue proactive lead generation efforts
8. Increase focus on the film/entertainment sector
9. Understand sustainable assets and plan for the future

ACCELERATOR

CREATE A ONE-STOP SHOP FOR ECONOMIC DEVELOPMENT IN ALABAMA

GOAL/OBJECTIVE

Ensure the economic development functions in Alabama are fully aligned at the state level and, therefore, most effective.

TACTICS | TIMELINE: 2016-2018

- Compare and analyze structure, staffing and funding of the Alabama Department of Commerce (DCOM) and its partners to other competing state EDOs. Focus on ways to eliminate redundancies, increase efficiencies, and maximize resources of DCOM to result in a more clearly aligned economic development function.
- Coordinate with strategic partners to ensure economic development success for the state now and in the future.
- Address DCOM funding and staffing needs based on the outcome of this research.

FUNDING	METRICS	RESPONSIBLE PARTIES
State	Elimination of redundancies Increasing efficiencies Maximization of resources	DCOM
Federal		EDPA

ACCELERATOR

INCREASE DCOM CAPABILITIES IN BUSINESS INTELLIGENCE ACTIVITIES

GOAL/OBJECTIVE

Ensure DCOM employees have access to the best data tools possible.

TACTICS | TIMELINE: 2016-2018

- Explore option of incorporating a business intelligence process into the DCOM function that interfaces with EDPA, and explore and evaluate coordination of the business intelligence function with other partners.
- Pursue adequate funding for staffing the business intelligence interface at DCOM.

- Consider purchasing access to adequate databases for lead development activities of project managers and that would meet other resource needs.
- Conduct sector analysis in partnership with EDPA of refined target business sectors on an annual basis, identifying growth patterns, new trends, and other relevant information. This data should be updated on the target profiles on the Made in Alabama website.

FUNDING	METRICS	RESPONSIBLE PARTIES
TBD	Assistance provided to DCOM employees	DCOM EDPA

ACCELERATOR

BUILD EQUITY IN THE MADE IN ALABAMA BRAND AMONG BOTH INTERNAL AND EXTERNAL AUDIENCES.

GOAL/OBJECTIVE

Enhance the perception of Alabama as a business location to create greater wealth in the state.

TACTICS | TIMELINE: 2016-2019

- Provide information about the findings and recommendations of Accelerate Alabama 2.0 among key internal allies and stakeholders through group presentations, newsletter stories, and postings on the Made in Alabama website.
- Utilize the rollout of Accelerate Alabama 2.0 to promote Made in Alabama social media accounts among in-state stakeholders in order to increase the use of these accounts.
- Develop an advertorial about Accelerate Alabama 2.0 for publication in the monthly purchased space in Business Alabama.
- Prepare a talking points document for DCOM

staff to use in talking with in-state stakeholders about the findings and recommendations of Accelerate Alabama 2.0.

- Develop a focused marketing program to promote the new incentive package approved in the 2015 legislative session, along with any other policy changes impacting Alabama’s competitiveness.
- The Alabama Secretary of Commerce should host one-on-one meetings with site location consultants and prospects in key geographic markets tailored to the interest of that individual that will focus on introduction to the new incentives package in Alabama.
- Host a series of luncheons or dinners for site location consultants, existing businesses and prospects in key geographic markets, including New York, Chicago and the Bay Area. The event should be built around the Made in Alabama brand, featuring an Alabama farm-to-table meal, an Alabama craft gift, and other ties to the brand. An introduction to the new incentives package should also be included in the discussion.
- Expand the reach of the Made in Alabama brand across all sectors and all components of economic development success. This would include messages about how the workforce, infrastructure, supply chain, and innovation are all Made in Alabama. Include these topics in social media strategies.
- Encourage economic development partner entities throughout the state to utilize the Made in Alabama brand. For example, when Alabama universities are advertising outside the state in markets such as Atlanta, Dallas and Miami, the Made in Alabama concept could be the message about how graduates are Made in Alabama.
- Utilize existing social media channels to promote economic development success stories and, when appropriate, tag key organizations and sectors in social media posts to extend their reach.
- Rebrand the DCOM Facebook page to Made in Alabama in order to ensure consistency with the website domain and Twitter handle, as well as further building equity in the brand.
- Reactivate the DCOM YouTube channel to feature

videos about success stories and testimonials of companies within the identified targeted sectors. Also, rebrand the channel to Made in Alabama.

- Develop concentrated social media strategies around key targeted sector events and initiatives to include promoted posts, unique messaging, and strategic hashtags to ensure decision makers in the sectors are receiving the information.
- On an annual basis, determine which events, trade and industry shows, and other forums in each targeted business sector provide the best opportunities to reach the right contacts.
- Explore creation of an organization similar to the Georgia Allies focused on marketing and promotion of the state that will be a pay-to-play structure. DCOM and EDPA should collaborate on the formation of this organization.

FUNDING	METRICS	RESPONSIBLE PARTIES
State appropriations Private partnerships	Increases in social media followers Attendance at events Expansion of use of Made in Alabama brand	DCOM EDPA Alabama Marketing Allies

ACCELERATOR

ENSURE WORKFORCE SKILLS ARE ALIGNED WITH REFINED TARGETED BUSINESS SECTORS.

GOAL/OBJECTIVE

To be recognized as a state with a skilled workforce that can meet the needs of business and industry long and short term.

TACTICS | TIMELINE: 2016-2018

- The non-academic workforce resources from ACCS and ADECA should be streamlined as programs at DCOM to meet the needs of future prospects and existing Alabama companies.
- The 2010 Standard Occupational Classification (SOC) system is used by Federal statistical agencies to classify workers into 840 different occupational categories. Identify SOCs related to the refined targeted business sectors and analyze data related to completions, openings and growth in each to determine current and future demand.
- Have a targeted focus on meeting the needs of the Information Technology sector, in which Software Developers is one of the top 20 fastest growing, top 40 high-demand and top 50 high-earning occupations in the State of Alabama, based on the State of the Workforce Report VIII: Alabama released in March 2014.
- Continually assess curriculum and programs at two- and four-year institutions to determine alignment with targeted business sectors.
- Update the identified strengths of curriculum and programs that can be used in marketing/ recruiting to the refined targeted business sectors, as well as gaps that the state can begin to address.
- Develop additional programs at the high school, two-year and four-year institution levels to produce qualified workers with skills that may be in urgent demand within the targeted business sectors.

FUNDING	METRICS	RESPONSIBLE PARTIES
State appropriations ACCS workforce funds ADECA workforce funds ALSDE (K-12) technical education funds	Survey feedback from companies that locate/expand operations in the state Tracking number of “open” positions for various skilled positions Tracking length of time various skilled positions remain “open” Tracking percent of skilled positions filled from out of state	Governor/DCOM ADECA ALSDE EDPA ACCS Four- and Two-Year Institutions

identification and advancement may be needed.

- Encourage and pursue AdvantageSite designations for sites that best meet product gaps and meet the potential criteria of the refined targeted business sectors.
- Re-evaluate AdvantageSite designation criteria to ensure that all sites certified under the program are marketable to prospects.
- Assess transportation (roads, water, rail, and air) and community infrastructure (water, sewer, and telecom/broadband) needs, focusing on rural or underserved regions.
- Ensure that rural communities are aware of and utilize the new Accelerate Rural Alabama Fund, which allows SIDA to make loans to rural entities of up to \$2 million for funding site preparation and other expenses associated with projects creating jobs in a rural area.

ACCELERATOR

ENSURE SITES AND INFRASTRUCTURE ARE AVAILABLE TO MEET THE NEEDS OF THE REFINED TARGETED BUSINESS SECTORS.

GOAL/OBJECTIVE

Confirm Alabama has sufficient and geographically diverse sites that meet anticipated infrastructure requirements.

TACTICS | TIMELINE: 2016-2018

- DCOM should partner with the primary utility companies, EDPA, and local EDOs to conduct an assessment of all available sites/buildings, including identification of any challenges that need to be addressed, and develop a plan to address any issues.
- Commit to identify a certain number of sites each year in rural areas with the focus on meeting the potential site requirements of the refined targeted business sectors that are more likely to consider locating in such areas.
- Generate a map of all marketable sites that can be used to identify product gaps in different areas of the state where assistance with site

FUNDING	METRICS	RESPONSIBLE PARTIES
Local Partners Federal Local Utilities	Increase in number of Alabama AdvantageSites Increase in number of 50-100-acre sites that are “prospect ready” in all parts of the state Increase in number on 100-500-acre sites that are “prospect ready” in all parts of the state Number of improvements in transportation and community infrastructure in rural arease Amount loaned through the Accelerate Rural Alabama Fund each year	AdvantageSite Committee ADECA DCOM EDPA Utilities Local EDOs

ACCELERATOR

ALIGN ALABAMA TAX POLICY AND FINANCIAL ASSISTANCE PROGRAMS WITH REFINED TARGETS.

GOAL/OBJECTIVE

Ensure that all target sectors meet the requirements of Alabama tax policies and financial assistance programs.

TACTICS | TIMELINE: 2017-2018

- Assess any new or existing corporate tax laws or financial assistance programs that may be inhibiting to companies seeking to locate that are in the targeted business sectors, and seek changes to such laws in the next legislative session.
- Each year, conduct an analysis of the use and value of the new incentives under the Made in Alabama Jobs and Incentives Package and prepare a summary report at the end of the three-year period outlining the success of the incentives, as well as identifying any potential gaps.

FUNDING	METRICS	RESPONSIBLE PARTIES
Legislative Appropriation Other TBD	<p>New incentives or tax law changes approved by legislatures to support recruitment and expansion of business in the state</p> <p>Increase in job creation over the next three years</p> <p>Increase in capital investment over the next three years</p>	<p>Governor</p> <p>DCOM</p> <p>ADECA</p> <p>Alabama Allies</p> <p>Alabama State Legislature</p> <p>EDAA</p>

ACCELERATOR

CONTINUE PROACTIVE LEAD GENERATION EFFORTS.

GOAL/OBJECTIVE

Increase the number of investment inquiries, project leads, projects and locations in refined targeted business sectors.

TACTICS | TIMELINE: 2016-2018

- **Additive Manufacturing/3-D Printing**
 - Focus on potential opportunities in Additive Manufacturing, or 3-D Printing, by becoming more involved in the Consortium for Industrialized Additive Manufacturing, which will focus on identifying and addressing the barriers to high-volume additive manufacturing.
 - Focus on division expansions of existing operations into 3-D printing.
 - Explore the potential opportunity of attracting manufacturers of 3-D printer materials and production systems.
- **Cybersecurity**
 - Examine the number of start-up companies, as well as established companies, focused on cybersecurity, and determine ways to provide support to further develop those companies in the State of Alabama.
 - Develop a targeted lead generation effort on companies on the Cybersecurity 500 List, which is updated quarterly, focused on companies located in more expensive markets such as California and New York.
- **General (Across all Targeted Business Sectors)**
 - For established sectors in the State of Alabama, such as Automotive, pursue the foundational targets for the existing companies that have a strong base in the state. For example, pursue the R&D and Data Center operations for some of the automotive OEMS and larger suppliers.

-Pursue eminent scholars that sectors such as the automotive, aerospace/aviation and bioscience sectors would need in a joint initiative by and among DCOM, Alabama universities that conduct research, and corporate and other partners, such as HudsonAlpha.

-With the existing base and continued success with the attraction of international companies, continue to focus on foreign direct investment.

-Continue to develop a process for gathering and incorporating existing industry input regarding supply chain in the marketing effort.

TACTICS | TIMELINE: 2016-2018

- Conduct an economic impact study of the film/entertainment industry in the State of Alabama.
- Determine ways to capitalize on the film industry success in Georgia, including, but not limited to, the infrastructure, workforce talent, educational programs and other areas.
- Integrate Alabama Film Office website into Made in Alabama website.
- Alabama should consider expanding its existing Entertainment Incentive or passing new legislation to include digital media and software development, as IT is one of the targeted business opportunities.

FUNDING	METRICS	RESPONSIBLE PARTIES
TBD	Number of investment inquiries (to be defined) Number of project leads (to be defined) Number of active projects (to be defined) Number of established projects (jobs, capital investment and wages) - Determine baseline and increase percentage	Governor DCOM ADECA Alabama Marketing Allies EDPA Local EDOS

FUNDING	METRICS	RESPONSIBLE PARTIES
Legislative appropriation	New legislation to support the Entertainment Industry New educational programs to support the Entertainment Industry Total expenditures by entertainment productions in the state	DCOM/Alabama Film Office ADECA Alabama State Legislature Four- and Two-Year Institutions

ACCELERATOR

INCREASE FOCUS ON THE FILM/ENTERTAINMENT SECTOR.

GOAL/OBJECTIVE

Understand and capitalize on the film/entertainment/digital media sector.

ACCELERATOR

UNDERSTAND SUSTAINABLE ASSETS AND PLAN FOR THE FUTURE.

GOAL/OBJECTIVE

Gain awareness and understanding of sustainability efforts in the state to be prepared for certain prospects.

TACTICS | TIMELINE: 2016-2018

- Review and gain an understanding of sustainability efforts in other competitive states.
- Complete inventory of sustainability efforts in the State of Alabama at both the public and private level.
- Ensure that state project managers receive training to have an understanding of the sustainable efforts in the state and how to respond to related questions on Request for Information (RFI)/Request for Proposals (RFP).
- Ensure that local EDOs are aware of key messages to utilize in responding to RFIs/RFPs issued by prospects.
- Promote sustainable assets, including at the higher education and community level, as well as companies practicing sustainability, such as Toyota, in marketing efforts. The Toyota Engine plant in Huntsville has won at least 11 consecutive Energy Star Partner of the Year Awards, which is more than any other automaker. Toyota has saved nearly \$600 million, reduced 14 billion kilowatt hours of energy, and cut CO2 emissions by 40 percent per vehicle since benchmarking began in 2002.²⁴⁸
- Develop Sustainable Plan to guide future efforts.

FUNDING	METRICS	RESPONSIBLE PARTIES
Legislative appropriation	Complete Sustainable Inventory Complete Sustainable Plan	DCOM Local EDO's Four- and Two-Year Universities

Economic Development Driver: Retention

OVERVIEW OF ACCELERATORS

1. Ensure workforce skills are aligned with existing business and industry
2. Provide support for BR&E activities at the local level
3. Understand resources and financial assistance for retention projects

at two- and four-year institutions to determine alignment with existing business/industry.

- Develop additional programs at the high school and two-year and four-year institution levels to produce qualified workers with skills that are in urgent demand with existing business/industry.
- Explore ways to retain, attract and engage young Alabamians through the creation of a Generation Alabama Commission that is comprised of individuals 35 and younger.
- Develop and implement strategies that direct student career interests toward appropriate programs within K-12, two-year colleges and four-year universities that are aligned with jobs being created across the state.

ACCELERATOR

ENSURE WORKFORCE SKILLS ARE ALIGNED WITH EXISTING BUSINESS AND INDUSTRY.

GOAL/OBJECTIVE

Meet the needs of existing business and industry by providing a trained and skilled workforce.

TACTICS | TIMELINE: 2015-2018

- Further alignment of all workforce preparedness and education processes.
- Continue to improve interconnectivity between universities and economic development leadership.
- Create an accessible and searchable database for higher education degrees/programs/graduates.
- Continue to use available data/information and existing industry input to assess current workforce needs.
- Identify skill sets and job classifications that are in greatest demand, as well as any gaps.
- Continually assess curriculum and programs

FUNDING	METRICS	RESPONSIBLE PARTIES
State appropriations	Survey feedback from existing business/industry	Governor/DCOM
ACCS workforce dollars	Tracking number of "open" positions for various skilled positions	ADECA ALSDE
ADECA workforce dollars	Tracking length of time various skilled positions remain "open"	EDPA ACCS
ALSDE (K-12) technical education dollars	Tracking percent of skilled positions filled from out of state	Four- and Two-Year Universities

ACCELERATOR

PROVIDE SUPPORT FOR BUSINESS RETENTION & EXPANSION (BR&E) ACTIVITIES AT THE LOCAL LEVEL.

GOAL/OBJECTIVE

Develop guidelines for BR&E activities in the State of Alabama in order to encourage consistency and effectiveness throughout the state.

TACTICS | TIMELINE: 2016-2018

- Establish a BR&E Committee comprised of DCOM representatives, EDAA members and business representatives drawn from the different regions of the state, as well as representatives from higher education and utility partners, to develop guidelines of a consistent approach to BR&E to be implemented at the local level.
- Include the use of higher education resources in the BR&E process, as needed, to work with local businesses to identify workforce and training needs, and ensure that such needs are addressed.
- Include the use of utility partners in the BR&E process, as needed, to work with local businesses to identify utility infrastructure needs and issues, and ensure that such needs/ issues are addressed.
- Once the guidelines are developed and approved by the Committee, develop a plan to present the new guidelines at the next EDAA annual meeting.
- Utilize the Made in Alabama website, as well as the various social media outlets that are currently used by DCOM, to further ensure that all local EDOs in the state are informed of the new BR&E guidelines.

FUNDING	METRICS	RESPONSIBLE PARTIES
DCOM EDPA Utility Partners	Number of communities who implement BR&E guidelines	DCOM EDPA Utility Partners Four- and Two-Year Institutions

ACCELERATOR

UNDERSTAND RESOURCES AND FINANCIAL ASSISTANCE FOR RETENTION PROJECTS.

GOAL/OBJECTIVE

Ensure that existing business and industry have the resources and/or financial assistance needed to retain jobs long term.

TACTICS | TIMELINE: 2016-2018

- Evaluate the level of financial assistance available to existing business and industry to retain jobs versus creating new jobs based on a review of new and existing Alabama incentives.
- Ensure that competitive programs are available for the retention of jobs in Alabama.
- As part of the promotion of the new incentive package approved in the 2015 legislative session, ensure that local EDOs have an understanding of which new and existing incentives can be used for the retention of business/industry.

FUNDING	METRICS	RESPONSIBLE PARTIES
TBD	TBD	DCOM ADECA EDAA EDPA Utility Partners

Economic Development Driver: Renewal

OVERVIEW OF ACCELERATORS

1. Create a renewal statewide standing committee
2. Provide access to resources and information in the area of renewal
3. Continue to build research and development capacity in the state of Alabama
4. Continue to work to coordinate and increase commercialization efforts
5. Provide financial assistance for innovation-based activities
6. Foster entrepreneurship and innovation

- Define roles and responsibilities of Committee members.
- Contact nominees to offer Committee Renewal role and finalize Committee membership.
- Schedule and conduct launch meeting of Committee.

FUNDING	METRICS	RESPONSIBLE PARTIES
TBD	Creation of the Renewal Statewide Standing Committee Renewal tactics accomplished	DCOM ALEPSCoR Southern Research HudsonAlpha EDPA Foundation

ACCELERATOR

CREATE A RENEWAL STATEWIDE STANDING COMMITTEE.

GOAL/OBJECTIVE

Create a Statewide Standing Committee to implement the *Renewal* component of Accelerate Alabama 2.0.

TACTICS | TIMELINE: 2016-2018

- Identify potential committee members, including ALEPSCoR and Economic Development at Alabama Universities, Southern Research and HudsonAlpha, representatives from the Economic Development Partnership of Alabama Foundation, and individuals from industry and government to be appointed by the Alabama Secretary of Commerce.
- Select Renewal Statewide Standing Committee members.

ACCELERATOR

PROVIDE ACCESS TO RESOURCES AND INFORMATION IN THE AREA OF RENEWAL.

GOAL/OBJECTIVE

Ensure local EDOs and others have access to information on R&D, commercialization activities, and entrepreneurial support available at Alabama universities and other organizations in the state.

TACTICS | TIMELINE: 2016-2017

- Identify all Renewal Allies in the state, which may include the research universities, private research institutions and government facilities, Alabama Launchpad, incubator facilities across the state, the venture capital and angel investor community, and start-up companies.
- Develop a list of universities conducting R&D in the state and publish a list of a point of contact at each university that can provide information on university resources. This list should be posted to the Made in Alabama website, as well as provided electronically to each EDO contact in the state.

- Develop a list of private research institutions in the state, as well as a point of contact for additional information. This information should also be posted to the Made in Alabama website, as well as provided electronically to each EDO contact in the state.
- Further define the roles and responsibilities of each point of contact.
- Develop a digital directory of resources available at each research university, as well as at other research institutions in the state, such as HudsonAlpha. This directory can be accessible from the Made in Alabama website.
- Ensure that these resources are made available to the venture capitalist community in the state, as well.

- Organize a Renewal conference in a major manufacturing region of Alabama to synergize and expand university/industry collaborations. The conference proceedings would lay the foundation for a strategic roadmap for future collaborations and provide a vehicle for communication between industries, universities, and laboratories.
- Link university and private research institutions together around targets and develop coordinated plan to expand capacity.
- Review current R&D funding at research universities and set target funding aspirations for the next three years.

FUNDING	METRICS	RESPONSIBLE PARTIES
State appropriations	Increase in knowledge of R&D, commercialization activities	DCOM ALEPSCoR Private Research Institutions

FUNDING	METRICS	RESPONSIBLE PARTIES
State appropriations	Track R&D operations that locate in the state Increase R&D funding at research universities	Governor Legislative Leadership DCOM ACHE ALEPSCoR Private Research Institutions Venture Community

ACCELERATOR

CONTINUE TO BUILD RESEARCH AND DEVELOPMENT CAPACITY IN THE STATE OF ALABAMA.

GOAL/OBJECTIVE

Continue to increase research and development capacity at the state's four-year research universities, private research institutions, and government assets.

TACTICS | TIMELINE: 2016-2017

- Have a focused initiative on attracting R&D operations across all targeted business sectors, with an initial focus on the existing automotive, aerospace/aviation, and bioscience companies in the state with the recent successes in 2014.

ACCELERATOR

CONTINUE TO WORK TO COORDINATE AND INCREASE COMMERCIALIZATION EFFORTS.

GOAL/OBJECTIVE

Create a statewide, coordinated initiative that results in increased commercialization efforts, including increased venture/angel funding.

TACTICS | TIMELINE: 2016-2017

- Research commercialization is the transformation of new ideas and discoveries into products or processes that will lead to economic development success in a state or region. Efforts in research commercialization across the state

should be catalogued and integrated into an effort with all of the Renewal Allies, as previously defined.

- The Renewal Allies should meet quarterly to discuss ways to coordinate and increase commercialization efforts in the state.
- Research partnerships among research universities and private research institutions should continue to be encouraged.
- Research partnerships among research universities and private corporations should also continue to be encouraged.
- Assess the performance of the various incubator facilities in the state to determine which could most effectively use additional state support.
- Continue to expand the Alabama Launchpad program focusing on increasing its investment in start-up companies each year.
- Develop an Innovation-to-Enterprise Commercialization program at one or more of the research universities, which provides opportunities for students to learn about research commercialization and develop entrepreneurial and business skills.

ACCELERATOR

PROVIDE FINANCIAL ASSISTANCE FOR INNOVATION-BASED ACTIVITIES.

GOAL/OBJECTIVE

Increase the state's capacity to foster creation of companies from public and privately funded research.

TACTICS | TIMELINE: 2016-2017

- Increase level of funding for the Alabama Innovation Fund to \$20 million annually and ensure the funds are distributed competitively in support of R&D that enhances Alabama's economic growth.

Support the following legislation:

- The proposed Small Business Early Stage Investment Act is essentially an Angel Investment Tax Credit that provides a credit of 30 percent of qualified investment made in a business with less than 20 employees that has annual revenues of less than \$500,000, if the equity investment is less than \$1 million.
- The proposed Accelerate Alabama Innovation Act is an R&D tax credit equal to 5 percent of research expenses incurred in Alabama, which is increased to 25 percent if the research is conducted with an Alabama university, HudsonAlpha, Southern Research, and other similar research institutions in the state.
- Explore the possibility again of creating and funding an SBIR/STTR Matching Grant Program.
- Explore the possibility again of creating and funding an Applied R&D Matching Grant Program to encourage private sector/university research partnerships.

FUNDING	METRICS	RESPONSIBLE PARTIES
State appropriations	<p>Increase in research partnerships between universities and private institutions</p> <p>Increase in venture capital/angel funding in the state</p> <p>Increased investment in start-ups by the Alabama Launchpad program</p>	<p>Governor</p> <p>DCOM</p> <p>State Legislature</p> <p>EDPA</p> <p>ALEPSCoR</p> <p>Venture Community</p>

FUNDING	METRICS	RESPONSIBLE PARTIES
State appropriations	Increase in funding under the Alabama Innovation Fund Passage of legislation	DCOM State Legislature EDPA/Alabama Launchpad ALEPSCoR Private Research Institutions Venture/Angel Community

in Alabama to support small business/entrepreneurs.

- Create a fund, perhaps called the Alabama Rural Innovation Fund, which targets existing small or start-up business with growth potential in Alabama's favored geographic areas for investments ranging from \$100,000 to \$300,000.
- Seek a top-10 ranking on State Entrepreneurship Index (SEI), which is a measure of a state's ability to grow new enterprises created by economists at the University of Nebraska-Lincoln.

ACCELERATOR

FOSTER ENTREPRENEURSHIP AND INNOVATION.

GOAL/OBJECTIVE

Create an entrepreneurial culture and environment in the State of Alabama.

TACTICS | TIMELINE: 2016-2018

- Rebrand the Alabama Office of Small Business Advocacy to be called the Alabama Office of Entrepreneurship and Innovation at DCOM to enhance the state's existing efforts to help start-up businesses by facilitating connections to the right partners and resources all across the state.
- Add an Entrepreneurship and Innovation section to the Made in Alabama website.
- Develop an Alabama Entrepreneurs Resource List, which will provide a list of entrepreneurs who are available to mentor or provide leadership to early-stage companies or other entrepreneurs based on their experience.
- Encourage development and implementation of entrepreneurship programs in middle and high school.
- Partner with the Center for Rural Entrepreneurship to develop other programs

FUNDING	METRICS	RESPONSIBLE PARTIES
State appropriations	Obtaining a top-10 ranking on the State Entrepreneurship Index Increasing number of entrepreneurship programs at the middle and high school levels Passage of a Rural Innovation Fund	EDPA - Alabama Launchpad DCOM Center for Rural Entrepreneurship

ALEPSCoR State Science and Technology Roadmap

Executive Summary

In 2009, the Alabama Research Alliance sponsored the development of the *Alabama Science and Technology Roadmap (2009 Roadmap)*. The update to that Science and Technology (S&T) Plan, the ALEPSCoR State Science and Technology Roadmap (AESSTR), is incorporated into *Accelerate Alabama 2.0* to address support for statewide *Renewal* of industry through the growth of innovation, research, and development activities directly related to the expertise and strength of Alabama's universities and laboratories. This document identifies areas of research expertise across Alabama and maps this expertise to targeted industry clusters in the State. We anticipate that these resources will describe a pathway for utilizing the skills and resources at Alabama's research institutions to achieve the goals of *Accelerate Alabama 2.0*.

This AESSTR plan for *Renewal* is designed to i) make recommendations for enhancing and expanding Alabama's infrastructure and list resources needed to "Accelerate Alabama" and ensure that the state is nationally and internationally competitive; ii) identify current technology expertise and planned focus areas in S&T resident at Alabama universities and institutes as well as map this expertise to potential industry sectors; and iii) provide point of contact information for each Alabama research university, Southern Research and HudsonAlpha Institute for Biotechnology (HudsonAlpha).

The recommendations are:

- **Recommendation #1:** Increase level of funding for the Alabama Innovation Fund to \$20 million annually and ensure that funds are distributed competitively in support of R&D that enhances Alabama's economic growth.
- **Recommendation #2:** The Alabama Department of Commerce should charge a Statewide Standing

Committee with implementing the *Renewal* component of *Accelerate Alabama*. This Committee would include the Vice Presidents for Research and Economic Development at Alabama universities, Southern Research (SR) and HudsonAlpha, representatives from the Economic Development Partnership of Alabama Foundation, and individuals from industry and government appointed by the Alabama Secretary of Commerce.

- **Recommendation #3:** Organize a *Renewal* conference in a major manufacturing region of Alabama to synergize and expand university/industry collaborations. The conference proceedings would lay the foundation for a strategic roadmap for future collaborations and provide a vehicle for communication between industries, universities, and laboratories.

I. INTRODUCTION

On a national level, the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (COMPETES) Act was enacted in 2007 and reauthorized in 2010. America COMPETES articulates the need for increased national attention to science, technology, engineering, and mathematics (STEM) education, research, and development. Alabama has long recognized the economic importance of encouraging growth in targeted STEM research areas.

The 2009 *Alabama Science and Technology Roadmap (2009 Roadmap)* provided guidance for leaders in the public and private sector to ensure the growth of a strong science and technology foundation in Alabama. The 2009 Roadmap identified core technology assets in the state and called for enhancing state and private support for "applying core technologies more extensively to promote innovation and global competitiveness of Alabama's key industries, such as automotive, aerospace, healthcare, agriculture, forest products and advanced manufacturing."

The 2009 Roadmap could be used as a companion document to *Accelerate Alabama*, the state plan later developed that recommended tactics for moving forward on three economic development drivers: *Recruitment* of new business and industry, *Retention* and expansion of existing business and industry and *Renewal* through job creation, innovation and research and development, as well as commercialization.

In coordination and in support of the Accelerate Alabama economic development strategic plan, Alabama EPSCoR (www.ALEPSCoR.org) developed the Alabama EPSCoR State Science and Technology Roadmap (AESSTR). The AESSTR identifies statewide research priorities and areas of research expertise across Alabama's universities and laboratories that provide the targeted economic growth of Accelerate Alabama 2.0. Statewide research priorities identified in the AESSTR are: advanced manufacturing, agricultural/food products, biosciences/biotechnology, chemical/petrochemical, energy, forestry products, information technology and cybersecurity, metal and advanced materials, nanotechnology, plasma science, and transportation. The AESSTR was crafted in consultation with the research leaders of the seven Ph.D. granting institutions in the State, representatives from the Alabama Department of Commerce, the Economic Development Partnership of Alabama (EDPA) and with input from research oriented companies Hudson Alpha Institute for Biotechnology (HudsonAlpha) and Southern Research (SR). This AESSTR plan, formally approved and endorsed by the Alabama EPSCoR Steering Committee on July 21, 2016, will be updated yearly to reflect evolving research priorities and new areas of research expertise.

Education and research organizations contribute directly to economic development efforts and are important for the *Recruitment* of new business and industry. An important element in the *Retention* of industry is research and development in collaboration with existing industries in Alabama. Alabama's efforts toward *Renewal* of industry through the development of innovations and research and development activities are directly related to the expertise and strength of Alabama's universities and laboratories.

The ALEPSCoR State Science and Technology Roadmap is incorporated into *Accelerate Alabama 2.0* and primarily addresses the support for statewide *Renewal*. The S&T segment of *Accelerate Alabama 2.0* identifies the vast areas of expertise across Alabama's research infrastructure and maps expertise to targeted industry sectors in the State. It is anticipated that this information will help describe a pathway for leveraging the skills and resources at Alabama's universities and private and public laboratories to achieve the goals of *Accelerate Alabama 2.0*. This document has two areas of focus:

1. Identification of current technology expertise and planned focus areas in science and technology resident at Alabama universities and research institutes and maps these capabilities to potential

industry sectors. In addition, institutional primary points of contact are included, as well as a detailed spreadsheet outlining institutional capabilities and expertise.

2. Recommendations for implementation of the strategies/tactics posed in the 2016 Roadmap for enhancing and expanding Alabama's infrastructure and resources needed for *Accelerate Alabama 2.0* and ensuring that the state is nationally and internationally competitive.

II. RESEARCH EXPERTISE AND CAPABILITIES DATABASE

A critical step in the effort to support *Renewal* in Alabama is the creation of a comprehensive database of current programs in research and technological development underway at research universities and institutions in the state. The AESSTR identifies statewide research priorities and expertise across Alabama's universities and laboratories that provide the targeted economic growth of Accelerate Alabama 2.0. Those statewide research priorities identified in the AESSTR in alphabetical order are:

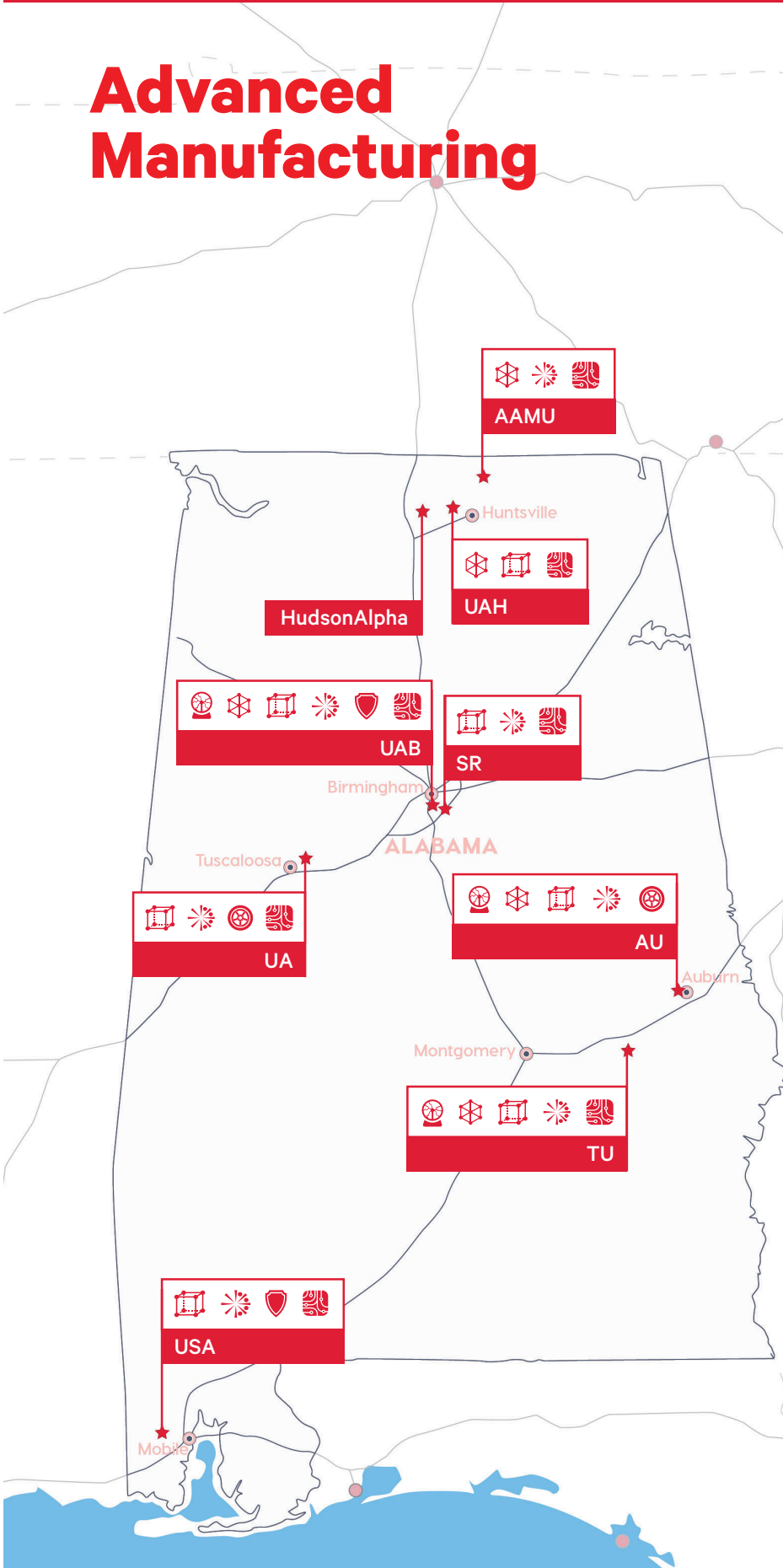
1. Advanced Manufacturing
2. Agricultural Products/Food Production
3. Biosciences/Biotechnology
4. Chemical/Petrochemical
5. Energy
6. Forestry Products
7. Information Technology and Cybersecurity
8. Metal and Advanced Materials
9. Nanotechnology
10. Plasma Science
11. Transportation

Institutional research expertise in these priority areas is illustrated graphically in the Alabama Expertise Maps with more detail provided in the Alabama Research and Technology Data Base, Appendix I.

a. Alabama Expertise Maps

The maps provided on the following pages graphically describe the targeted industry sectors and expertise for priority research and technology that supports Alabama's industries. The icons reflect the major research emphases at Alabama research institutions. More detailed information on the specific focuses in each area is provided in Appendix I.

Advanced Manufacturing



HudsonAlpha

HudsonAlpha Institute for Biotechnology

AAMU

Alabama A&M University

AU

Auburn University

TU

Tuskegee University

UA

University of Alabama

UAB

University of Alabama at Birmingham

UAH

University of Alabama in Huntsville

USA

University of South Alabama

SR

Southern Research



Modeling & Simulation



Additive Manufacturing



Advanced Materials



Security



Tribology, Wear & Coatings

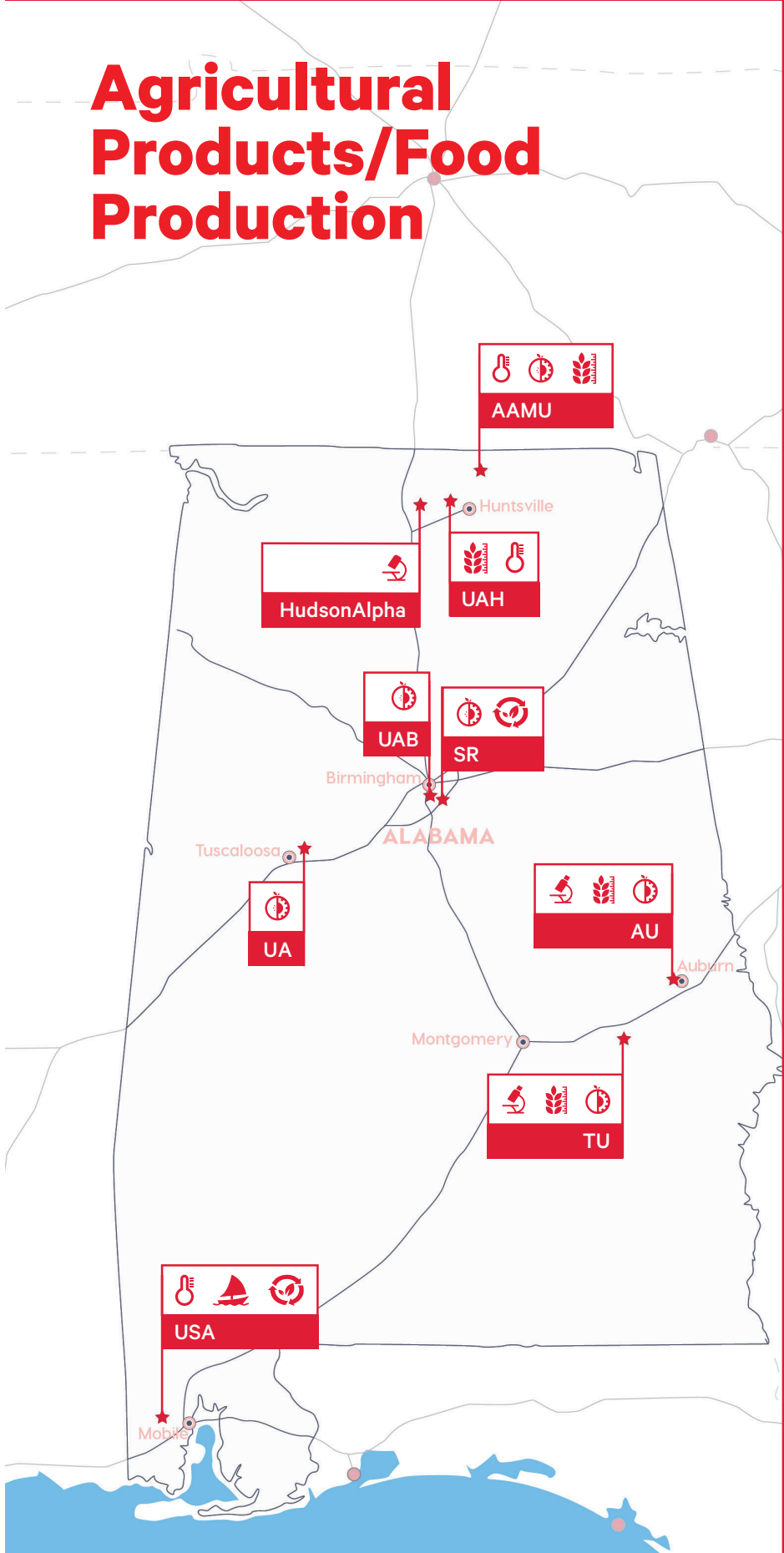


Systems Engineering



Plasma

Agricultural Products/Food Production



HudsonAlpha

HudsonAlpha
Institute for
Biotechnology

AAMU

Alabama A&M
University

AU

Auburn
University

TU

Tuskegee
University

UA

University of
Alabama

UAB

University of
Alabama at
Birmingham

UAH

University of
Alabama in
Huntsville

USA

University of
South Alabama

SR

Southern
Research



Genomics &
Biotechnology



Precision
Agriculture



Modeling - Soil,
Climate & Water



Food Processing
Nutrition & Packaging

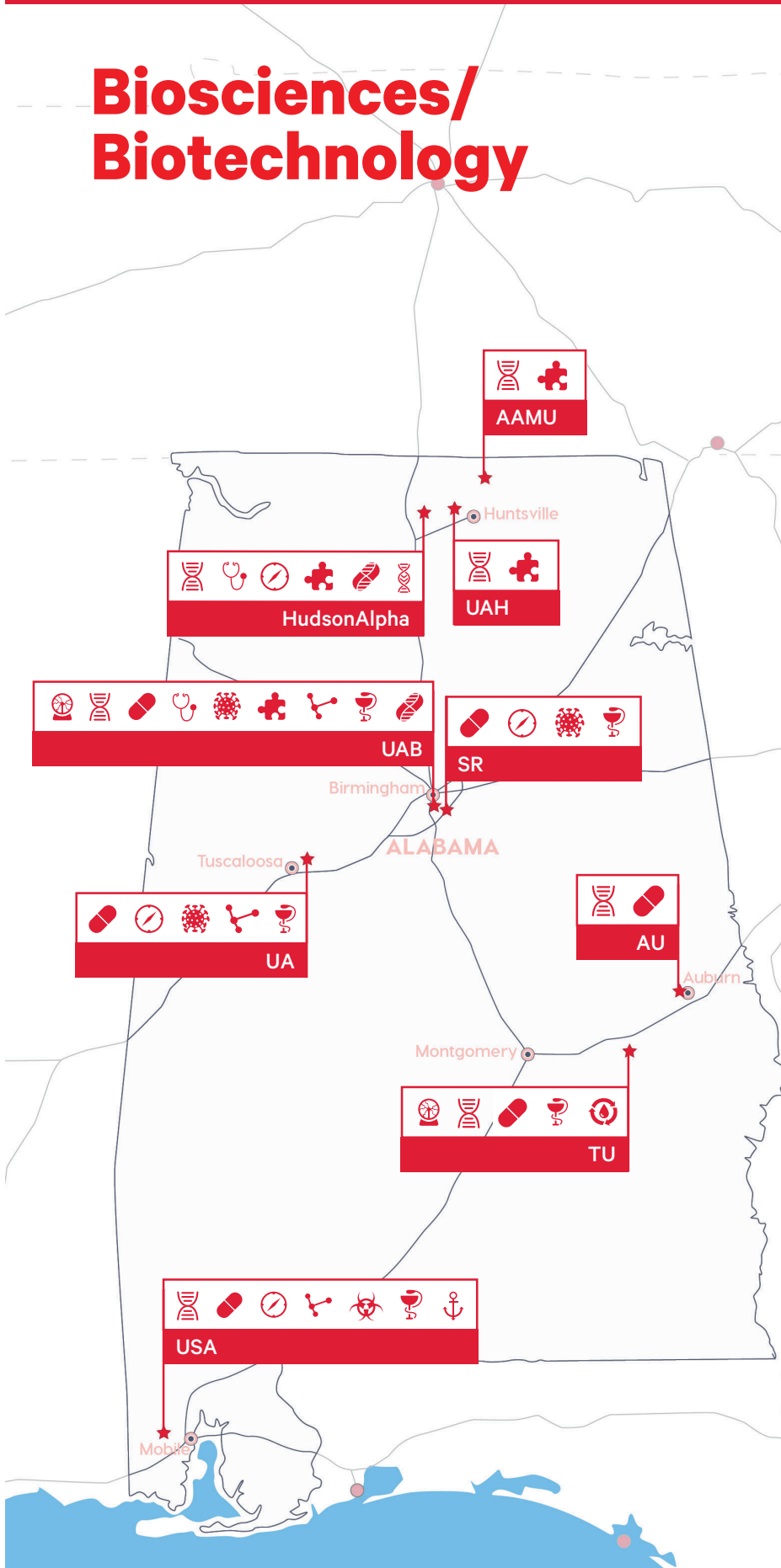


Fisheries &
Aquaculture



Agricultural Waste
Management

Biosciences/ Biotechnology



HudsonAlpha
HudsonAlpha
Institute for
Biotechnology

AAMU
Alabama A&M
University

AU
Auburn
University

TU
Tuskegee
University

UA
University of
Alabama

UAB
University of
Alabama at
Birmingham

UAH
University of
Alabama in
Huntsville

USA
University of
South Alabama

SR
Southern
Research


**Biomedical
Genomics
& Informatics**


**Pharmaceutical
Development**


**Patient Care &
Clinical Research**


**Biomarker
Discovery**


Disease Models


**Systems
Biology**


**Protein Chemistry
& Engineering**


**Remediation &
Waste Management**


**Biomedical
Devices &
Materials**


**Marine
Pharmacology**

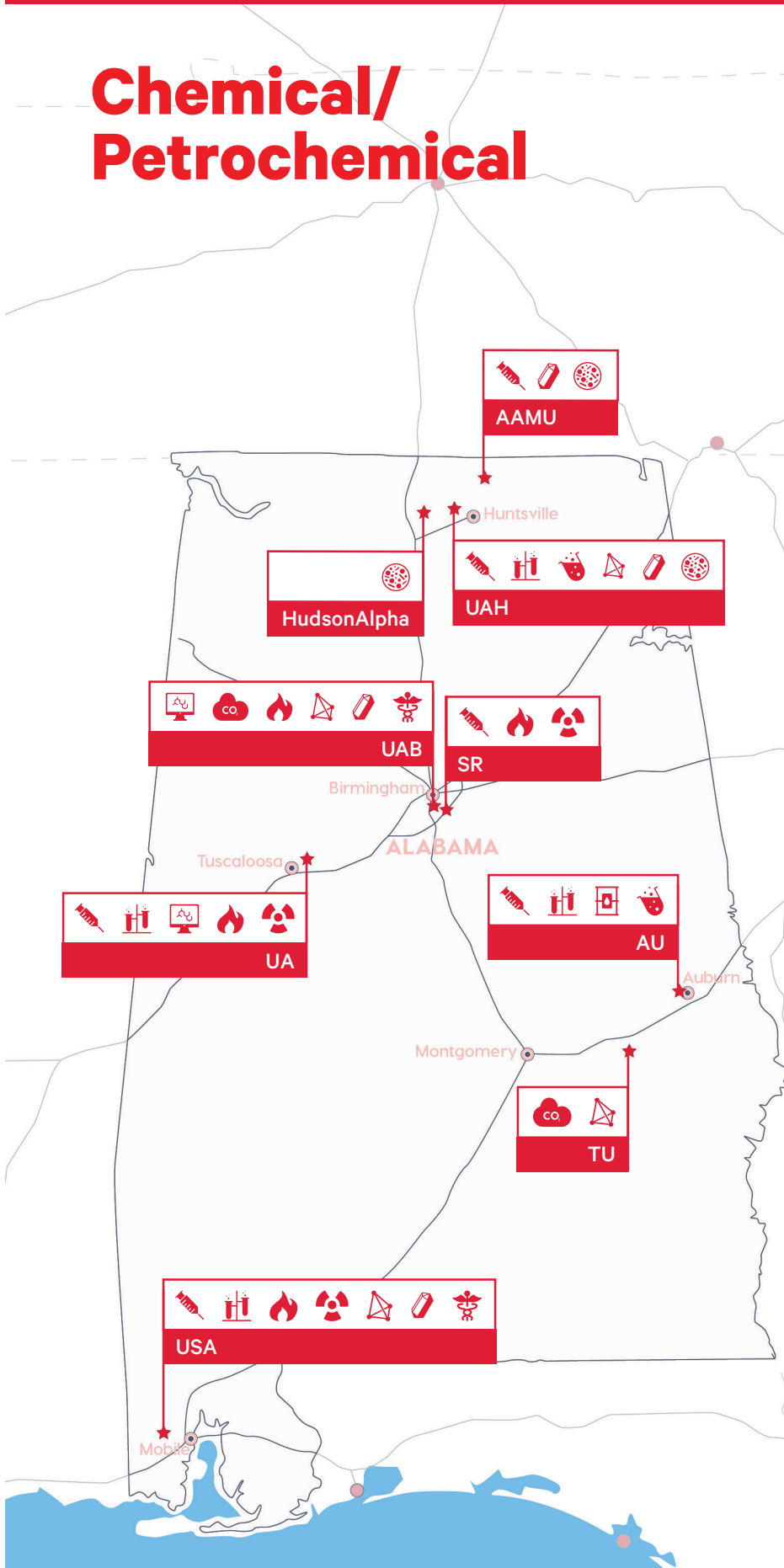

**Molecular
Medicine**


**Agricultural
Genomics
& Informatics**


**Waste Water
Treatment**


Plasma

Chemical/ Petrochemical



HudsonAlpha

HudsonAlpha
Institute for
Biotechnology

AAMU

Alabama A&M
University

AU

Auburn
University

TU

Tuskegee
University

UA

University of
Alabama

UAB

University of
Alabama at
Birmingham

UAH

University of
Alabama in
Huntsville

USA

University of
South Alabama

SR

Southern
Research



Analytical
Chemistry



Chemical
Engineering



Petroleum
Remediation
& Management



Computational
Chemistry



Carbon
Sequestration



Catalysis



Environmental
Chemistry &
Toxicology



Surface
Chemistry



Polymer & Material
Chemistry



Crystallography

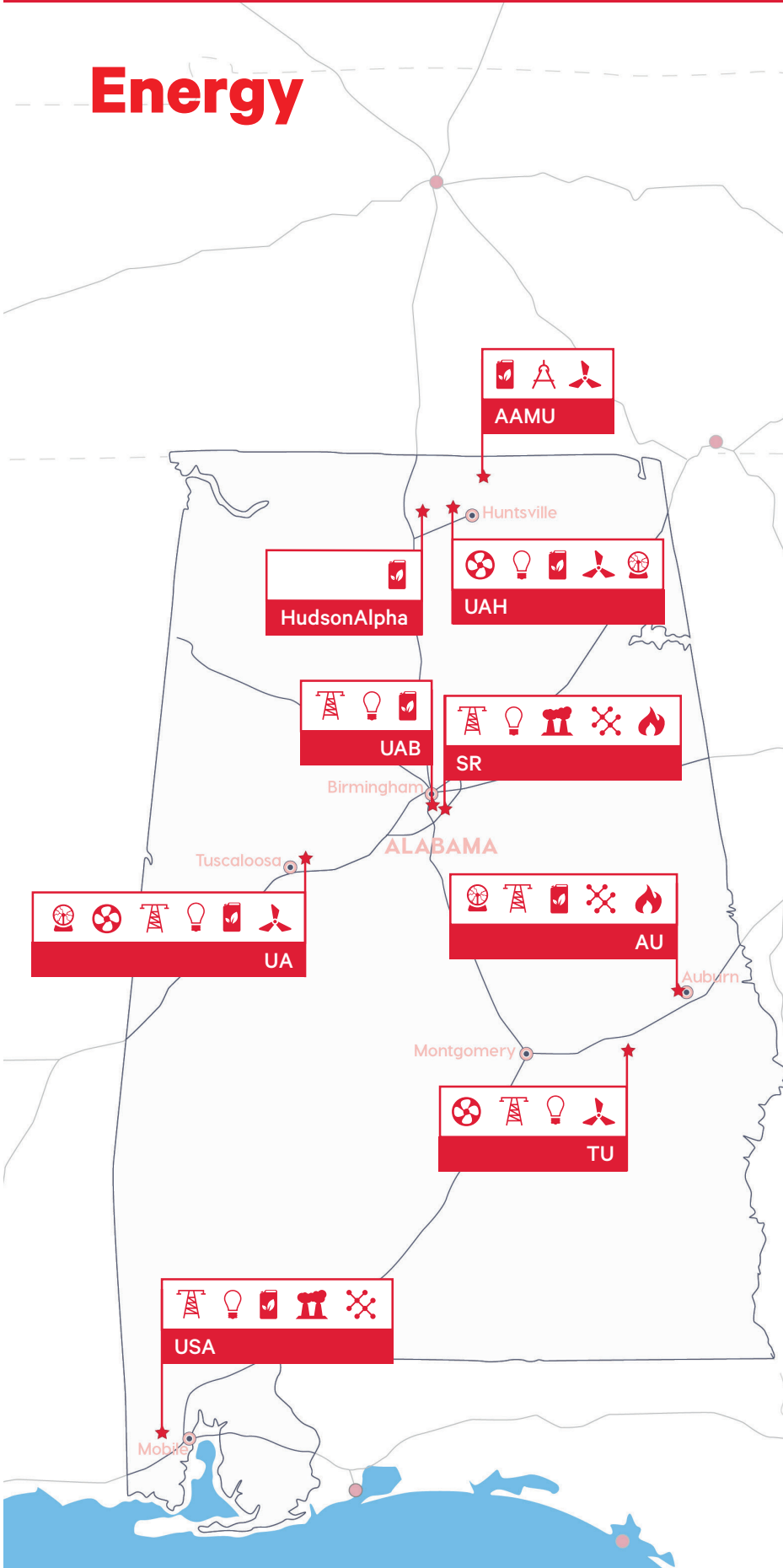


Biochemistry



Medical
Chemistry

Energy



HudsonAlpha

HudsonAlpha Institute for Biotechnology

AAMU

Alabama A&M University

AU

Auburn University

TU

Tuskegee University

UA

University of Alabama

UAB

University of Alabama at Birmingham

UAH

University of Alabama in Huntsville

USA

University of South Alabama

SR

Southern Research



Propulsion Systems



Power Grid Technology



Energy Storage



Biofuels



Wind & Solar



Pollution Control



Hydrocarbon Energy



Modeling & Engineering

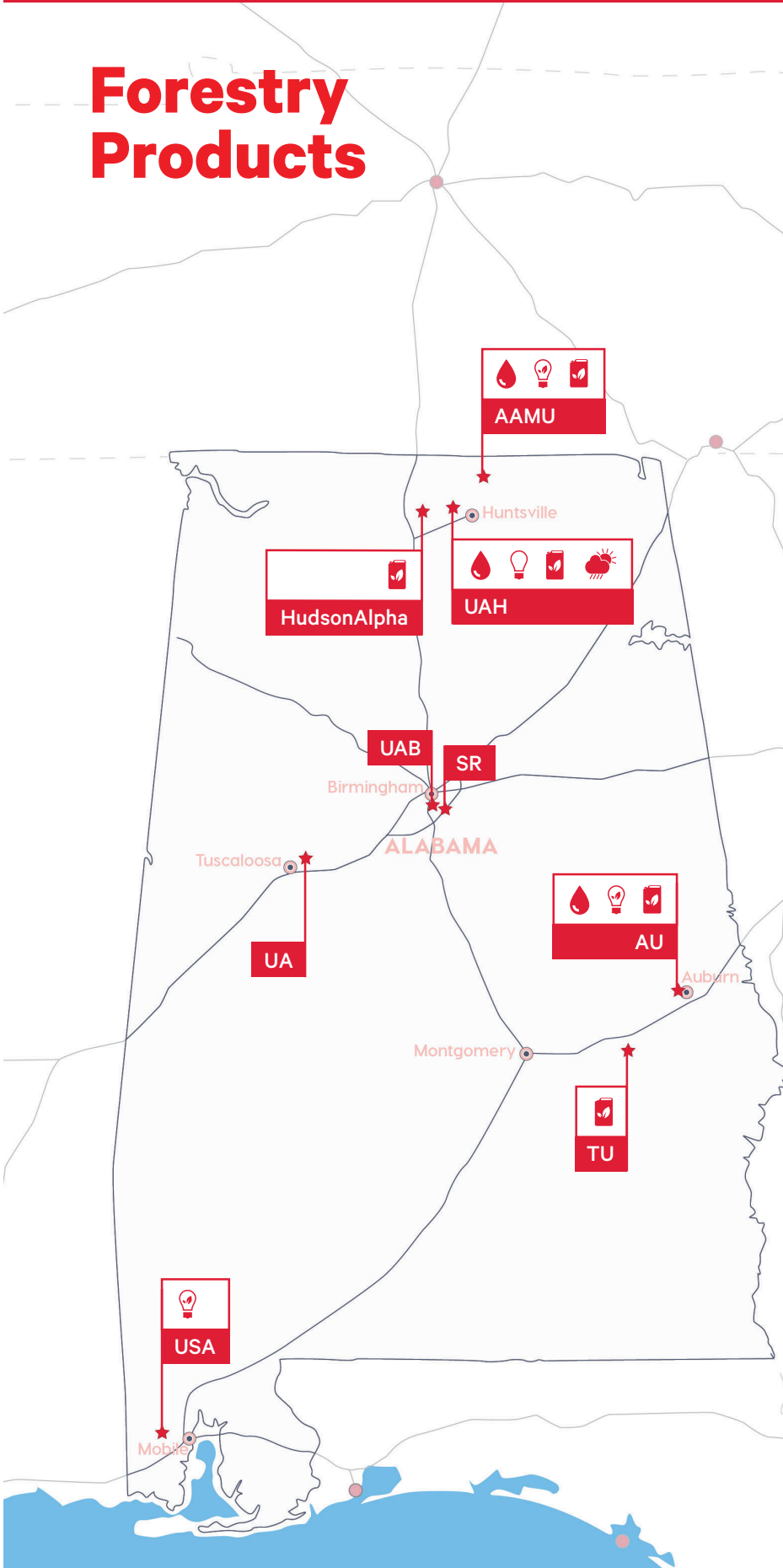


High Temperature Materials



Plasma

Forestry Products



HudsonAlpha

HudsonAlpha
Institute for
Biotechnology

AAMU

Alabama A&M
University

AU

Auburn
University

TU

Tuskegee
University

UA

University of
Alabama

UAB

University of
Alabama at
Birmingham

UAH

University of
Alabama in
Huntsville

USA

University of
South Alabama

SR

Southern
Research



Water Resources



Environmental Health &
Modeling

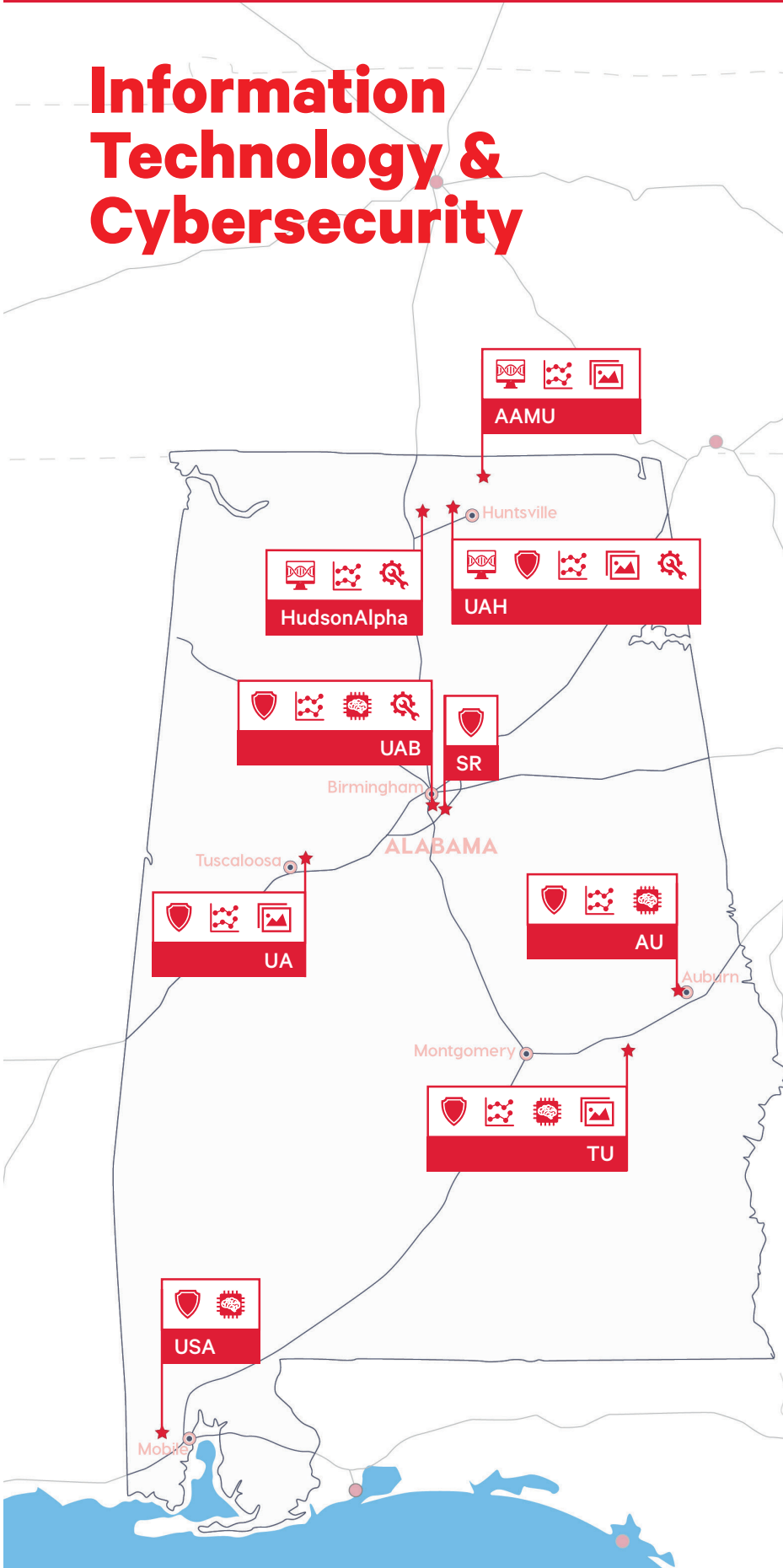


Biofuels & Products



Atmospheric Science

Information Technology & Cybersecurity



HudsonAlpha

HudsonAlpha Institute for Biotechnology

AAMU

Alabama A&M University

AU

Auburn University

TU

Tuskegee University

UA

University of Alabama

UAB

University of Alabama at Birmingham

UAH

University of Alabama in Huntsville

USA

University of South Alabama

SR

Southern Research



Bioinformatics



Security



Big Data



Artificial Intelligence Machine Learning

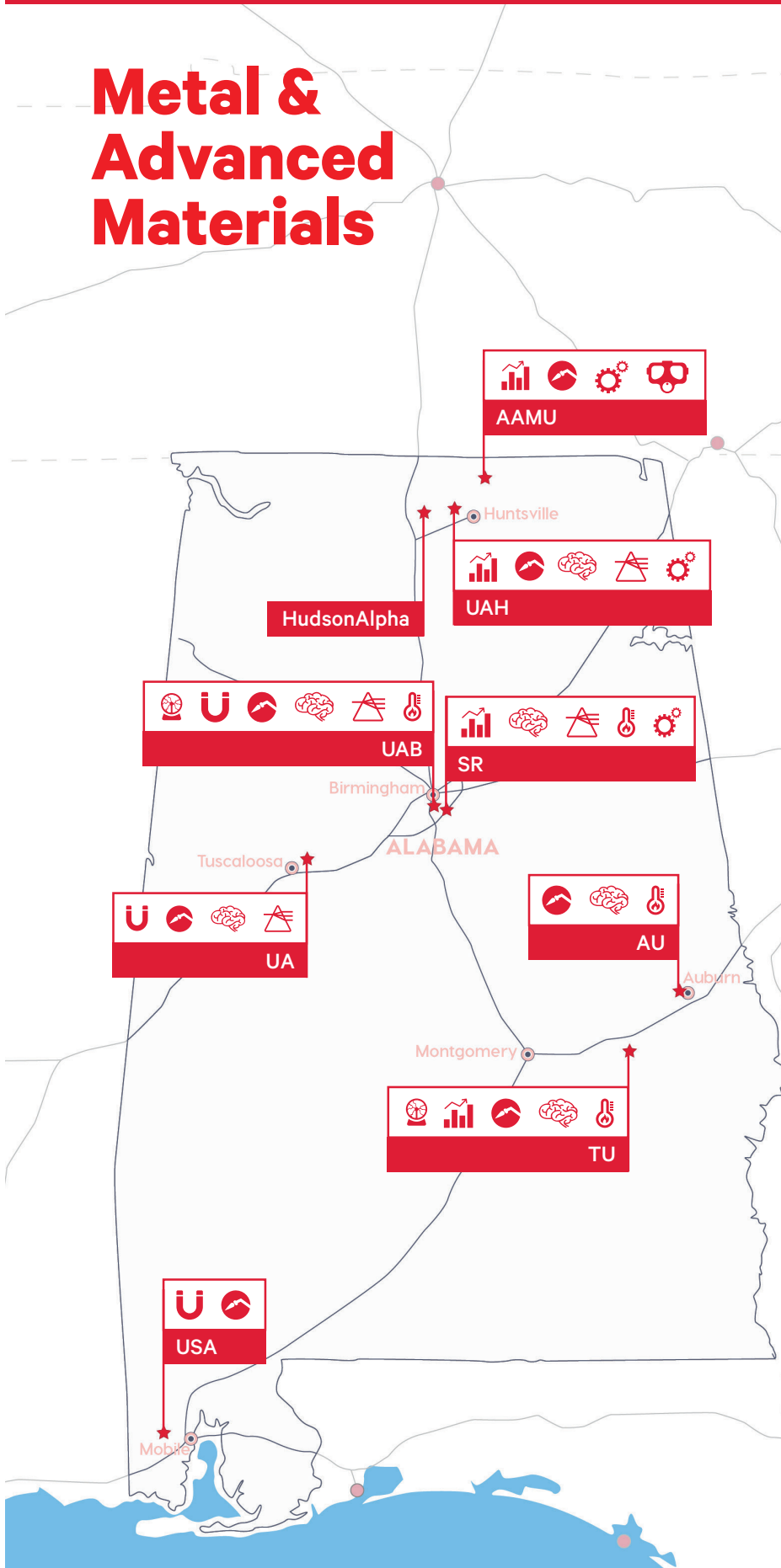


Modeling & Image Processing



Software Engineering

Metal & Advanced Materials



HudsonAlpha

HudsonAlpha
Institute for
Biotechnology

AAMU

Alabama A&M
University

AU

Auburn
University

TU

Tuskegee
University

UA

University of
Alabama

UAB

University of
Alabama at
Birmingham

UAH

University of
Alabama in
Huntsville

USA

University of
South Alabama

SR

Southern
Research



Chemical Property
Analysis & Testing



High Magnetic
Materials



Materials Processing
& Chemistry



Smart Materials



Electronic &
Optical Materials



Extreme Materials



Materials Treatment

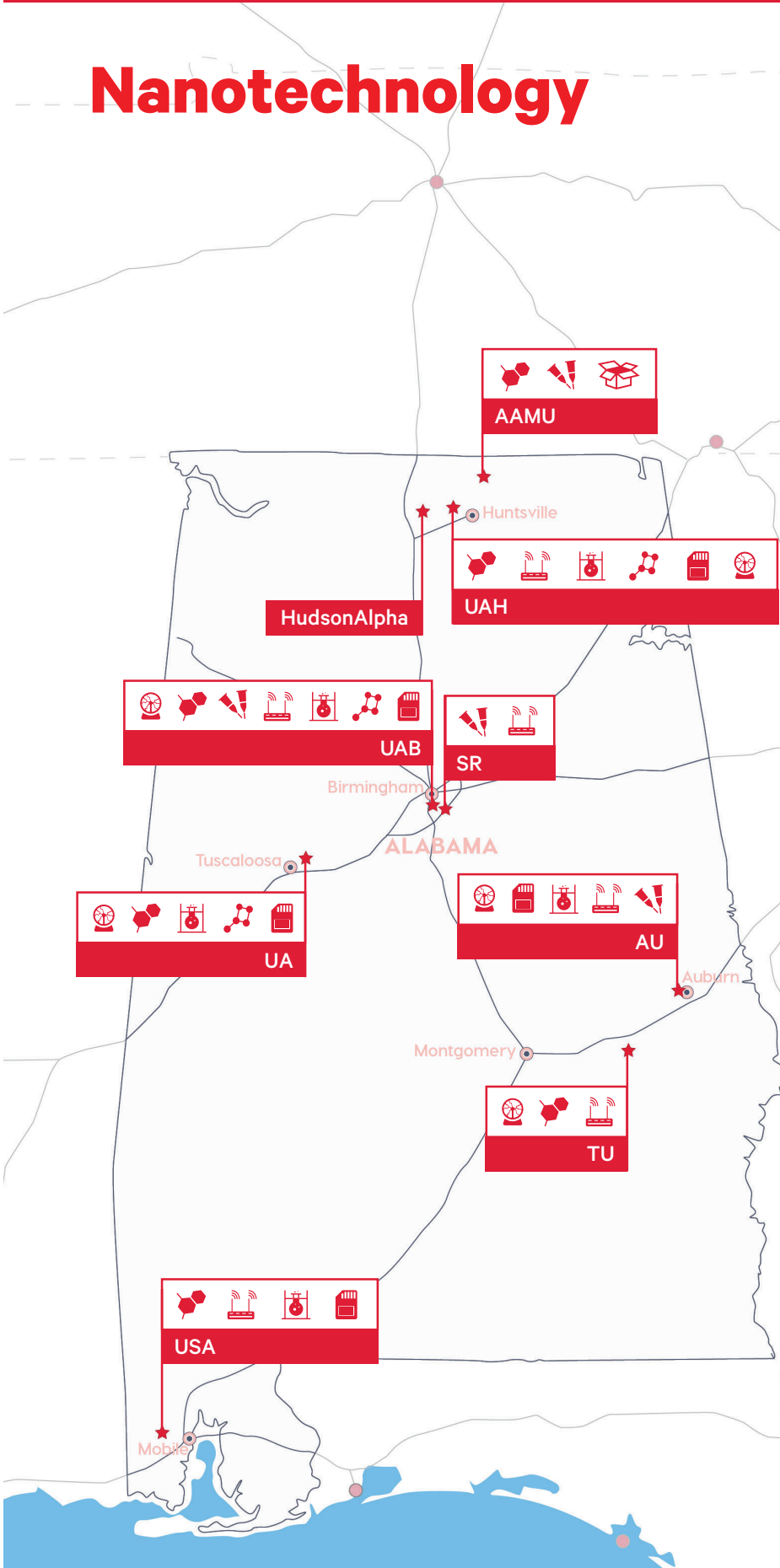


Nuclear Material Safety



Plasma

Nanotechnology



HudsonAlpha

HudsonAlpha Institute for Biotechnology

AAMU

Alabama A&M University

AU

Auburn University

TU

Tuskegee University

UA

University of Alabama

UAB

University of Alabama at Birmingham

UAH

University of Alabama in Huntsville

USA

University of South Alabama

SR

Southern Research



Nano Material Composites & Fabrication



Therapeutics & Drug Delivery



Food Packaging



Sensor Technology



Nanostructures, Particles & Chemistry



Engineered Nano Effects

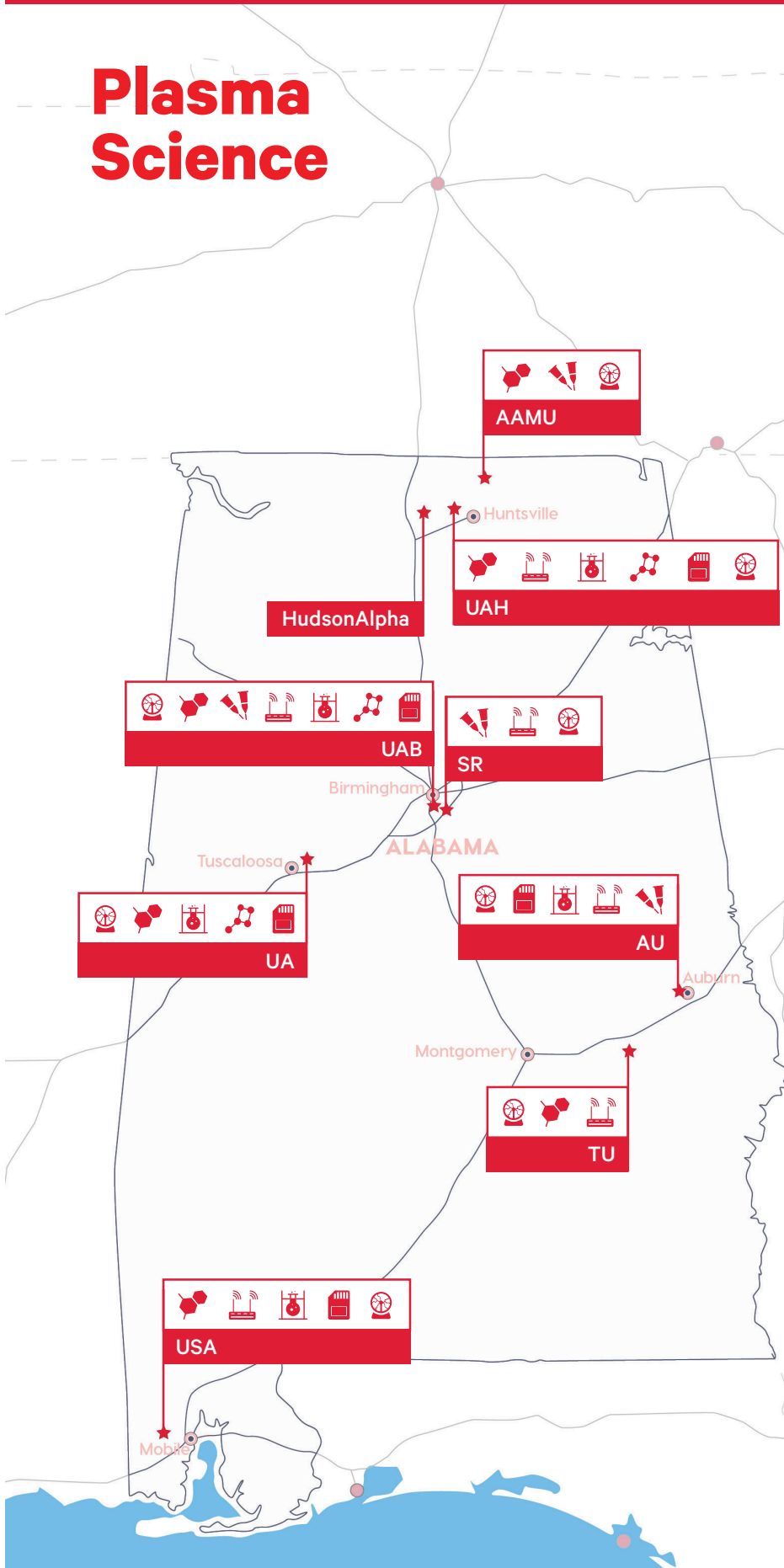


Nanoelectronics



Plasma

Plasma Science



HudsonAlpha

HudsonAlpha Institute for Biotechnology

AAMU

Alabama A&M University

AU

Auburn University

TU

Tuskegee University

UA

University of Alabama

UAB

University of Alabama at Birmingham

UAH

University of Alabama in Huntsville

USA

University of South Alabama

SR

Southern Research



Nano Material Composites & Fabrication



Therapeutics & Drug Delivery



Plasma



Sensor Technology



Nanostructures, Particles & Chemistry

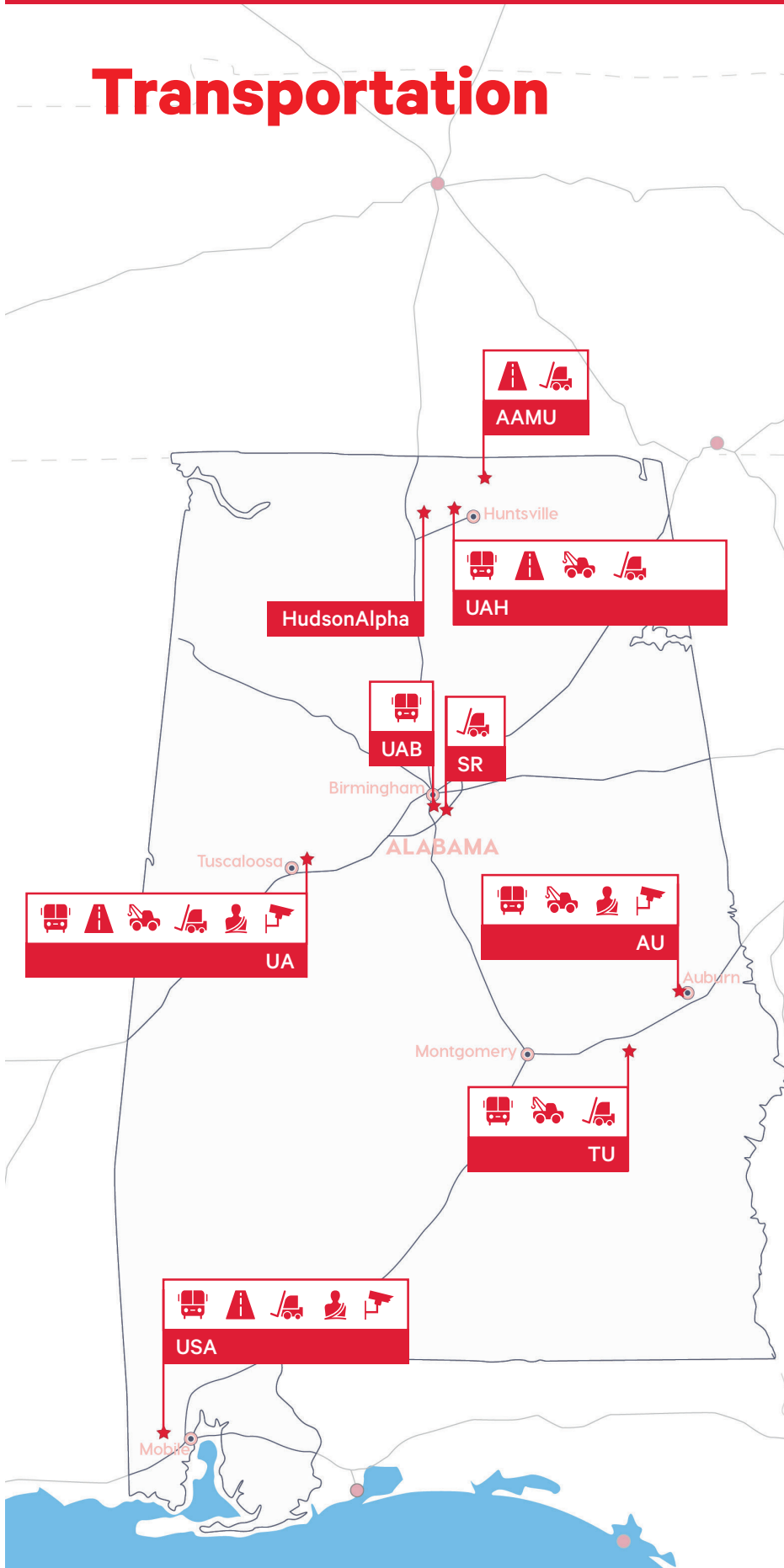


Engineered Nano Effects



Nanoelectronics

Transportation



HudsonAlpha

HudsonAlpha
Institute for
Biotechnology

AAMU

Alabama A&M
University

AU

Auburn
University

TU

Tuskegee
University

UA

University of
Alabama

UAB

University of
Alabama at
Birmingham

UAH

University of
Alabama in
Huntsville

USA

University of
South Alabama

SR

Southern
Research



Intelligent
Transportation



Traffic
Management



Vehicle
Development



Transportation
Related Engineering



Transportation Safety



Road Technology

b. Alabama Research and Technology Database

The research expertise and capabilities data collected from the State's major research institutions are summarized in greater detail in Appendix I, in three levels of increasing detail. At the top level, research expertise across the State has been separated into eleven Primary Target categories described previously.

Each of these Primary Target Categories (see first column of Appendix I) is subdivided into several secondary Sub-Target Categories, each distinguished by a separate color (within the Primary Category). Specific institutional research strengths and capabilities are listed by column according to research institution with each specific capability highlighted in the same color as the Sub-Target Category for the State. As an example, the first Primary Target Category is Agricultural Products/Food Production. The first Sub-Target Category under this Primary Target is Genomics and Biotechnology in yellow, with specific research capabilities listed under HudsonAlpha (third column), Auburn University (fifth column), and Tuskegee University (sixth column).

This Research Capabilities Table will eventually be expanded into an extensive database of major research and development resources for the State. This will include not only expertise, but also physical resources such as, but not limited to, high throughput screening labs for small molecule drug development, resources for additive manufacturing and the manufacture of advanced composites, and facilities to develop high temperature superconductors. This database will facilitate collaboration between and among universities, government labs and businesses in the State, and help minimize duplication of effort. The establishment and updating of this database will be supervised by members of the Alabama EPSCoR Steering Committee and the EDPA Foundation Board working with the Alabama Commerce Department. This group will track the development of new large-scale collaborative projects undertaken in Alabama. The continuing outcome assessment will be essential to determine the effectiveness of this component of the *Renewal* effort.

III. STRATEGIES FOR ENHANCING COLLABORATION

Research institutions throughout Alabama have, from their founding, engaged with their respective communities and regions to address public and private

sector challenges. Whether responding to crises like natural and man-made disasters like the BP oil spill in the Gulf of Mexico, addressing societal issues or economic development opportunities, or contributing expertise to a space race that landed a man on the moon, Alabama colleges, universities and research centers have and continue to play a critical role in the state's growth and prosperity.

For more than a century, the talents of higher education faculty and staff have been leveraged to support community development efforts, education, and training. Experts from academia provide technical assistance to targeted populations; support Alabama business recruitment and expansion efforts; conduct industry-sponsored research and development; and make use of business and faculty knowledge to create innovative products that result in commercialization, increased entrepreneurship, and technology transfer.

Given their extensive existing infrastructures and tradition of engagement, Alabama's research institutions are poised to play an ever increasing role in fostering the state's flourishing knowledge-based economy through strategic public/private sector interactions. Groundwork for these interactions is already being laid in research parks, business incubators, and workforce development efforts throughout the State.

Collectively, we are working to build stronger and better-informed collaborative relationships through extensive engagement with economic developers, civic leaders, state agencies, Chambers of Commerce professionals, and other professional organizations across the region with improved economic development outcomes as our goal. The Alabama EPSCoR Steering Committee is one such collaborative organization where the Vice Presidents for Research (VPRs) representing Alabama's seven Ph.D. granting research institutions meet quarterly with Alabama industry leaders from AT&T Alabama, HudsonAlpha, Southern Research, Alabama Power, Boeing Research, and TVA, as well as, leaders from Alabama Commerce Department, the Alabama Commission on Higher Education (ACHE), and the Economic Development Partnership of Alabama (EDPA). The EDPA Foundation Board is another such collaborative organization where many of these same university and government leaders meet quarterly with Alabama industrial leaders.

Alabama's institutions of higher education have maintained continuously positive relationships with their valued external stakeholders and are now poised to explore creative ways to better serve existing partners and identify new ones. Meaningful partnerships and collaborations are currently on-going between Alabama's research institutions and noted partners such as GE Aviation in Auburn, NASA Marshall Space Flight Center and Redstone Arsenal in Huntsville, and the Mercedes, Honda, and Hyundai automotive plants in Tuscaloosa, Lincoln, and Montgomery, and Airbus and Austal in Mobile, to identify a few. We are committed to strengthening external engagement and economic development efforts, and work strategically and intentionally to build the economy of Alabama and the Southeast.

IV. GROWTH OF ALABAMA R&D

As in industry, universities and laboratories chart their future growth areas. Many of the areas in which universities are investing track well with the Renewal innovations and investments needed by Alabama's small to large businesses and industries. As an example, listed below are some of the stated areas in which Alabama institutions are increasing their investments in faculty, instrumentation and facilities. As shown on the capability table (Appendix I) many universities and laboratories have already developed extensive R&D capabilities in multiple sectors and with the added capacity, Alabama will expand its support for economic growth. Some examples are:

- **Additive Manufacturing/3D /4D Printing:** This effort, which could revolutionize low cost, high throughput manufacturing technology for Alabama, has institutional participants including University of Alabama, Auburn University, University of Alabama in Huntsville, University of Alabama at Birmingham, University of South Alabama, Alabama A&M University, Southern Research and Tuskegee University.
- **Precision and/or Smart Agriculture:** This effort, which could significantly increase Alabama crop yields and reduce costs, includes expertise at Alabama A&M University, University of Alabama at Birmingham, Auburn University, University of Alabama, University of Alabama in Huntsville, and Tuskegee University.
- **Low Temperature Plasma Science and Technology:** This effort, which underpins

the existing aerospace and defense sectors, is finding novel applications within multiple areas including the automotive, health, agricultural, food, plasma medicine, nanotechnology and microprocessor, bio-electrochemistry, and optoelectronics industries from experts at University of Alabama in Huntsville, HudsonAlpha, Auburn University, University of Alabama at Birmingham, University of Alabama, Tuskegee University, University of South Alabama and Alabama A&M.

- **Cybersecurity and Big Data Analytics:** This effort, which could make Alabama a leader in analyzing Big Data and reducing the vulnerability of the nation to cyber-attacks, has experts at Auburn University, University of South Alabama, University of Alabama in Huntsville, University of Alabama at Birmingham, Tuskegee University, and HudsonAlpha.
- **Biosensor Technology Development:** This effort, which could revolutionize biological and medical sensing is primarily centered at Alabama A&M, University of Alabama in Huntsville, Auburn University, Tuskegee University, University of South Alabama, Southern Research and HudsonAlpha.
- **Alternative Energy Systems:** This effort to make Alabama a leader in renewable energy research has experts at Auburn University, Tuskegee University, University of Alabama in Huntsville, University of South Alabama, Southern Research, and HudsonAlpha.
- **Transportation:** This effort to develop creative solutions for improvements in vehicle safety; design, construction and maintenance of roads and bridges; as well as the impact that a quality transportation system has on the state exist at Auburn University, Tuskegee University, University of Alabama, University of Alabama at Birmingham, University of Alabama in Huntsville and the University of South Alabama.

A key component of ensuring the Renewal of Alabama industries is maintaining global competitiveness. Innovation through research and development is critical to Alabama's universities and other research institutions. Equally critical is enhancing Alabama's R&D infrastructure. Listed below are some of the key resources included in strategic roadmaps at Alabama

universities and laboratories. Provided below are examples of one important statewide priority and several institutional priorities:

STATEWIDE PRIORITIES:

Expansion of the Alabama Innovation Fund (AIF): A Statewide priority is the expansion of the Alabama Innovation Fund (AIF). This fund was created by the Alabama Legislature to promote R&D at universities, Southern Research and HudsonAlpha. The AIF has not been consistently funded since it was created in 2012. As described in Recommendation #1 in the Executive Summary, we recommend that the AIF be funded annually at the \$20M level. When fully funded, the AIF will support the recruitment of top tier researchers and R&D funding to enhance the Renewal of Alabama industries and be a primary job creator in the State.

INSTITUTIONAL INVESTMENT PRIORITIES:

University of Alabama at Birmingham (UAB):

Data and Genomic Sciences Building:

Construction of a new research building that will house new investigators studying the genetics underlying personalized medicine and other “big data” subjects and result in an additional \$20 million in grants annually and create hundreds of high-paying jobs.

Alabama Drug Discovery Alliance: Expand the initiative by UAB and Southern Research (and potentially expand to other State universities) leading to new pharmaceuticals and add a lucrative ongoing new revenue stream to support State medical science initiatives.

University of Alabama in Huntsville (UAH):

Engineering Research Building: Construction of a new College of Engineering/UAH Research facility to replace the aging Von Braun Research Hall and College of Engineering buildings to enhance and support state-of-the-art research efforts at UAH.

Auburn University (AU):

Additive Manufacturing Laboratory: Equipment support and staffing to rapidly advance the state-of-the-art Additive Manufacturing Laboratory currently under construction to develop new low cost, high throughput manufacturing technologies.

University of South Alabama (USA):

USA Environmental Sciences Building:

Construction of a state-of-the-art teaching and laboratory building. This will enable the development of solutions to pressing environmental issues, help support and create Alabama’s resilient and sustainable ecosystems, and educate the next generation of environmental scientists and professionals.

Nuclear Genome Technology and Research Center:

An interdisciplinary research group focused on DNA damage and repair, genome sequencing, big data analytics and mitochondrial DNA in metabolic syndrome. Funds would be used to support the recruitment of nationally recognized researchers and research grants, leading to job creation in Alabama.

Alabama A&M University (AAMU):

Science Building: Construction of a new science building that will be used for science educational activities.

Discovery Center: Construct and equip a major co-laboratory where basic Science, Technology, Engineering, and Math (STEM) research activities will be centralized.

University of Alabama (UA):

Alabama Transportation Institute (ATI): Build on the strengths in surface transportation research directed toward solving many of our nation’s transportation problems, particularly in the areas of highway safety, roadway engineering, and automated vehicles. This initiative will consolidate several ongoing efforts at UA by providing a single interface to maintain a broad, interdisciplinary focus that will include every academic unit.

Alabama Water Institute (AWI): Basic and applied research in water, severe weather, and disaster management to solve national and regional water issues including water resource management, severe weather issues including improvements in warning processes and disaster management for emergency responders.

Correct Care Initiative: Provide genome sequencing for the elderly and offer cutting-edge care to senior citizens of Alabama and make Alabama a hub for pharmaceutical companies interested in developing new targeted medical treatments. The funding would allow HudsonAlpha to provide genomic analysis for known genetic markers and work with commercial partners to develop new ones.

Southern Research (SR):

Increased Capabilities for Renewable Energy and Energy Storage: Matching funds over a 3-year period to enhance the infrastructure being established for grid-ready energy storage, creating jobs for testing and development of new technologies.

Bioscience Discovery Building: Matching funds for construction of a new research building on the SR campus to replace 50-year-old buildings to recruit new principal investigators and teams who will drive innovations in infectious disease (including Zika), oncology and CNS research via commercial clients, grants and new drugs.

Tuskegee University (TU):

New Research Building: Perform cutting edge research that will lead to new start-up businesses for the state.

Student Endowments: Tuition support and stipend for 10 graduate students per year and salaries for five postdoctoral fellows per year to support cutting edge research that will create new jobs for the state.

HudsonAlpha Institute for Biotechnology (HudsonAlpha):

Genomics and Pharmacogenomics Core: Provide whole genome sequencing for Alabamians with rare diseases while enhancing the scientific prestige. This program may reduce the cost and make Alabama the first state to offer whole genome sequencing to all babies by 2021 through a combination of government, self-pay, insurance and philanthropy.

Institutional Points of Contact

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Alabama Research Target Areas - Capabilities										
Primary Target Areas	Secondary, Sub-Target Areas	Spring 2016								
		HudsonAlpha	AAMU	AU	TU	UA	UAB	UAH	USA	SR
Advanced Manufacturing (p. 1 of 2)	Modeling and Simulation		Modeling and Simulation	Automotive Process, Systems and Data Analysis	Modeling and Adaptive Control of Electromechanical Systems		Manufacturing Process Simulation			
	Additive Manufacturing									
				Additive Manufacturing, Polymeric	3D Printing with Biocompatible Plastics	3-D Printing / Additive Manufacturing	Additive Manufacturing of Biomedical Implants	3-D Printing/Additive Manufacturing	Printable Electronics	Machine Shop with Broad Capabilities including Rare Materials and Composites
							Additive Manufacturing	Supply Chain Manufacturing		
							Manufacturing Process Optimization and Cost Minimization	Lean Manufacturing		
							UAVs for Infrastructure Safety and Monitoring	Additive Manufacturing		
	Advanced Materials									
				Nano Materials	Polymeric Composites, Fiber Reinforced Composites	Composite Characterization, Development and Processing	Lightweight Composites for Automotive and Aerospace	Concrete Science	Composite Fabrication Capabilities	
			Polymers	High-Temperature Polymer Composites		Long Fiber Reinforced Thermoplastic Materials Processing	Intelligent and Virtual Manufacturing for Composite Materials	Optics and Electro-Optics Manufacturing under ISO and TS for Military Applications		
			Ceramic and Polymer Matrix Composites	Microfluids for Materials Processing		Thin Wall Casting, Lost Foam Casting	Liquid Composites Molding			
			Organic Electronics and Microfibrous Materials			Electrospinning	Green Manufacturing			
Low Temperature Plasma										
						Highway Safety (Roadside Barriers)	Cellulose Nanofiber Extraction			
	Surface Engineering			Nano- and Microparticle Formation and Control	Surface Treatment	Surface Treatment, Surface Ablation	Deposition	Surface Treatment		

Advanced Manufacturing (p. 2 of 2)									
	HudsonAlpha	AAMU	AU	TU	UA	UAB	UAH	USA	SR
Security						Cyber Security for Critical Infrastructure Interdependency and Cascading		Supply-Chain security	
Tribology, Wear and Coatings			Tribology		Tribology, Wear and Coatings			Cybersecure Electronics Manufacturing	
Systems Engineering				Micro-Fabrication and Rapid Prototyping with Multi-Materials	Joining Technology	Spacecraft Thermal Systems	Industrial Control Systems	Seed Structural Engineering	
					Electromechanical Systems		Systems Engineering		
					Embedded Systems		Advanced Robotics		
					Manufacturing Metrology				

Agricultural Products/ Food Production									
	HudsonAlpha	AAMU	AU	TU	UA	UAB	UAH	USA	SR
Genomics and Biotechnology	Plant Genomics/Genetics		Agricultural Biotechnology	Plant Genetics					
	Plant Genome Sequencing								
	De Novo Assembly of Complex Plant Genomes								
Precision Agriculture			Precision Ag	Microirrigation and Enhanced Water Use Efficiency			Multispectral Remote Sensing		
			Disease / Pest Management						
Modeling - Soil, Climate and Water		Soil/Climate Modeling					Atmospheric Science	Atmospheric Science	
							Water Resource Management		
Food Processing Nutrition and Packaging		Food Processing/ Engineering/ Packaging	Food Chemistry and Safety	Enhanced Novel Food Products	Food Processing- Nutrient Content	Food Production			Chemical and Biochemical Testing
		Nutritional Biochemistry		Sustainable Organic Plant and Animal Production		Nutrient Flow Sensing			Toxicology and Reproductive Toxicology/Testing of New Additives and Ingredients
		Food Chemistry and Safety							
Fisheries and Aquaculture								Aquaculture	
								Fisheries	
Agricultural Waste Management								Agricultural Waste Management	
Low Temperature Plasma									
				Nanoparticle Treatment for Polymer Filler Compatibility	Surface Chemistry		Seed Treatment and Food Processing		

Biosciences/ Biotechnology (p. 1 of 3)									
Biomedical Genomics and Informatics					Pharmaceutical Development				
HudsonAlpha	AAMU	AU	TU	UA	UAB	UAH	USA	SR	
Medical Genomics	Nutrigenomics	Omics / Informatics	Gene Discovery		Bio-informatics	Genomics/Transcriptomics	Microbial Metagenomics		
Bioinformatics and Data Analysis		Molecular Medicine			Genomics	Genetics	Population Genetic Analysis		
Genomics		Genomics					Immunotoxicology		
Immunogenomics							Plant Genomics		
							MicroRNA Technologies		
							Novel Reagents to Assess DNA Damage and Repair		
							Silver Nanoparticles in Skin Cancer Prevention		
		Pharmaceutical Engineering	Drug Delivery	Drug Delivery	Nanoscale Materials and Biointegration		Drug Discovery	1 Million Compound Library for New Drug Analysis	
		Drug Discovery / Drug Delivery	Nano-Biomedicine	Nanomaterial Based Diagnostic Systems	Biomaterials			HTS (High Throughput Screening) Capabilities	
								Medicinal/Organic Chemical Synthesis and Combinatorial Design	
								Commercialization Capabilities for New Drugs	
								FDA Regulated Preclinical Capabilities	
								Infectious Disease Screening for New Drugs and Vaccines including Biothreat	
								Preclinical Toxicology	

Biosciences/ Biotechnology (p. 2 of 3)									
	HudsonAlpha	AAMU	AU	TU	UA	UAB	UAH	USA	SR
Patient Care and Clinical Research	Personalized Medicine					Arthritis and Autoimmunity Diagnosis and Treatment			
	Clinical Genomic Medicine					Diabetes and Obesity Research, Nutrition, and Clinical Care			
	Rare Diseases					Disability Health and Rehabilitation Science			
						Basic and Clinical Studies of Aging			
						Pulmonary Diseases			
						Health Disparities Research			
						Patient Outcomes and Comparative Effectiveness			
						Exercise Biology and Medicine			
						Infectious Diseases			
						Visual and Oral Systems			
Biomarker Discovery	Cancer Diagnosis and Prognosis				Bio-Scarfolds			Biomarkers for the Detection of Ovarian Cancer	
	Drug Response and Pharmacogenomics							Biomarkers for the Detection of Pancreatic Cancer	
	Cell Free DNA Analysis							Tissue Engineering	
Disease Models					Tumor Models/Cancer Progression and Therapy Mechanisms	Cancer Diagnosis and Treatment			Relevant Models in Cancer, CNS, Infectious Disease
						Animal Models of Human Disease			Immuno-Oncology Models
	Cancer Biology/	Reproductive Physiology/ Endocrinology				Structural Biology	Evolutionary Biology		
Systems Biology	Brain and Nervous System	Lipid Biotechnology					Microbiology		
	Metabolic Systems	Plant Molecular Biology					Molecular Biology		
	Cardiovascular Disease						Structural Biology		

Biosciences/ Biotechnology (p. 3 of 3)										
Low Temperature Plasma	Agricultural Genomics and Informatics			Waste Water Treatment	Molecular Medicine	Marine Pharmacology	Biomedical Devices and Materials		Remediation and Waste Management	Protein Chemistry and Engineering
		Plant Genomics/Genetics	Plant Genome Sequencing		Broad Genomics and Genetics in Clinical and Research Approaches					HudsonAlpha
	De Novo Assembly of Complex Plant Genomes									AAMU
										AU
				Waste Water Treatment			Biomedical Device Technology	Bio-Sensors and Recognition		TU
							Bio-Robotics and Prosthetics	Bio-Tissue Mechanics	Metallobiochemistry	UA
					Novel Microbiological Approaches		Biosensors	Device Development for Patient Rehab	Synthetic Vaccines	UAB
										UAH
						Marine Pharmacology	Biomedical Devices	Hyperspectral Imaging	Biological Waste Management	USA
								Medical Device Engineering	Microbial Remediation	SR
Nanoparticles Based Cancer Treatment										
Plasma Biology and Medicine										
Cancer Treatment										

Chemical / Petrochemical (p. 1 of 2)											
	Hudson/Alpha	AAMU	AU	TU	UA	UAB	UAH	USA	SR		
Analytical Chemistry			Small Molecule Synthesis		Organic/Inorganic synthesis Chemical Analysis		Analytical	Analytical Chemistry Naturally Chemical Synthesis Environmentally Benign Solvent Systems	Carbon Fuels and Other Chemical Analysis		
Chemical Engineering			Chemical Engineering		Functionalized Membranes for Separations and Reactors			Process Control and Automation			
Petroleum Remediation and Management			Oil Spill Management Petroleum Chemistry								
Computational Chemistry					Computational Chemistry	Computational Chemistry					
Carbon Sequestration				CO ₂ Capture and Storage, Adsorption, Membrane Separation		CO ₂ Sequestration					
Catalysis					Heterogeneous Catalysis	Catalysts and Sensors		Sensors Supercritical Fluids Phase - Transfer Catalysis	Design and Analysis of Catalysts		
Environmental Chemistry and Toxicology					Ionic Liquids			Environmental Chemistry and Toxicology Ionic Liquids			
Surface Chemistry			Surface Chemistry				Surface Chemistry				

Chemical / Petrochemical (p. 2 of 2)									
	HudsonAlpha	AAMU	AU	TU	UA	UAB	UAH	USA	SR
Polymer and Material Chemistry				Polymer Chemistry- Nanoparticle Catalysis, Nanoparticle Synthesis, Cellulose Deconstruction, Small Molecule Synthesis and Characterization; Plant Derived Extracts; Bioactive Compound Synthesis		Polymer Chemistry, Materials Chemistry	Polymers	Materials Chemistry	
Crystallography						Crystallography	Crystal Growth	Chemical Oceanography Crystallography	
Biochemistry	Computational and Structural Biochemistry						Biochemistry		
Medical Chemistry					Medical Chemistry	Drug Design and Development		Adhesive Joints for Composite Materials	
Low Temperature Plasma				Plasma Induced Nanoparticles Synthesis		Microwave Plasma Synthesis and Processing of Superhard Materials	Plasma Induced Chemical Reactions	Combustion For Micro- Thrusters	

Energy (p. 1 of 3)		Hudson/Alpha	AAMU	AU	TU	UA	UAB	UAH	USA	SR
Power Grid Technology		Propulsion Systems			Energy Device Characterizations	Internal Combustion Engines		Power Systems		
					Advanced Vehicle Systems and Components	Traditional and Alternative Fuel Combustion		Propulsion		
				Optimization of Electric Power Systems	Distributed Co-Operative Control, Optimization and Stability of Power Systems	Building Energy and HVAC Systems	Development and Hardware for Systems Resiliency		Smart Grid	Water/Fuel Interface at Power Plant Stage (Cartersville, GA)
					Particle Swarm Optimization Applied to Power Systems				Gas Turbine Technology / Power Generation	
					Renewable Energy Integration and Micro-Grid Simulations					
					Smart Grid Data Analysis					
					Dynamic Co-Operative Distributed Control and Optimization of Power Systems with Integrated Renewable Energy Systems Using Game Theory					
					Particle Swarm Optimization Test Bed for Power Loss in Transmission Lines					
					Hardware-In-The-Loop Simulation of Power Systems/Smart Grid					
					Real-time Statistical Analysis of Smart Grid Data					

Energy (p. 2 of 3)		HudsonAlpha	AAMU	AU	TU	UA	UAB	UAH	USA	SR	
Energy Storage					Fuel Cell Science and Technology	Chemical Approaches to Energy Storage	Solid Oxide Fuel Cell Materials	Advanced Energy Storage	Natural Gas Storage	Solar and Energy Storage for Grid-Ready	
					Conversion of Water into Hydrogen Energy		Energy/Systems Modeling	Industrial Control Systems	Hydrogen Storage		
					Thin Film Super-Capacitors, Light Weight Energy Storage		Power System Protection and Control, Fault Detection Hardware		Ionic Liquids		
					Energy Storage Modeling and Simulation for Renewable Energy Systems				Home Energy Monitoring		
					Radiant Heat Control for Solar HVAC Application				Battery Technology		
					Dynamic Analysis Tool for Renewable Energy/Grid Integration				Rapid Charging Technology		
	Biofuels	Cellulosic Crop and Biomass Genomics	Biofuels (Diesel)	Bioenergy Production and Bioproducts		Bioreactors for Fuel and Fine Chemical Production	Microbiological Energy Production	Energy Efficiency & Environmental Sustainability	Biomass Processing		
		Plant Genomics/Genetics	Biomass Production	Growing and Harvesting Bioenergy Fuels		Alternative Fuels		Biofuels			
		Plant Genome Sequencing									
		De Novo Assembly of Complex Plant Genomes									
Wind and Solar					Conversion of Solar Energy, Mechanical Energy, Chemical into Electrical Energy	Photovoltaic Materials		Photon and Particle Sensing Technology			
					Wind/Photo-Voltaic (PV)/Fuel Cell Modeling, Simulation and Control			Solar/Wind/Hydro Modeling			
					Hardware Validation of Wind/pv/Fuel Cell-Grid Models						
					Wind and Solar Modeling and Energy Prediction						
					Renewable Energy Power Systems Analysis						

Energy (p. 3 of 3)									
	HudsonAlpha	AAUWU	AU	TU	UA	UAB	UAH	USA	SR
Pollution Control								Carbon Capture	Broad Range of Technology and Testing for Air Pollution Control from Fossil Fuels
									Carbon Capture at Power Plant Stage (Wilsonville, AL)
									Fuel and Chemical Production for Waste Streams
Hydro-Carbon Energy			Hydrocarbon Systems					Petroleum Geology	Hg Testing from Fossil Fuels
Modeling and Engineering									
High Temperature Materials			High Temperature Materials						
Low Temperature Plasma									
		Plasma Radiation	Thermal Properties of Plasmas		Satellite Propulsion, Space Systems		Electric Propulsion	Small Satellite Propulsion	

Forestry Products																		
	Hudson/Alpha	AAMU	AU	TU	UA	UAB	UAH	USA	SR									
Atmospheric Science	Water Resources	Water Resources	Water Resources				Water Resources											
										Wildlife Management	Sustainable, Healthy Wildlife Populations				Environmental Engineering	Insect Pheromology		
										Aquatic Ecology	Carbon Sequestration				Genetics			
										Forest Fire Fighting Technology	Environmental Health for Humans				Combustion			
										Forest Ecology	Control of Animal and Plant Invasive Species							
										Ecology	Modeling of Climate Influences on Forests, Wildlife, and People							
											Socioeconomic Factors							
Biofuels and Products	Plant Functional Genomics/Genetics	Wood Products Technology	Expanding Products, Reducing Manufacturing Costs	Lignocellulose Extraction			Natural Products Chemistry											
										Plant Genome sequencing	Biofuels	Lowering Transportation Costs for Bioenergy Feed Stocks	Biopolymers					
										De Novo Assembly of Complex Genomes			Biocomposites					
													Bioenergy/ Biorefinery Technologies, Pulp and Paper Process Engineering					
													Biodiesel From Vegetable Oils with Honeycomb Monolithic Catalysts					
Atmospheric Science							Weather/Climate Models											
										Atmospheric Science								

Information Technology and Cybersecurity (p. 1 of 2)									
	HudsonAlpha	AAMU	AU	TU	UA	UAB	UAH	USA	SR
Security	Bioinformatics and Data Analysis	Bioinformatics					Biometrics		
			Cyber Vulnerability Assessment	Security and Privacy, Wireless Networks, Cyber Physical Systems	Software Reliability and Security	Cyber Security	Software Safety	Smart Grid	
			UAV Security	Network Security	Computer Forensics, Phishing, Signryption, Cloud Security	Server-Area Networking			
			High Performance Computing Intrusion Detection		High Performance Computing	Embedded Systems			
					Device Design for Cyber Security, Signal Processing, Embedded Systems	Digital Forensics			
					Cyber Security of In-Vehicle and Inter-Vehicle Systems	Software Protection			
					Automotive Security/ Smart Car Research	Cloud Security			
						Cyber Physical Systems			
						Security of 3D Printing			
						Voting Systems			
Big Data	Big Data	Big Data	Internet of Things	Big Data Analysis	Data Analytics	Big Data Analytics	Data Mining	Mobile Device Protection	
	Biological Meta Analysis	Data Mining		Data Mining		Internet of Things		Electronic Medical Device Security	
	Bioinformatics and Study Design					Cloud Computing		Supply-Chain Security	
								Malware Analysis	
Artificial Intelligence Machine Learning			Agent-Directed Simulation	Artificial Intelligence, Machine Learning, and Smart Health Networks		Digital Threat for Manufacturing		Machine Learning	
								Ortology	

Information Technology and Cybersecurity (p. 2 of 2)		HudsonAlpha	AAMU	AU	TU	UA	UAB	UAH	USA	SR
Low Temperature Plasma	Software Engineering	Genomics Analysis Pipeline Development						Software Engineering		
		Clinical Genomics Software for CIAA Certified Use						Software Engineering		
		Bioinformatics and Data Analysis						Software Metrics		
				High Speed Imaging and Image Processing						
				High Performance Computing of Atomic Processes in Plasmas						
					Signal/Image Processing, Sensor Data Analytics, Intelligent Systems	Geographic Information Systems		Control Theory		
					Statistical Signal and Image Processing			Image Processing		
					Modeling and Simulation of Systems (Communications, Bio, UAV, Vehicles)			Modeling and Simulation		
					Automatic Target Detection and Tracking			Visualization and Graphics		

Metal and Advanced Materials (p. 2 of 2)										
		HudsonAlpha	AAMU	AU	TU	UA	UAB	UAH	USA	SR
Electronic and Optical Materials						Photonics and Biophotonics	Electronic and Optical Materials	Optics		Optics and Electro-Optics Manufacturing Under ISO and TS for Military Applications
				High Temperature Materials	High Strength Low Alloy Steels		Materials Under Extreme Pressure and Electromagnetic Fields			High Temperature Testing of Materials for Hypersonics
Extreme Materials							High Temperature Ceramic Materials			
			Laser Treatment					Surfaces and Interfaces		Machine Shop with Broad Capabilities Including Rare Materials and Composites
Materials Treatment			Ion Bombardment							
Nuclear Material Safety			Nuclear Material Safety							

Plasma Sciences									
	HudsonAlpha	AAMU	AU	TU	UA	UAB	UAH	USA	SR
Applications of Plasma Science			Laboratory Plasma Experiments	Material Science / Engineering	Material Science / Engineering	Material Science / Engineering	Gas Discharge	Probe Development	
			Probe Development	Chemistry	Gas Discharges	Chemistry			
			Optical Plasma Diagnostics			Gas Discharges			
			Plasma Probe Engineering			Bioscience / Bioengineering	Propulsion		
			Engineering of Optical Plasma Diagnostic Systems				Aerospace		
			Space Plasma		Space Plasma		Space Plasma	Space Plasma	Space Plasma
			Atomic Physics		Material Science / Engineering				
					Chemistry				
			Human Development	Human Development			Human Development	Human Development	
	Plasmonics	Plasmas for Food and Agriculture	Nanoparticle Pattern Formation in Magnetized Plasmas	Plasma Induced Nanoparticle and Polymer Synthesis	Plasmas for Surface Chemistry	Microwave Plasma Synthesis of Superhard Materials	Seed Treatment and Food Processing Applications	Plasma Related Combustion for Micro-Thrusters	
	Plasma Engineering of Surfaces for Manufacturing	Plasma Radiation for Energy Applications	Plasma Erosion of Surfaces	Nanoparticle Based Cancer Treatment	Plasma Surface Interactions	Plasma Based Smart Materials	Plasma Induced Chemical Reactions	Plasma Based Nanodevice Fabrication and Diagnostics	
			Atomic Processes at Plasma-Surface Interfaces	Plasma Surface Treatment for Nanoparticles and Polymers	Plasma Surface Treatments and Surface Ablation for Advanced Manufacturing	Plasma Surface Deposition for Advanced Manufacturing	Plasma Biology and Medicine	Plasma Based Cancer Treatment	
			Plasmas for Nano and Microparticle Formation and Control in Manufacturing	Plasma Surface Treatment for Metals, Alloys, Metal Oxides	Plasma Related Satellite Propulsion and Systems		Plasma Surface Treatments for Advanced Materials and Advanced Manufacturing	Plasmas for Small Satellite Propulsion	
			Plasma Science for High Speed Imaging and Image Processing	Plasma Surface Treatments for Manufacturing			Plasmas for Electric Propulsion		
			Plasma and Atomic Science for High Performance Computing						
			Energy Related Thermal Properties of Plasmas						

Transportation														
Road Technology	Transportation Safety	Transportation Related Engineering	Vehicle Development	Traffic Management	Intelligent Transportation	HudsonAlpha	AAMU	AU	TU	UA	UAB	UAH	USA	SR
								Testing of Electronic Components for Harsh Environment, CAVE3, Center for Advanced Vehicle Electronics for Extreme Environment	Intelligent Transportation	One of the Top Five Test Bed Facilities in the Nation	Vehicle Dynamics and Controls	Traffic Engineering	Route Optimization	
								Autonomous Vehicle Development, Guidance and Control and GPS Systems	Vehicle Sensing and Re-Identification Applications	Test Bed of 85 Radio-Instrumented Traffic Signals	Wireless Sensor and Bridge Weigh in Motion (BWIM) System for Next Generation Infrastructure Safety	Geographic Information Systems		
									Automatic Road Sign Detection for Smart Vehicles	Infrastructure-to-Vehicle Communication Test Bed Research		Simulation		
								Use of the NCAT Test Track for Testing of Vehicle and Fuel Systems	Electric Battery Impedance Measurement Facility	Heavy Equipment Engine Efficiency Combustion		Public Transport	Round-About Design	
								Hybrid Propulsion System for Automobiles		Vehicle Antennas for a Connected-Vehicle Environment		Urban Planning		
												Management Systems		
								Materials Engineering for Transportation Sector: Automotive, Aerospace, Defense and Marine		Timely and Less Costly Roadway Pavement Rehabilitation Techniques		Transportation Engineering	Coastal Engineering	Composites Testing
										Repository and Study Center for Data for Crashes, Roadway Characteristics, Traffic, Driver Credentials, Emergency Response and Patient Treatment		General Civil Engineering		
								Construction Site Work Zone Safety and Erosion and Sediment Control on Construction Sites					Transportation Safety	
								Asphalt Pavement Research		Concrete Pavement Friction and Texture			Bridge Maintenance	
										Reinforced Structural Composites			Infrastructure Resilience	
										Design Prestressed Girders			Bridge Wave Load	
													Highway Runoff Treatment and Management	
													Pile Foundation Setup (Geotechnical)	

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