Progress and Promise: A Blueprint for Diversification and Growth at the NASA Michoud Assembly Facility

Prepared By:

Louisiana Center for Manufacturing Sciences

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Dear Mike:

As President of the Louisiana Center for Manufacturing Sciences (LCMS), I am pleased to send you the study which our organization executed for the U.S. Office of Naval Research to examine assets and opportunities that could lead to an expanded and more diverse manufacturing enterprise at the Michoud Assembly Facility.

“Progress and Promise: A Blueprint for Diversification and Growth at the NASA Michoud Assembly Facility” is the result of several months of research, interviews and analysis by an LCMS team led by Stuart McAvoy of UPS, with support from his UPS colleagues, and significant contributions from other LCMS members, including Radiance Technologies and the National Center for Defense Manufacturing and Machining; from our affiliate member, the Manufacturing Extension Partnership of Louisiana, and from several outside partners who are cited in the report.

As our team discussed with you and your Jacobs/NASA colleagues over the course of our study, we believe that Michoud is well-positioned to contribute in new and significant ways to strengthen the Defense industrial base and thereby to continue to add great value to the Greater New Orleans and Louisiana economy. The presence of the National Center for Advanced Manufacturing alone represents an asset of immense value for Michoud, and NASA’s new flexibility and the strengths of the Jacobs team constitute powerful tools to grow the “new” Michoud.

Our entire team at LCMS is proud to partner with you, and we look forward to a long relationship that will enhance our national security and bring benefit to Louisiana and the Southeast Gulf region.

Sincerely,

Charlie McBride

Att: “Progress and Promise: A Blueprint for Diversification and Growth at the NASA Michoud Assembly Facility”
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Executive Overview

Cancellation of the Constellation program by the Obama Administration, combined with steady budget reductions in NASA programs, has left excess manufacturing capacity at certain NASA facilities. The Louisiana Center for Manufacturing Sciences (LCMS) was tasked by the Office of Naval Research to develop an assessment of the NASA Michoud Assembly Facility’s (MAF) expanded manufacturing potential and to identify specific manufacturing opportunities utilizing MAF’s extensive manufacturing equipment available for the Defense Industrial Base. MAF is currently seeking tenants to utilize the available manufacturing equipment.

Focus of the Study

The focus of the study was to identify NASA Michoud’s current manufacturing systems and capabilities within this facility that can support the manufacturing, repair and overhaul of Unmanned Aircraft Systems (UAS) as well as the Department of Defense (DoD) vehicle mobility reset manufacturing requirements in support of the Prototype Integration Facilities. It was also meant to identify the regional industrial-base capabilities relevant to attracting high-tech manufacturing companies to the NASA Michoud site. It has several key objectives:

- Understand the current equipment and technology capabilities of MAF as it relates to the Defense Industrial Base
- Understand the regional support capabilities for MAF, with particular emphasis on the Stennis Space Center in Mississippi
- Understand what particular areas of the Defense Industrial Base MAF can support
- Determine any gaps that need to be addressed to allow MAF to support these Defense Industrial Base areas

Another dynamic included in this study is the ownership model of much of the manufacturing equipment at MAF. Louisiana Economic Development has purchased in excess of $60 million of high-tech manufacturing equipment for MAF over the years for workforce expansion in Louisiana. This equipment falls under the management of the National Center for Advanced Manufacturing (NCAM) at MAF. NCAM operates under the joint leadership of Louisiana State University and the University of New Orleans (UNO), offering extensive research capabilities through active participation by all engineering schools in Louisiana.

The high-level overview of the study shows that the manufacturing capabilities of MAF are extremely strong to support the Defense Industrial Base. The findings in the study align the MAF capabilities to two main areas to support the Defense Industrial Base. The first is the support of the growing Unmanned Aviation Systems (UAS) industry. This is an area experiencing rapid growth and in need of additional manufacturing and testing support. The maintenance of this UAS equipment can also be facilitated using the MAF model. With the Stennis Space Center partnership, MAF can fill both areas.
The second area is the Defense “reset” mission. With the shrinking defense budget, and as two major wars wind down, more equipment is being refurbished, or reset, to extend the lifecycle of that equipment. The growing number of reset projects also creates a shortage of specialty parts to support those reset efforts. With the use of NCAM and the use of MAF, one strategy is outlined below:

- Dozens of contracts have been awarded for DoD reset
- Challenges exist related to "hard-to-find" parts for reset awards
- Prototype Integration Facilities (PIF) are the Government source for the manufacturing of these parts for award winners
- PIFs look to other sources for many parts where they cannot fill all the needs
- NCAM can reverse-engineer, design, prototype, and test the needed specialty parts
- Manufacturers will be sought to take this design and maintain the manufacturing of these parts, housed at Michoud
- This strategy would work as well for the UAS industry as that fleet ages

The study also outlines the regional and state support capabilities in the workforce area, and outlines the incentives for manufacturers to utilize MAF. The Regional Supply Chain capabilities outlined in the study also represent strengths for manufacturing at Michoud, with the access of rail movement, land transportation movement, deep-water access at MAF, and the regional air capabilities.

**Significant Management Advances at NASA and Michoud**

Thanks to a strong joint effort from NASA, the State of Louisiana, and a management team led by Jacobs Technology, the Michoud facility has made rapid progress in positioning itself to compete for new tenants and meet new and diverse manufacturing demands. Much of the vision for this evolution originated with Michoud’s former chief operating officer, Patrick Scheuermann, who has remained a strong advocate for Michoud through his ensuing service as director of the nearby Stennis Space Center in Mississippi, and now as director of the Marshall Space Flight Center in Alabama.

Mr. Scheuermann understood that Michoud needed to be true to its principal mission of space launch systems, but he also recognized that declining NASA budgets made it imperative that Michoud and other NASA facilities reduce costs and change old business practices to attract commercial companies of varying sizes. He also believed that attracting and growing those technology companies would in fact ultimately be a strong complement to strengthen the agency’s execution of core activities.

NASA has shown increasing willingness to embrace this flexible approach. Gone is the old one-size-fits-all lease pricing model, and gone, too, is a rigid adherence to regulations that
made sense for large single tenants but were potentially crippling to smaller tenants. Acting on a need to monetize excess capacity, NASA as landlord has embraced a commercially competitive pricing structure.

Because of its large presence as a technical-services provider across the NASA network, Jacobs Technology is uniquely suited to perform the role of managing, maintaining and operating the Michoud facility. Jacobs offers the global reach to lure commercial companies and, equally important, the depth to help those tenant companies meet their technology needs. And the Jacobs partnership at Michoud with a prominent New Orleans engineering and software-development company, Geocent, provides a strong liaison with the regional and state business and government sectors.

State and Local Economic Climate

Despite the serious economic impact caused by reduced space-program activities at Michoud, the overall business and governmental climate in the Greater New Orleans region is increasingly strong and attractive as a home for manufacturing companies. An aggressive, concerted effort by state and local agencies has helped to produce an array of specific incentives and an overall climate aimed at making it easy to find and train workers and do business in the region. Forbes Magazine recently hailed Louisiana’s “dramatic economic transformation” and called the state “America’s New Frontier For Business Opportunity.”

The proof is in a series of strong indicators that paint a picture of a regional economy on the move and poised for further growth:

- A Brookings Institution study of 100 large U.S. Metropolitan areas identified Greater New Orleans as having a combination of factors that contribute to the “best economic health” in the country.

- Greater New Orleans was named the No. 1 growing metropolitan area for employment.

- Louisiana was named the most cooperative state government in the U.S, and was ranked in the top five for incentives, economic recovery, speed of permitting, workforce training, cost of doing business, business climate and labor climate.

- Louisiana is among the 10 top states in the country for overall tax competitiveness and was voted by CEOs as the most improved state in the U.S.

A more detailed description of Louisiana’s economic incentives and services for businesses, including its exceptional FastStart program, is contained in the study as Appendix III.

Future Michoud and Gulf Region Opportunities

Although the subject is not addressed in detail in the study, the LCMS team believes that MAF holds great potential as a technical-facility anchor for a discrete initiative that would bring to bear the unique strengths of the immediate Gulf Coast region in advanced manufacturing. The Obama Administration more than a year ago unveiled plans for an extensive National
Network for Manufacturing Innovation designed to focus on different aspects of advanced manufacturing. One LCMS member, the National Center for Defense Manufacturing and Machining, organized and led the 80-member team selected to develop the first such institute, in Youngstown, Ohio.

The Congress will be asked to provide funding for as many as a dozen additional institutes throughout the U.S. Discussions with key manufacturing leadership in both DoD, NASA and other federal agencies have led us to conclude that this is an effort well worth pursuing, with MAF -- alone or with other NASA partners -- at its core.

In summary, MAF is uniquely positioned to support the Defense Industrial Base in the above listed areas. This study is considered a living document, through which LCMS will continue to work with MAF, the MAF site manager Jacobs Technology, NASA, and other DoD entities to determine the best outcome for MAF, and the regional workforce, while supporting the Defense Industrial Base.

Finally, although this study is limited in scope to Defense applications, the authors note the significant opportunities for which Louisiana in general and Michoud in particular are well-positioned in the civilian manufacturing sector, especially in aircraft production. Louisiana, through its active participation in the Aerospace Alliance comprising states along the Gulf Coast corridor, stands to contribute to and benefit from the partnership formed to meet manufacturing requirements that already are growing in the region.

**Louisiana Center for Manufacturing Sciences**

The study is a product of the Louisiana Center for Manufacturing Sciences (LCMS), a consortium which focuses on improving manufacturing efficiencies across the Defense industrial base - including shipbuilding, munitions, armored vehicles, parts replacement and other critical Defense functions. LCMS has a rich history of improving client operations not only in Louisiana and along the Gulf Coast, but across the country. To achieve its goals, LCMS leverages the knowledge and experience of its manufacturing- and technology-based members and key subcontractors.

Since its formation in 1997, LCMS has executed a wide range of projects for the U.S. Army's Research, Development and Engineering Command and for the U.S. Office of Naval Research's Office of Manufacturing Technology. Through the use of more than $70 million in congressionally directed funding, the LCMS team has aided in manufacturing-process improvement for many partners in Louisiana and the Gulf Coast region. At the direction of the Army and Navy, the consortium also has performed similar services in New Jersey, Connecticut, Rhode Island and Washington State.

LCMS is committed to growing its presence at Michoud and to expanding its partnership with government agencies, NCAM and industry tenants at MAF.

- **Consortium Members**
  - UPS Customer Solutions
  - National Center for Defense Manufacturing and Machining (NCDMM)
  - Radiance Technologies
  - Tiburon Associates, Inc.
  - Praeses LLC
• Contributing Partners for MAF Study
  ➢ Capital Technology Group, Inc.
  ➢ The Boeing Company

• Government Partners
  ➢ Office of Naval Research (ONR)
  ➢ Louisiana Economic Development (LED)
  ➢ Manufacturing Extension Partnership of Louisiana (MEPOL)
  ➢ National Aeronautic and Space Administration (NASA)
  ➢ U.S. Army Research Development and Engineering Command (RDECOM)

Background

Michoud Assembly Facility

The Michoud Assembly Facility in New Orleans is a world-class, advanced manufacturing facility providing vital support to NASA exploration and discovery missions. Michoud is perhaps best known for the manufacture of the external fuel tank for the recently terminated space shuttle program. Michoud is a NASA-owned facility managed by the Marshall Space Flight Center (MSFC) and is operated by Jacobs Technology. The 832-acre Michoud campus contains one of the largest production buildings in the United States, with more than 43 acres under one roof.

NASA Michoud continues to be at the forefront of aerospace advanced manufacture and tooling. The many innovative technological approaches and advanced manufacturing techniques deployed at Michoud started with the Apollo program and continued to the manufacture of the space shuttle external tanks from 1973 to 2010. Since 1999, the State of Louisiana, through its National Center for Advanced Manufacturing (NCAM) organization, has made significant contributions through the purchase of state-of-the-art automated fiber placement machines (FPM) and friction stir welding machines. NCAM’s collaborative efforts with the federal government and industry has introduced new manufacturing techniques and procedures to respond to increasing pressures of cost control while ensuring that the manufacturing process continues to meet high flight-safety standards.

In 2007, NASA began to explore moving the Michoud facility from a single-user facility to a multi-tenant operation business model. NASA’s vision saw aerospace manufacturing taking place alongside other new, innovative advanced manufacturing businesses. This new concept would support companies that chose to relocate to the Michoud site to gain access to advanced materials, high-tech advanced manufacturing systems and equipment coupled to state-of-the-art research and development.
NASA’s Michoud Assembly Facility is one of the largest employers in New Orleans, with federal, state, academic and technology-based industry employees on-site. The unique facility serves as home to several government entities, universities and private-sector companies.

**National Center for Advanced Manufacturing – Louisiana Partnership**

The National Center for Advanced Manufacturing (NCAM) – Louisiana Partnership was created in March 1999. In August 2012, the State of Louisiana, NASA, Louisiana State University (LSU), and the University of New Orleans (UNO) committed to a five-year extension of the agreement that now will provide for participation by all the engineering departments of the state’s universities and colleges. All of the universities are connected through a high-speed data network, the Louisiana Optical Network Initiative. NCAM offers three major services:

- Leading-edge manufacturing technology in composite materials
- Leading-edge manufacturing technology in metallic materials
- Modeling and simulation for manufacturing and operation support

NCAM essentially provides a vehicle for NASA tenants to utilize state-of-the-art manufacturing resources through a lease rather than having to invest significant up-front capital to procure the equipment. Below is a list of major equipment types that can be utilized by tenants of the Michoud Assembly Facility. A detailed description of the equipment and of MAF laboratory capabilities is included as Appendix I to the study:

- Autoclave – 10 ft. Diameter
- Fiber placement machines
- Universal friction stir weld systems
- Universal Non-destructive Evaluation (NDE) System
- High-speed gantry machining systems

The friction stir welding process utilizes frictional heating combined with forging pressure to produce high-strength bonds virtually free of defects. Friction stir welding transforms the metals from a solid state into a "plastic-like" state, and then mechanically stirs the materials together under pressure to form a welded joint.

The fiber placement machines are used for the manufacture of complex structures composed of composite materials. The machines feature state-of-the-art robotics and other advanced features to manufacture complex tight radii or multiple-layer components.

The Non-Destructive Evaluation System applies nondestructive evaluation techniques in the testing of composite materials by employing a twin five-axis traveling column configuration and multiple inspection system capability.

The 10’ autoclave functions in support of the advanced fiber placement machines. The autoclave applies heat and pressure in a controlled environment, providing the conditions needed to manufacture many of today’s composite materials.
The high-speed gantry machining systems are able to machine complex components using multi-axis capability. This technology is capable of machining both composite and metal materials.

**Soft Assets**

The soft assets of an organization or facility are defined as the intangible assets (information, brands and reputation) and human resources (people, skills, and knowledge) available within a location. The Michoud Assembly Facility has an extensive list of soft assets centered on people and past practices based on the experience of designing and building the external tanks for NASA’s Shuttle Program. The details of the MAF soft assets follow in the next few sections.

**Manufacturing**

The greatest soft assets at MAF center on the advanced manufacturing and machining knowledge associated with the men and women who have been involved with designing and building major components and integrated systems for NASA. The site has a history of manufacturing specialty parts with complex geometries using traditional and exotic materials in a wide variety of advanced processes including friction-stir welding and composite transformation.

The advanced manufacturing and machining capabilities are further extended thanks to the NCAM’s presence at MAF. The relationship between NCAM and MAF started in 1999 and continues providing support to the tenants of Michoud. The agreement reflects and amplifies NASA’s long commitment to sustaining a strong, technically competent workforce. The MAF tenants are able to benefit from the years of manufacturing excellence through cooperation with NCAM and the associated technical universities in Louisiana.

**Quality**

Over the years the MAF has positioned itself as a leader in quality assurance and control. The quality process understanding present at the facility can be attributed to working on NASA “Space Safe” end products. The discipline established while working on the Shuttle Program is leveraged by each of the tenants present at MAF. Through a variety of training and qualification programs in Lean Six Sigma, Quality Assurance and Process Control, the tenants will continue to manufacture products meeting the International Organization for Standards Quality Management Standard (ISO9001) and Aerospace Quality Management Standard (AS9100) requirements.

**Safety**

The MAF has detailed procedures to keep the people working on-site safe at all times. The required safety training includes lockout/ tag-out, forklifts, rigging, crane, fall protection, hazardous waste and foreign object debris. The training required is based on the employee’s responsibilities in the workplace. There is an expectation that every employee work in a safe manner at all times.
Material Handling Procedures

The MAF provides the tenants a warehouse management system (WMS) capable of real-time web visibility, radio frequency identification (RFID) tracking, and barcode labeling and scanning in an effort to support each tenant’s individual material handling requirements. The MAF has a proven track record of managing and segregating conforming and non-conforming goods for a wide variety of business units. The containment and separation of material goods by the tenant is critical to the operation of a multi-tenant facility.

Michoud continues to expand its asset tracking and visibility capabilities through the investment in RFID technologies and advanced cloud-based solutions. Michoud is piloting an RFID asset tracking solution in the tool crib in the main manufacturing building. This solution automatically links selected RFID tagged hand tool assets to RFID tagged employees or contractors, and captures the asset number, employee number, and date and time information. The captured information feeds to a cloud-based software solution, and ultimately back to the NASA Maximo asset lifecycle and maintenance software. There are plans to expand this asset tracking cloud-based solution to larger material handling assets such as lift trucks, scissor lifts, and other more specialized equipment on a campus-wide basis upon the successful completion of the tool crib pilot. Tenants will be able to benefit from this technology through extremely accurate tracking and visibility of the pool of shared tools and equipment.

Main Manufacturing Building – Building 103

Building 103 serves as the primary manufacturing facility on site and is one of the largest environmentally controlled facilities in the world with 43 acres/two million sq. ft. under one roof. This building is the focal point of the 832-acre campus and contains most of the capabilities mentioned above.
Available Space at Michoud

Building 103 is currently dominated by just a few tenants, including Boeing, Lockheed Martin, NASA, Jacobs, and the film production company Big Easy. The actual footprint of each tenant is dynamic and is subject to change as tenants evolve to either expand or restrict their operations. Currently, several hundred thousand square feet of manufacturing space is available in this advanced manufacturing facility. The figure below is a recent snapshot of each tenant’s footprint in Building 103.

Campus Buildings Availability

The 832-acre Michoud campus contains many other buildings other than the unique Building 103. There is a significant amount of office space, manufacturing, storage, labs, and workshop space available in the other buildings on campus. The usage in these buildings is dynamic and very likely to change as tenants evolve to either expand or restrict their operations.

Campus Capabilities

- 832-acre site
- Interstate access
- Port/harbor facilities
- 27 major utility systems
- 900,000 square feet of office facilities
- 400,000 square feet of warehouse facilities
- 200,000 square feet of site operations
- Nearby railway accessible
- On-site parking (5,300 vehicles)
- 3.8 million square feet of total infrastructure, including deep-water access
Michoud Campus

Manufacturing Capabilities
- 2.2 million square feet of manufacturing space (open high-bay areas)
- Full complement of plant equipment, tooling and skills

Testing Capabilities (component and full-scale)
- Hydrostatic testing
- Structural load testing

Advanced Manufacturing Capabilities
- National Center for Advanced Manufacturing

Regional Market

Stennis Space Center

John C. Stennis Space Center is a multi-disciplinary, multi-tenant facility with more than 30 resident agencies and 5,000 employees engaged in a host of activities, including large data centers, geospatial and earth sciences activities, satellite and rocket assembly and jet-engine testing. Surrounded by a 125,000-acre acoustic buffer zone, it was originally created to test rocket engines for NASA and is where NASA will test the next generation of rockets for space exploration. The 3,900-acre John C. Stennis Space Center Technology Park is designed to attract new government and private entities compatible with the adjoining land use. The park is located in close proximity to I-10 and I-59 with easy access to two commercial airports and three ports. Additionally, it is adjacent to Stennis International Airport (HSA), a general aviation (GA) airport with an 8,500-foot runway.
List of Current Park Tenants:

- Government Printing Office
- Lockheed Martin
- Mississippi Enterprise for Technology
- Naval Oceanographic Atmospheric Administration
- Naval Research Laboratory
- NASA
- National Data Buoy Center
- Pratt & Whitney Rocketdyne
- Rolls Royce
- United States Geological Survey
- United States Navy

3900-Acre John C. Stennis Space Center Technology Park
Unmanned Aircraft Systems Background

The Unmanned Aircraft Systems (UAS) industry could be an excellent fit for the Michoud campus. The UAS industry continues to grow within the DoD [FY 2012 base budget includes $4.8 billion] and is promising to expand, not just in terms of military applications in aerospace and defense, but through the incorporation of technology that will promote other market opportunities for the public and private sectors.

The Association for Unmanned Vehicle Systems International (AUVSI) estimates that over the next 15 years more than 23,000 UAS jobs could be created in the U.S. as the result of UAS integration into the National Air Space (NAS). These new jobs will include positions in industry, academia, federal government agencies and the civilian/commercial UAS end-user community.

New UAS-related employment opportunities could translate into more than $1.6 billion in wages over the next 15 years, or $106.6 million annually. Of the new jobs created via increased UAS access to the NAS, many positions will be in the manufacturing sector. There will also be positions created for UAS pilots and operators, data analysts, software developers, maintenance personnel, and consultants. To keep pace with the expanding technology, the U.S. needs to ensure that in a period of overall reductions, its defense industrial base is strong and able to evolve from traditional defense manufacturing to meet the specialized needs of this vital national-security industry.

Testing – Air Space
Stennis COA Partnership

Currently, the Federal Aviation Administration (FAA) licenses only federal, state, and local governments with the Certificate of Waiver and Authorization (COA). The COA process is available to such public entities like NASA, local law enforcement, and state universities for authorization to fly in the National Air Space. Stennis Space Center, with its existing COA, providing access to the National Air Space, is uniquely positioned to help prospective NASA Michoud clients. Access to a facility with a COA, like nearby SSC, is critical for UAS original equipment manufacturer (OEM), Parts Manufacturer Approval (PMA), and Maintenance Repair Overhaul (MRO) companies. In addition to the SSC COA, companies are attracted to the area by the advanced manufacturing facilities and capabilities that Michoud can offer in conjunction with NCAM.

One clear need are for companies to evaluate their emerging UAS technology or their manufactured UAS products through operational testing and validation flights at low altitude in the NAS; in time, to gain higher altitudes clearance from FAA.

Michoud is strategically located with easy access to Stennis for manufacturing, testing and maintenance of small to medium UAS systems for the OEM/MRO/FAA-PMA companies and larger UAS air frames.

125,000 Acre SSC Buffer Zone (Green), Fee Area and Western Maneuvering Areas (Red)
FAA UAS Test Center Potential for SSC

The Mississippi Chapter of the AUVSI recently responded to the Federal Aviation Administration’s mandate to establish six national test sites to help safely and efficiently integrate unmanned aircraft systems into the National Airspace System. AUVSI-MS is seeking to help the FAA develop refined UAS test-site requirements, designation standards and oversight activities in responding to the Request for Information (RFI). The AUVSI-MS membership is composed of industry, academia, state and local government and non-profit organizations.

It was anticipated that the FAA would issue a Request for Proposal (RFP) by October 2012. However, as the year ended, the FAA had not released the RFP. A growing chorus of elected officials is pressing the agency to resolve privacy concerns and move with dispatch to issue the RFP.

Stennis Space Center is uniquely suited to play this very important FAA test role due to the existence of the pre-established SSC Buffer Zone that offers a large acoustic easement and the accompanying land that provides the capability to operate in a safe environment. Adjacent to the buffer zone is Stennis International Airport, a general aviation airport with an 8,500-foot runway that meets take-off and landing capabilities for all UAS as well as maintenance and engineering and support services.

The U.S. Navy’s new live-fire range in the northwest corner of the SSC acoustic buffer zone has been certified for use of 5.6mm, 7.62mm and .50 caliber short-range training ammunition (SRTA) by Naval Facilities Command. SRTA has a maximum range of 700 meters.

The range will be managed and operated by Special Boat Team 22 (SBT-22) located at SSC. SBT-22 is the only command in the DoD specifically designated to conduct special operations in riverine environments.

Mississippi’s plan will also likely include corridors to the National Guard UAS training area located 90 miles northeast at Camp Shelby (just south of Hattiesburg MS) and corridors to the Whiskey Ranges of Eglin AFB located over the north central Gulf of Mexico. UAS companies located at Michoud will have timely access to these facilities if approved.

Mississippi’s Restricted Airspace R-4403

The R-4403 Gainesville MS (R-4403) was proposed for designation May 1965 per FAA 14 CFR Part 73 requirements. NASA requested the joint-use restricted airspace to protect aircraft from possible explosion hazards, which could occur in the static testing of large-space vehicle stages.

The dimensions of R-4403 are defined by the boundary coordinates at latitude 30° 21’ 02” N, longitude 89° 36’ 53” W; to latitude 30° 22’ 33” N, longitude 89° 36’ 53” W; to latitude 30° 22’ 34” N, longitude 89° 34’ 05” W; latitude 30° 21’ 03” N, longitude 89° 34’ 04” W; to the point of beginning. Altitude of R-4403 is from the surface to 5,000 feet mean sea level (MSL). Time of
use is intermittent, 0600-2300 local time daily; other times by notice to all airmen (NOTAM) 24 hours in advance.

Stennis Space Center also is pursuing restricted airspace for the majority of the Buffer Zone and expects the process to last about a year.

NASA operates and uses ranges for the purpose of launching, flying, landing and testing space and aeronautical vehicles and associated technologies. These range operations often involve substantial hazards that can pose significant risk to life, health and property. To address these hazards, NASA’s Range Safety Program provides for the safety and health of the public, the workforce and property during range operations. This program is supported by the NASA Range Safety Office at Stennis Space Center and involves the efforts of people and organizations throughout NASA.

The Stennis Air Range Safety Office requests that a Flight Request Application be submitted for each aircraft entering Stennis Space Center’s buffer zone and fee area. Each submission will give the SSC Air Range Safety Officer an opportunity to properly schedule and educate the user of the hazards within Stennis Space Center. Key locations at the Center shall be avoided due to increased flight risks to ground hazards (i.e. areas which contain high stores of highly pressurized cryogenic material). The application will allow for security verification of the pilots, passengers and cargo, as applicable. The pilot(s) and/or passenger(s), if applicable, will be given a permit number, via email, to fly into the SSC air space.

**Air Worthiness Certification**

The current FAA Air Worthiness Certification requirements for FAA-PMA and OEM are needed to manufacture UAS parts at the Michoud facility. The FAA Airworthiness standards ensure aircraft are constructed for safe and reliable operation. FAA-PMA is a method that allows qualified sources that are not the original Type Certificate (TC) holder to design and manufacture replacement parts for UAS.

The FAA specifically the Aircraft Certification Office (ACO) of the FAA, is responsible for approving any part design related to commercial aircraft. An OEM is subject to the same regulations to qualify and validate parts as a PMA holder is. An OEM does not approve its own parts.

The FAA’s airworthiness regulations ensure that aircraft will minimize their hazard to people, and property on the ground. Airworthiness is concerned with the material and construction integrity of the individual aircraft and the prevention of the aircraft coming apart in mid-air and/or causing damage to persons or property on the ground. Over the 19-year period from 1982 to 2000, an annual average of 2.2 percent of all aviation fatalities involved people hurt from parts falling off aircraft. A UAS that must be available for unrestricted operations worldwide in most classes of airspace compels serious consideration for the safety of people on the ground. The operational requirements for UAS operation in civil airspace means flight over populated areas must not raise concerns based on overall levels of airworthiness; therefore, UAS standards cannot vary widely from those for manned aircraft without raising public and regulatory concern.

FAA regulations do not require “public aircraft” (government-owned or operated) to be certified airworthy to FAA standards. Most nonmilitary public aircraft are versions of aircraft
previously certified for commercial or private use; however, the only public aircraft not related to FAA certification standards in some way are usually military aircraft.

The three levels of airworthiness are: Level 1 certifies to standards equivalent to manned systems tailored for UAS with catastrophic failure rates no worse than one loss per 100,000 flight hours. Level 2 authorizes to standards less stringent than manned systems with catastrophic failure rates no worse than one loss per 10,000 flight hours. Level 3 authorizes UAS to a minimum acceptable level of safety with catastrophic failure rates no worse than one per 1,000 flight hours.

The FAA has approved a Light Sport Aircraft (LSA) category in the regulations and does not require either airworthiness or pilot certification (similar to Part 103 aircraft) uses or limited operations. These aircraft achieve an equivalent level of safety to certificated aircraft with a slightly lower level of reliability. Many restricted category aircraft perform special purpose operations. The Army’s RQ-7 Shadow and MQ-5 Hunter share similar characteristics and performance. UAS OEMs and TPS of unmanned aircraft of these sized airframes or smaller or usually considered to be equivalent to ultra-lights, LSA, or restricted category aircraft.

As a final case with application to UAS, the FAA has chosen not to explicitly regulate certain other aircraft, such as model rockets, fireworks, and radio-controlled (RC) model aircraft. Title 14 CFR 101 specifically exempts smaller balloons, rockets, and kites from the regulation; and FAA Advisory Circular 91-57 addresses RC model airplanes, but is advisory only. These systems are absent from the regulations. The FAA is moving toward a two-class structure for the NAS: “terminal” and “en route.” Terminal will subsume Class B, C, and D airspace, and en route will include Class A, E, and G airspace.

The FAA categorizes UAS into three categories as defined here:

- **UAS (Cat III).** Capable of flying throughout all categories of airspace and conforms to Part 91 (i.e., all the things a regulated manned aircraft must do including the ability to SAA). Airworthiness certification and operator qualification are required. Global Hawk and Predator are examples of UAS built for beyond LOS operations.
- **UAS (Cat II).** Non-standard aircraft that perform special purpose operations. Medium sized UAS the size of the Army’s Shadow UAS must provide evidence of aircraft airworthiness and operator qualification. Cat II UAS may perform routine operations within a specific set of restrictions.
- **UAS (Cat I).** Analogous to RC models as covered in Advisory Circular 91-57. Operators must provide evidence of airworthiness and operator qualification. Small UAS are generally limited to visual LOS (Line Of Sight) operations and altitude restrictions. Examples include the Raven, Wasp and Dragon Eye.

The FAA codes, regulations, and polices are found in:

**Title 14 Code of Federal Regulations (CFR)**
- Part 1, Definitions, Civil Aircraft, section 1.1
- Part 21, Certification Procedures for Products and Parts
- Part 21, Subpart H, Airworthiness Certificates, Experimental Certificates, sections 21.191 and 21.193
Michoud is well positioned to offer manufacturing space and some of the required systems and equipment to UAS OEM, UAS FAA-PMA, as well as to start-up companies. Also available are Quality Assurance/Quality Control (QA/QC) testing capabilities to support the UAS manufacturer. However, missing are the guidance and training opportunities that would enable small and medium companies to gain the capability to obtain FAA OEM or PMA certification. Without this certification, those companies would not be authorized to manufacture UAS structural items, power plant components, or avionic items in accordance with approved design data or safe operation conditions.

**UAS Maintenance Repair Overhaul (MRO)**

Today, Louisiana is home to 74 airports, seven of which provide commercial service, some 35 Fixed Based Operators (FBO) providing some level of MRO services, and several stand-alone companies. Most of the FBOs are located at general aviation airports.

General Aviation airports in Louisiana contribute over $2 billion or $454 per capita annually to the state’s Gross Domestic Product, which ranks Louisiana seventh in the nation in the importance of aviation to its economy. Also GA airports employ nearly 8,000 Louisianans, who earn over $240.5 million annually. Other aviation and aerospace jobs in the state bring total employment to 11,000 jobs, with $416 million in payroll.

Many FBOs are also FAA certified repair stations. Among Alabama, Louisiana and Mississippi, approximately 105 have capabilities in airframes, power-plant, instrument, radio, propeller, and accessories. In this defined region there are approximately 9,000 certified mechanics and technicians with an annual impact of ~$962M. This provides a strong base of trained personnel to support a new start or satellite division to locate at NASA Michoud site.

MRO industry is rebounding as expected in 2012, with carrier maintenance costs increasing and the aftermarket ramping up once again to take on this increased demand.
One of the primary driving forces has been the ever-increasing complexity of aircraft structures, systems, and components. MRO activities also have increased due to more stringent requirements for avionics and systems upgrades. In addition, economic factors are forcing both civilian and military fleets to rely more on legacy aircraft instead of purchasing of new ones.

Along with this expansion, there has been an increased desire for MRO providers to offer everything from engine maintenance and repair to exterior painting - all under one roof.

The FBOs and stand-alone aviation companies within Louisiana are the support base for UAS companies, and will turn to establishing their initial workforce to populate their expansion or initial startup. Michoud is ideally positioned to support them with their advanced manufacturing capabilities and research and development through NCAM.

Many OEMs are aggressively pursuing the MRO market. For independent MRO providers wanting to gain market share and increase their service capabilities, especially in regard to the parts supply chain, partnering with the OEMs makes sense. OEMs have vast knowledge of system designs and operations, not to mention a broad base of civilian airline and military customers. When linked to an OEM, an MRO provider has direct access to spare parts, technical data and a storehouse of technical expertise.

According to the consulting group, commercial airline engine MRO service will continue to represent the portion of the market most likely to embrace outsourcing over the next few years. With major airlines doing less and less heavy maintenance in-house, it is estimated that 75 to 80 percent of engine checks, repair, and maintenance will be outsourced to MRO contractors by 2017.

MRO services play a vital role in seeing that commercial aircraft remain safe and that commercial airlines remain in business. Today, the United States MRO market for commercial aircraft is over $40 billion and growing. According to industry figures, the market is experiencing a growth rate of almost 4 percent per year, and it could reach almost $68 billion within the next 5 to 10 years.

This rapid growth is creating opportunities for new companies and causing the roles of existing MRO providers to change and evolve. In order to continue to provide efficient resources to the airlines and their affiliates, MRO providers will need to consider taking on new roles, adding value, and working more closely with OEMs, airlines, and other service providers.

**FAA Certificated 14 CFR Part 145 Repair Station**

Independent repair stations account for the majority of the industry’s jobs and economic activity. Repair stations collectively employ 200,000 workers. These companies, the majority of which are small businesses, are closely regulated and receive their “license to do business” (known as a repair station certificate) from the FAA. Repair stations are highly specialized and get better return on investment in training, equipment, facilities, etc. Airlines therefore rely on them to reduce costs while achieving the highest level of safety.
Aviation maintenance in Louisiana:

- Repair stations in Louisiana employ 2,354 workers.
- The aviation maintenance industry (repair stations, plus airline base and line maintenance and parts distribution and manufacturing) employs 2,589 workers in Louisiana.
- The annual impact of repair stations and airline base and line maintenance on Louisiana’s economy is $256.6 million.
- The aviation maintenance industry’s total annual impact on Louisiana’s economy is $292.6 million.

Aviation maintenance in Mississippi:

- Repair stations in Mississippi employ 838 workers.
- The aviation maintenance industry (repair stations, plus airline base and line maintenance and parts distribution and manufacturing) employs 964 workers in Mississippi.
- The annual impact of repair stations and airline base and line maintenance on Mississippi’s economy is $91.3 million.
- The aviation maintenance industry’s total annual impact on Mississippi’s economy is $118.3 million.

Aviation maintenance in Alabama:

- Repair stations in Alabama employ 5,836 workers.
- The aviation maintenance industry (repair stations, plus airline base and line maintenance and parts distribution and manufacturing) employs 6,046 workers in Alabama.
- The annual impact of repair stations and airline base and line maintenance on Alabama’s economy is $615.2 million.
- The aviation maintenance industry’s total annual impact on Alabama’s economy is $656.5 million.

This segment of the aviation industry will be key to attracting UAS, existing-OEM, and new startups to the NASA Michoud site.

**FAA Parts Manufacturer Approval Industry**

Another manufacturing market that NASA Michoud can support is the FAA Parts Manufacturer Approval (PMA) industry,

A PMA part is simply a replacement part, made by an entity that has successfully undergone the FAA’s PMA certification process, but not by the original Type Certificate or Production Certificate holder. (In some cases PMA holders manufacture parts under license for an OEM, which are subsequently branded and sold as OEM parts.)

PMA parts originally were developed to facilitate the transfer of surplus World War II-era aircraft to the civilian market. Many of the aircraft needed parts that were no longer in production to return to airworthy status. Industry and the FAA came together to create the
standards and procedures for a parts manufacturer to become a PMA holder. The standards include the mandate that the replacement part has to be as good as or better than the original part, while the procedures spell out the process for proving compliance with the FAA’s airworthiness standards.

Some major PMA holders also serve as repair stations for the parts they make. They contend that their experience, combined with new technologies and proprietary processes, can give PMA parts an advantage that goes beyond lower cost.

So if PMA parts are "the same or better than the part it seeks to replace" by FAA mandate, how can they cost less? For example, engines are sold on the old “razor blade model,” where you practically give away the razor and make your profit on the blades. The cost of a new engine sold to an air carrier does not support the OEM’s research and development investment. Engines are therefore being sold below their true cost to be produced. OEMs expect to recoup their development costs and make a profit by offering replacement parts at an inflated price. This razor blade model works until somebody else starts to sell the same replacement razor blades. And since an aftermarket manufacturer producing a preexisting part does not have to recoup development costs, it can sell that part for less. Michoud is positioned to provide an even larger margin of profitability to that company upon relocation to its site.

Moreover, the PMA companies can cherry-pick the parts that are going to be lucrative and do not have to spend money on designs that will not be. Thus, these companies are able to profit from making only those parts that the air carriers need the most.

NCAM again is positioned to help the PMA improve their manufacturing processes, thus resulting in lower fabrication costs for aftermarket parts. In cases where the PMA holder is the actual producer of the OEM part, the PMA part simply can be sold without the OEM’s markup.

The cost differential puts the OEMs at a disadvantage in the aftermarket. In the past, the OEMs’ usual response, according to the PMA has been to sow doubts about PMA parts and to warn customers that using such parts could jeopardize warranties and/or the performance of their products.

The final opportunity area is manufacturing and maintenance quality control. NASA Michoud’s long experience in maintaining quality control for the nation’s space programs provides a wealth of knowledge to assist companies looking to expand into the general aviation or more specifically in to the UAS maintenance markets.

Aircraft OEM, MRO and PMA companies all must perform dimensional inspections as accurately and quickly as possible in order to meet strict tolerance standards. To speed measurements, cut down on operator error, and ease the inspection of difficult-to-measure parts, some MRO companies are switching from mechanical instruments to digital measuring systems.

As a result of aircraft complexity, coupled to the needs for them to tolerate harsh conditions and to fit parts into the space allocated, these systems must be held to exact dimensional tolerances. At each step, from tooling to first-article check, every piece of each product is inspected to ensure that the dimensions are within specifications.
Many aircraft manufacturers or repair organizations continue to manually take hundreds of quality measurements using mechanical gauges, surface comparators, squares and rules. Blueprints of design drawings are typically laid out and parts are checked with gauges against blueprint dimensions.

This method is slow and prone to operator error in the form of misread scales or dial indicators. To get accurate, secure readings, technicians have to repeat measurements. Additionally, some key dimensions of complex assembled units are difficult to measure because manual tools cannot always be rotated in and out of specific planes to reach certain points.

Employing digital techniques greatly simplifies inspections because the portable digital measuring arm can articulate freely in all directions. This configuration gives spherical freedom of movement at the measuring tip and in all directions along the length of the arm. The arm approach provides seven degrees of freedom and provides data to a host computer for XYZ location and IJK vector positioning.

A technician takes measurements by touching the stylus of the arm to points on a prototype tool or product. Then, this data is processed by CAM software. As an operator collects data with the arm probe, the software processes the data and literally draws the part or tool as it’s measured. In most cases, the arm and the software sit on the shop floors of manufacturing facilities, providing a continuous link between design and production and instantly validating components as production occurs.

In addition, the stylus arm is able to reach spots that are not easily accessible with manual measuring tools. Engineers and technicians familiar with this digital measurement method estimate that it can reduce the hours spent inspecting parts and assemblies by 50 to 60 per cent. Rework associated with measuring errors has also been demonstrated to drop noticeably.

By helping small and medium sized companies move from manual analog methods to digital computation capabilities, this maintains the quality standards that the aircraft industry requires. The ability to perform manufactured or repair part inspections in three axes significantly simplifies these tasks and saves dollars for a company.

The OEM, FAA-Repair Station and PMA industrial base is strong in the defined region of the Gulf South. Moreover, this area provides the requisite base of personnel, training, and experience to support any company looking to establish a new or satellite manufacturing facility at the NASA Michoud site.

NCAM is a large component in enticing new companies to relocate to this facility. Clearly, they need to continue exploring the latest advanced material technology and structures for enhancing UAV reliability and availability. High temperature materials and light-weight structures can offer significant weight savings for UAV airframes. On the horizon, “smart” materials such as shape memory alloys will offer alternatives to the servos, flight control surfaces, and even de-icing systems of existing aircraft designs, which in turn will reduce components count and increase reliability.
Composites are the material of choice for UAV airframes, regardless of size. The high strength-to-weight ratio, limited radar signature and signal transparency are the main drivers. Since pilot and passenger risk is not an issue, designers have a wider range of possibilities to meet mission objectives. The NASA Michoud/NCAM team can provide the current manufacturing expertise in carbon fiber/Friction Stir Welding and can also help potential new companies meet government and industry standards requirements in the MRO process.

**Local Workforce**

From elementary, through high school and vocational-technical (VOTECH) school to post-graduate degrees, education opportunities in the region abound. Nationally ranked public and private schools are available throughout the area for kindergarten through 12th grade. Community colleges and vocational-technical education schools that teach everything from welding to nursing, sign language to interior design, provide whatever opportunities you might need or enjoy. Nationally ranked universities are present on both sides of the lake, river and state line. Louisiana’s Taylor Opportunity Program for Students (TOPS) provides tuition-free higher education to in-state students with good academic records and test scores.

Louisiana also has in place the Recovery School District (RSD). This is a special statewide school district administered by the Louisiana Department of Education.

Created by legislation enacted in 2003, the RSD is designed to take underperforming schools and transform them into successful places for children to learn. Strategic goals of the RSD are:

- Increase school readiness and prepare children to enter school
- Ensure high academic standards and achievement for all students
- Create a system of autonomous schools that are held accountable
- Actively engage families and community as partners in raising student achievement
- Develop and streamline business practices to ensure efficiency and high standards
- Provide safe, clean modernized buildings and classrooms that are conducive to learning

RSD-supervised schools are located in five areas of the state, with the majority of them in the New Orleans area. Other parishes with RSD-supervised schools are East Baton Rouge, Caddo, Pointe Coupee and St. Helena.

The parishes having the greatest impact on providing a prepared and qualified work force are:

**St. Tammany Parish**

Each year school system personnel garner national, regional and state recognition for outstanding accomplishments, and St. Tammany students are awarded millions of scholarship dollars annually. Grants also totaling millions of dollars are brought into the system by parish educators. *Money* magazine named the district one of the top 100 school systems within the nation’s major metropolitan areas, and seven of its schools are National Schools of Excellence.

**Jefferson Parish**

The Jefferson Parish Public School System is one of the largest districts in the state and is nationally ranked in the top 100 for student enrollment. With 88 schools in Jefferson Parish
and a total enrollment of 44,844 students, the system’s size is a testament to its efficient management and ensures a diversity of extracurricular and academic offerings.

**Orleans Parish**

Schools within the Orleans Parish Public School System are governed by several entities, including the Orleans Parish School Board (OPSB), which directly administers four schools and has granted charters to another 12, and the Recovery School District of Louisiana, which directly administers 33 schools and has granted charters to another 37. New Orleans is the only city in the nation where more than half of all public school children attend charter schools.

**Hancock County, MS**

The schools in Hancock County, home of Stennis Space Center, offers excellent academic, practical, vocational, fine arts, and athletic programs. Moreover, the High School averages an 80% graduation rate – one of the highest in the state of Mississippi.”

Area schools offer quality public, private and parochial education opportunities, accredited by the Mississippi Department of Education, and secondary schools accredited by the Southern Association of Colleges and Schools (SACS).

**Higher Education**

A large number of institutions of higher education exist within the region, including Tulane University and Loyola University New Orleans and William Carey University in Mississippi, the region’s three biggest private universities. The University of New Orleans is a large research university, while Dillard University, Southern University at New Orleans and Xavier University are among the leading historically black colleges in the United States. Our Lady of Holy Cross College, Notre Dame Seminary and the New Orleans Baptist Theological Seminary are among religiously affiliated universities in the region.

**Community Colleges**

The community colleges in the state have the fastest growing student body. They have placed a renewed emphasis on technology programs to meet the growing demand from industry. The colleges that make up the Louisiana Community and Technical College System are:

- Acadiana Technical College
- Baton Rouge Community College
- Bossier Parish Community College
- Capital Area Technical College
- Central Louisiana Technical Community College
- Delgado Community College
- L.E. Fletcher Technical Community College
- Northshore Technical Community College
- Northwest Louisiana Technical College
- Nunez Community College
- River Parishes Community College
- South Central Louisiana Technical College
- SOWELA Technical Community College
Higher Education Research

Louisiana universities have cooperated with each other to create exceptional computational capabilities to do materials research for the private sector. Experts at LSU, Grambling, Louisiana Tech, UNO, Southern, Tulane and Xavier have combined their efforts to create a network of materials science research capabilities available to businesses. The project is called the Louisiana Alliance for Simulation-Guided Materials Applications (LA-SiGMA), and it is the result of the largest National Science Foundation grant ever awarded to Louisiana ($20 million). This was a competitive grant, and the LA-SiGMA team won it over powerful research groups across the country. LA-SiGMA scientists are available to do research for the business community at a level beyond most businesses. The research focus is mainly on the predicted performance of various materials. The LA-SiGMA team members can create, and have actually created, incredibly complex numerical models to accurately predict the behavior of materials under specific conditions.

Manufacturing Extension Partnership of Louisiana

The Manufacturing Extension Partnership of Louisiana (MEPOL) improves the productivity and profitability of manufacturers and other firms through training and consulting at both the organizational and shop floor levels. MEPOL is part of a national network of centers throughout the United States, with specialties in productivity improvements, product innovation, rapid prototyping and polymer materials testing. MEPOL provides basic and advanced training in lean manufacturing, quality, leadership and innovation management. Offerings are approved by the Louisiana Incumbent Worker Training Program.

The state is well positioned to assist any company, small, medium or large, to quickly and effectively develop a rigorous program to identify and establish the required training programs to provide a superior work force to support any company moving to the NASA Michoud location. When one combines its capabilities with FastStart, LA-SiGMA, and the newly expanded NCAM, one can clearly see all the tools are in place to meet its workforce needs.

Infrastructure

Infrastructure is the basic physical and organizational structures needed for the operation of a society or enterprise, or the services and facilities necessary for an economy to function.

"Hard" infrastructure generally refers to the large physical networks necessary for the functioning of a modern industrial nation, whereas “soft” infrastructure refers to all the institutions which are required to maintain the economic, health and cultural and social standards. The greater New Orleans area is a major United States port and the largest city and metropolitan area in the State of
Louisiana. The population of the city was 343,829 as of the 2010 U.S. Census. The New Orleans–Metairie–Bogalusa Combined Statistical Area had a 2010 population of 1,214,932.

Ground Transportation

Highways: Major highways in the area include Interstate 10, Interstate 12, Interstate 610, Interstate 310, Interstate 510, Interstate 55, Interstate 59 as well as U.S. Highway 90 and U.S. Highway 61. The Lake Pontchartrain Causeway, a 24-mile (39 km) span that is the world’s longest bridge over water, connects Metairie to Mandeville on the North Shore.

Railroads: Metropolitan New Orleans is served by all six Class 1 freight railroads operating in North America. Passenger train service is provided by Amtrak on the Crescent, City of New Orleans and Sunset Limited routes.

Ground Supply-Chain Reach

The ability to distribute goods is important. When sending goods to land-locked locations, ground transportation tends to be the most economical.

Looking at small package ground shipping, the bulk of the Midwest is served within three business days. Most major metropolitan areas in the U.S. are served within four business days. All of the United States is served within five business days.

Water Transportation

The port and water transportation system in Louisiana is expansive, diverse and sophisticated. There are 28 active and five developing ports in Louisiana, serving a wide variety of needs. Louisiana has five of the largest ports in the United States. Ports can generally be divided into four categories -- inland ports (13), shallow-draft ports (9), deep-draft ports (6), and developing ports (5). Overall, goods worth approximately $223B move through these ports.

Port of New Orleans: The Port of New Orleans is at the heart of the world’s busiest port complex Louisiana’s Lower Mississippi River. Its proximity to the American Midwest via a 14,500-mile inland waterway system makes New Orleans the port of choice for the movement of cargoes such as steel, rubber, coffee, containers and manufactured goods. The Port of New
Orleans itself is the third largest port in the United States, as measured by total bulk tonnage exported.

Other major ports in the greater New Orleans area include:

- Port of Southern Louisiana
- St. Bernard Port
- Ports of Terrebonne, Venice and Fourchon
- Port of Jefferson Parish and Plaquemines

**Air Transportation**

The largest airport in the Greater New Orleans area is Louis Armstrong New Orleans International Airport (IATA: MSY). MSY is a Class B public-use international airport located in Jefferson Parish, Louisiana. It is owned by the city of New Orleans and is located 10 nautical miles (19 km) west of its central business district.

In 2011, Louis Armstrong International Airport served 8,382,236 passengers.

Cargo providers operating out of MSY include Ameriflight, FedEx Express and UPS.

Other airports within a 150-mile radius include:
• Baton Rouge Airport (BTR) - Baton Rouge, LA (66 miles)
• Gulfport Biloxi Regional Airport (GPT) - Gulfport, MS (77 miles)
• Lafayette Regional Airport (LFT) - Lafayette, LA (105 miles)
• Mobile Regional Airport (MOB) - Mobile, AL (129 miles)

**Warehousing**

In early 2011 there was over 6.7M-square feet of available warehouse inventory in the greater New Orleans area.

<table>
<thead>
<tr>
<th>Area</th>
<th>Q4 2010</th>
<th>Q1 2011</th>
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</thead>
<tbody>
<tr>
<td>Central Business District</td>
<td>1,331,707</td>
<td>1,197,900</td>
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<td>New Orleans East</td>
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<td>1,184,558</td>
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<td>Elmwood/South Metairie</td>
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<td>Kenner</td>
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<td>North Metairie</td>
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<td>St. Charles/St. John</td>
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<tr>
<td>Westbank</td>
<td>970,272</td>
<td>1,113,048</td>
</tr>
<tr>
<td>Greater New Orleans Area</td>
<td>6,692,986</td>
<td>6,755,495</td>
</tr>
</tbody>
</table>

**Healthcare**

Quality health care is widely available to insured residents of the greater New Orleans region. With four major hospitals and strong medical schools, New Orleans is a viable option for those with and without serious health care needs alike. Following the closure of Charity Hospital—which cared for the majority of uninsured patients in the area, options for this population are limited. New Orleans EMS response times are similar to national averages.

**LSU/VA Medical Complex:** Through a partnership with LSU and the U.S. Department of Veterans Affairs, New Orleans plans to house one of the premier teaching hospitals in the country—the new University Medical Center in conjunction with the Veterans Affairs Medical Center. Slated for completion in 2013, this complex will feature the most advanced technology available, cutting-edge diagnostic and treatment areas, 424-bed UMC, a non-profit, will encompass a wide range of services focused on creating healing environments that support patients and their families. Equally important, the new hospital will serve as a major training center for the education of medical professionals for generations to come.
Supply Chain

LCMS is aware of the numerous obstacles in a client’s Supply Chain. A non-optimized Supply Chain can lead to excess costs and inferior service. The potential for these issues to increase is magnified when relocating an operation.

There are several definitions of supply chain management in the marketplace, but the one that LCMS follows when working with clients is that supply chain management is “the managing the flows of good, information and funds from product conception to consumption in a cost effective and efficient manner”. LCMS helps clients synchronize both the physical and electronic flow of activities to achieve a positive impact on clients’ asset utilization as well as service to their customers.

Below is a depiction of the many moving parts of a supply chain that should be considered for optimization.

![Supply Chain Diagram](image)

LCMS has extensive experience and expertise in optimizing the supply chains for clients in the defense industry including several shipbuilders on the Gulf Coast. When engaging with clients, LCMS seeks initially to understand the current operational challenges and business goals. From this review, a needs analysis is developed where potential opportunities for improvement and estimated savings are returned.

LCMS supply chain projects use a combination of industry and proprietary tools and approaches to best capture and analyze relevant data so as to make impactful steps in improving the supply chain.

Army Repair/Reset Background

Since 2007, the Army has spent roughly $54 billion (DoD IG Report) for reset - the repair, recapitalization or replacement of equipment - and is expecting to retrograde additional amounts of equipment for reset as a result of the drawdown of U.S. forces from Afghanistan.

Some argue that the drawdowns will actually increase the need for logistics and supply chain as the DoD organic capability redeploy. During the next 10 years of budget austerity, existing platforms will need to last longer and will require robust programs for recap/reset, modifications, and upgrades. This is especially true for the Army’s land systems; some
estimate that this equipment from the two wars alone will cost billions of dollars over several years. This will fall to private contractors, and it will represent an ever-increasing share of their job-base growth.

A key to the reset program is the required reverse-engineering of vehicle parts. In many cases, the DoD did not secure the rights of the manufacture design specifications, which now impacts its ability to engage third party vendors that would allow for lower costs than the OEM. Meeting this challenge will require a programmatic approach to gaining the technical manufacturing data through laser-scanning cloud-point database development in a cost effective manner. This approach is ideally suited to working with companies contracted to conduct the various reset programs and lacking the required technical data to manufacture missing or damaged parts on the vehicles. LCMS member organizations offer a depth of personnel and expertise in innovative manufacturing technology and processes. That, combined with the strengths of NCAM, enables Michoud to offer a capability to attract those companies selected by the DoD to perform under reset contracts.

**Defense Logistics Agency**

The Defense Logistics Agency (DLA) reports to the Deputy Under Secretary of Defense for Logistics and Materiel Readiness. The DLA provides worldwide logistics support for the missions of the military departments and the Unified Combatant Commands.

Since September 11, 2001, the DLA has seen a military buildup requiring the agency to expand its vast network of capable manufacturers, both OEM and non-OEM. Because of stringent but necessary procurement requirements, the DLA lacks sources for a wide variety of manufactured components. The DLA Internet Bid Board System (DIBBS) is a web-based bid board that allows vendors to search for, view, and submit secure quotes. Occasionally, the DLA is left with a long list of “hard to source” parts, particularly in cases in which the OEM is no longer in business or the responsible party did not purchase the technical data package. These parts are then outsourced to a PIF for production, and in the event that no suitable vendors are identified through DIBBS, the DLA is forced to pursue alternate sources.

The DLA developed a process that allows vendors to present alternate offers and source approval requests. An “Alternate Offer” is a package of data, which can be submitted for evaluation against an active Solicitation. This alternate offer is reviewed and potentially qualifies the company as an “Approved Source” in future procurements. The Source Approval Request (SAR) package contains all the technical data needed to demonstrate that the prospective contractor can competently manufacture the Critical/Weapon System Item to the same level of quality or better than the system prime contractor, major subsystem contractor or initial Approved Source.

The DLA also has a process for working with the organic manufacturing community, whether it be the depots, arsenals, air logistics centers, or shipyards, which allows these government entities to pursue the “hard to source” part manufacturing opportunities. Despite these efforts, a considerable number of part manufacturing opportunities go unfilled. Consequently, our Warfighters are not getting adequate support it in theater.

The DLA is a logistics combat support agency with a primary role of providing supplies and services to America’s military forces worldwide. Essentially, DLA procures equipment for the
DoD. If industrial base suppliers cannot be found or cannot provide the equipment required in a timely manner, DLA may request production of parts from Depots and/or PIFs.

The vast manufacturing capabilities and capacities at Michoud present an opportunity to manufacture and produce components for DLA currently categorized as “hard-to-source.”

**Prototype Integration Facility**

The Research, Development and Engineering Command Prototype Integration Facility organizations include the following six organizations:

1. The Armament Research, Development and Engineering Center (ARDEC) Materials, Manufacturing and Prototype Technology (MM&PT) Division, headquartered at Picatinny Arsenal, NJ.

2. The Aviation and Missile Research, Development and Engineering Center (AMRDEC) Prototype Integration Facility, headquartered at Redstone Arsenal, AL.

3. The Communications-Electronics Research, Development and Engineering Center (CERDEC) Quick Reaction and Battle Command Support (QR&BCS) Division, headquartered at Aberdeen Proving Ground, MD.

4. The Edgewood Chemical Biological Center (ECBC) Advanced Design and Manufacturing (ADM) Division, headquartered at Aberdeen Proving Ground, MD.

5. The Tank Automotive Research, Development and Engineering Center (TARDEC) Center for Ground Vehicle Development & Integration, headquartered (CGVDI) at Detroit Arsenal, MI.

6. The Natick Soldier Research, Development and Engineering Center (NSRDEC) Shelters Technology Engineering & Fabrication Directorate, and Warrior Protection & Aerial Delivery Directorate, both headquartered at Natick, MA.

The mission of the PIFs is to provide rapid acquisition, development, fielding, and sustainment of technology, including engineering, manufacturing, integration, qualification and delivery of hardware within all stages of a systems lifecycle.

The six PIFs utilize their comprehensive engineering capabilities to strengthen and increase rapid and seamless support to the Warfighter while developing manufacturing-ready processes from initial prototypes through Limited Rate Initial Production. The organizations leverage their organic expertise to position the Government as a smart buyer. The PIF generates positive schedule impacts and cost avoidance through maintaining data integrity for on-going support of projects in the absence of industry, integrating engineering and manufacturing to help modernize and maintain equipment, and acting as transition and validation authority for immediate consideration of on-going solutions and capabilities that need to get fielded. This manufacturing engineering core competency integrates advanced mission solutions into weapons systems in support of the Depots, Arsenals and Industrial Base suppliers. These services and functionalities are provided directly or through RDECOM Science and Technology (S&T), Program Executive Officer/Program Manager (PEO/PM),
Army Material Command (AMC) and DLA as well as other Government agencies that directly support the Warfighter.

The PIF model is represented in the following diagram:

Capabilities of the PIFs

1. The ARDEC MM&PT Division provides an integrated design and manufacturing engineering capability, conducting rapid response prototyping on production-ready processes. MM&PT focuses on maturing manufacturing readiness by developing, demonstrating and transitioning affordable manufacturing processes within the industrial base. MM&PT uses model-based enterprise manufacturing processes within a digital environment in support of ARDEC’s vision of providing innovative armaments solutions to the Warfighter.
2. The AMRDEC PIF has the mission of rapidly equipping the Warfighter in support of current operations, prototype development, modifications and upgrades, sustainment, and bridging technology gaps in DoD requirements. The product offerings include: design solutions, mechanical piece parts, circuit card assemblies, cable harnesses, electromechanical devices, platform integration of complex systems, kitting operations, re-set and refurbishments, field support, trade studies, logistics support, drafting Modification Work Orders (MWO), and new source qualifications.

3. The CERDEC Command and Control Directorate (C2D), Quick Reaction and Battle Command Support Division provides engineering design, development, fabrication, installation, integration, testing and fielding of shelter, vehicular, aircraft, watercraft and soldier prototype Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) systems. The QR&BCS Division also identifies, develops (where appropriate) and demonstrates inexpensive and innovative new technologies for application to our core business areas.

4. The ECBC performs scientific, engineering, and technical functions for the design, development, testing, production, fielding, engineering sustainment, and disposal of Chemical Biological Defense (CBD) systems in support of the National Defense Strategy and the CBD Program. ECBC has configuration management responsibilities for a wide array of legacy, current, and new CBD systems. ECBC performs the System Manager role for assigned items. ECBC performs the Research and Development Acquisition Logistics functions for new and/or developing items as designated by the Joint Program Executive Office or Joint Program Managers. The ECBC ADM division provides PIF support for the ECBC CBD mission as well as rapid response support for current operations.

5. The TARDEC CGVDI develops, fabricates and integrates advanced solutions into current and future ground systems. CGVDI serves as a single entry point to RDECOM for ground vehicle system integration projects, as well as for managing cost, schedule, performance and risk. This includes TARDEC-led capabilities which include: vehicle electronics and architecture, power and mobility, intelligent ground systems, maneuver support & sustainment, and survivability, as well as capabilities led by other RDECOM elements.

6. The NSRDEC Shelters Technology & Fabrication Directorate, Design Engineering & Fabrication; fabricates prototypes and conducts small run production for items in the areas of rigid wall shelters, tents & fabric covers, mechanical aerial delivery parts & components, and kitchens & combat feeding items. The Warrior protection and Aerial Delivery Directorate Fee-for-Service Division, designs and fabricates clothing, parachute, and aerial delivery textile material prototypes.

The PIFs are working on an effort to establish a framework for cooperative efforts among the PIFs in order to forge an alliance that will result in mutually acceptable decisions to fully leverage the experience, expertise, and technological capabilities of each. The intent is to maintain and enhance the mission capabilities and performance of the PIFs through a teaming approach to develop and accomplish common goals and coordinated projects. The PIFs would benefit from leveraging the manufacturing and testing capabilities and capacities available at Michoud. Past efforts have been executed to demonstrate the interoperability
between the PIFs and NASA as it related to manufacturing goods. The project proved that the Michoud Assembly Facility could meet the design and quality requirements of the defense industrial base. The advanced capabilities of the PIFs, coupled with the manufacturing and test capabilities and capacities at Michoud, would create a partnership that would become a great asset to the DoD and the defense industrial base.

The mission of the PIFs is to provide rapid acquisition, development, fielding, and sustainment of technology, including engineering, manufacturing, integration, qualification and delivery of hardware within all stages of a systems lifecycle.

**Rapid Prototyping**

Rapid prototyping is a group of techniques used to quickly fabricate a scale model of a physical part or assembly using three-dimensional computer aided design (CAD) data. Manufacturers can use a wide variety of tools to manufacture these prototypes, including numerous three dimensional (3D) printing techniques and CNC machine tools. These manufacturing approaches can be used as needed based on the requirements of the prototype. The 3D printing approaches have made significant advancements over the past 25 years, and are now able to produce fully functional prototype and test parts that can be placed in service and evaluated. These advancements have dramatically reduced the cost to design, evaluate and manufacture new products.

Rapid prototyping has also become an important technology as it relates to the DoD. Often, the DoD is challenged with finding replacement parts for critical systems that have not been manufactured in years. Having the ability to scan a part using a laser tracker or similar device which then generates point-cloud data, which in turn is translated to a 3D CAD file, has significantly reduced the cost and time required to manufacture these parts and assemblies.

The ability to create finished parts directly from digital input is a breakthrough technological advancement, and the same principles used to quickly manufacture replacement parts have given designer and product managers the freedom to design and produce products containing solid parts that may have intricate geometries and finishes that are not possible using conventional subtractive processes. In short, digital data drives low volume production without tooling or molding. With this direct digital manufacturing process, the speed and design freedom allow for huge advances in product development and the products themselves.

NASA Michoud is a premier anchor in advanced aerospace manufacturing, and this experience, coupled with on-site systems and equipment makes it an ideal site to attract companies seeking help and support with their manufacturing requirements. LCMS has the experience and capabilities to establish a bridging organization to help attract commercial manufacturing companies to the NASA Michoud facilities. LCMS will work with Jacobs Technology and NASA-Michoud to identify candidate companies requiring the various government manufacturing certification qualification and work with them through their initial Low Rate of Initial Production phase. Clearly, with the right support mechanism in place NASA Michoud can realize its goal of becoming an advanced manufacturing multi-tenant facility.
## Glossary of Acronyms and Initials

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<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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<tbody>
<tr>
<td>3D</td>
<td>Three Dimensional</td>
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<tr>
<td>ACO</td>
<td>Aircraft Certification Office</td>
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<td>ADM</td>
<td>Advanced Design and Manufacturing</td>
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<tr>
<td>AES</td>
<td>Atomic Emission Spectrometry</td>
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<tr>
<td>AMC</td>
<td>Army Materiel Command</td>
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<tr>
<td>AMRDEC</td>
<td>Aviation &amp; Missile Research Development and Engineering Center</td>
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<tr>
<td>ARDEC</td>
<td>Armament Research Development and Engineering Center</td>
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<tr>
<td>AS9100</td>
<td>Aerospace Quality Management Standard</td>
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<tr>
<td>AUVSI</td>
<td>Association for Unmanned Vehicle Systems International</td>
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<tr>
<td>BTR</td>
<td>Baton Rouge Airport</td>
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<tr>
<td>C2D</td>
<td>Command and Control Directorate</td>
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<tr>
<td>CAD</td>
<td>Computer-Aided Design</td>
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<tr>
<td>CAM</td>
<td>Computer-Aided Manufacturing</td>
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<tr>
<td>CBD</td>
<td>Chemical Biological Defense</td>
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<tr>
<td>CERDEC</td>
<td>Communications-Electronics Research Development and Engineering Center</td>
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<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
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<tr>
<td>CGVDI</td>
<td>Center for Ground Vehicle Development and Integration</td>
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<td>CID</td>
<td>Collision-Induced Dissociation</td>
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<tr>
<td>CNC</td>
<td>Computer Numerical Control</td>
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<tr>
<td>COA</td>
<td>Certificate of Authorization</td>
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<tr>
<td>COTS</td>
<td>Commercial Orbital Transportation Services</td>
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<tr>
<td>CPS</td>
<td>Composite Programming Software</td>
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<tr>
<td>CRS</td>
<td>Congressional Research Service</td>
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<tr>
<td>CTG</td>
<td>Capital Technology Group</td>
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<tr>
<td>DIBBS</td>
<td>DLA Internet Bid Board System</td>
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<td>DLA</td>
<td>Defense Logistics Agency</td>
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<td>DoD</td>
<td>Department of Defense</td>
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<td>DOF</td>
<td>Degrees of Freedom</td>
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<td>DoN</td>
<td>Department of Navy</td>
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<tr>
<td>DSC</td>
<td>Differential Scanning Calorimeter</td>
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<td>DSRC</td>
<td>DoD Supercomputing Resource Center</td>
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<td>EDI</td>
<td>Electronic Data Interchange</td>
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<td>ECBC</td>
<td>Edgewood Chemical Biological Center</td>
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<td>FAA</td>
<td>Federal Aviation Administration</td>
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<td>FBO</td>
<td>Fixed Based Operators</td>
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<td>FID</td>
<td>Flame Ionization Detector</td>
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<td>FPM</td>
<td>Fiber Placement Machine</td>
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<td>FTIR</td>
<td>Fourier Transform Infrared</td>
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<td>GA</td>
<td>General Aviation</td>
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<tr>
<td>GC</td>
<td>Gas Chromatography</td>
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<tr>
<td>GPC</td>
<td>Gel Permeation Chromatography</td>
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<td>GPT</td>
<td>Gulfport Biloxi Regional Airport</td>
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<td>GTA</td>
<td>Gas Tungsten Arc</td>
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<tr>
<td>HEPA</td>
<td>High Efficiency Particulate Air</td>
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<tr>
<td>HP</td>
<td>Horse Power</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<td>HPLC</td>
<td>High Performance Liquid Chromatography</td>
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<td>HSA</td>
<td>Stennis International Airport</td>
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<td>HSK</td>
<td>Hollow Shank Taper</td>
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<tr>
<td>IC</td>
<td>Ion Chromatography</td>
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<tr>
<td>ICP</td>
<td>Inductively Coupled Plasma</td>
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<tr>
<td>IDIQ</td>
<td>Indefinite Delivery Indefinite Quantity</td>
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<tr>
<td>IG</td>
<td>Inspector General</td>
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<td>IR</td>
<td>Infrared</td>
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<td>Kilowatt</td>
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<td>LA-SiGMA</td>
<td>Louisiana Alliance for Simulation-Guided Materials Applications</td>
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<td>LCMS</td>
<td>Louisiana Center for Manufacturing Sciences</td>
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<td>LED</td>
<td>Louisiana Economic Development</td>
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<td>LFT</td>
<td>Lafayette Regional Airport</td>
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<td>LLC</td>
<td>Limited Liability Corporation</td>
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<td>LONI</td>
<td>Louisiana Optical Network Initiative</td>
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<tr>
<td>LRIP</td>
<td>Limited Rate Initial Production</td>
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<td>LSU</td>
<td>Louisiana State University</td>
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<tr>
<td>M&amp;P</td>
<td>Materials &amp; Process</td>
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<tr>
<td>MAF</td>
<td>Michoud Assembly Facility</td>
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<tr>
<td>MEPOL</td>
<td>Manufacturing Extension Partnership of Louisiana</td>
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<tr>
<td>MissiON</td>
<td>Mississippi Optical Network</td>
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<tr>
<td>MM&amp;PT</td>
<td>Materials, Manufacturing &amp; Prototype Technology</td>
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<td>MOB</td>
<td>Mobile Regional Airport</td>
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<tr>
<td>MRO</td>
<td>Maintenance Repair Overhaul</td>
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<td>MSL</td>
<td>Mean Sea Level</td>
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<td>MSD</td>
<td>Mass Selective Detector</td>
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<td>MSFC</td>
<td>Marshall Space Flight Center</td>
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<tr>
<td>MSY</td>
<td>Louis Armstrong New Orleans International Airport</td>
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<td>MWO</td>
<td>Modification Work Order</td>
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<td>NAS</td>
<td>National Air Space</td>
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<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
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<td>NCAM</td>
<td>National Center for Advanced Manufacturing</td>
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<td>NCDMM</td>
<td>National Center for Defense Manufacturing and Machining</td>
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<tr>
<td>NDE</td>
<td>Non-Destructive Evaluation</td>
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<tr>
<td>NOTAM</td>
<td>Notice to All Airmen</td>
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<tr>
<td>NORBP</td>
<td>New Orleans Regional Business Park</td>
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<td>NPD</td>
<td>Nitrogen Phosphorus Detector</td>
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<td>NSRDEC</td>
<td>Natick Soldier Research Development and Engineering Center</td>
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<tr>
<td>OEM</td>
<td>Original Equipment Manufacturer</td>
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<td>ONR</td>
<td>Office of Naval Research</td>
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<td>OPSB</td>
<td>Orleans Parish School Board</td>
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<td>PAUT</td>
<td>Phased Array Ultrasonic Testing</td>
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<tr>
<td>PEO/PM</td>
<td>Program Executive Officer/Program Manager</td>
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<tr>
<td>PIF</td>
<td>Prototype Integration Facility</td>
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<td>PMA</td>
<td>Parts Manufacturer Approval</td>
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<tr>
<td>PSI</td>
<td>Pounds per Square Inch</td>
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<tr>
<td>PSIG</td>
<td>Pounds per Square Inch Gauge</td>
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<tr>
<td>QA</td>
<td>Quality Assurance</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>QC</td>
<td>Quality Control</td>
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<tr>
<td>QR&amp;BCS</td>
<td>Quick Reaction and Battle Command Support</td>
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<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
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<td>RDECOM</td>
<td>Research Development and Engineering Command</td>
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<td>RFI</td>
<td>Request for Information</td>
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<td>RFID</td>
<td>Radio Frequency Identification</td>
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<td>RFP</td>
<td>Request for Proposal</td>
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<td>RLMA</td>
<td>Regional Labor Market Area</td>
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<td>RPM</td>
<td>Revolutions per Minute</td>
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<td>RSD</td>
<td>Recovery School District</td>
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<td>RTV</td>
<td>Room Temperature Vulcanization</td>
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<td>S&amp;T</td>
<td>Science &amp; Technology</td>
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<td>SAR</td>
<td>Source Approval Request</td>
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<tr>
<td>SBA</td>
<td>Small Business Administration</td>
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<tr>
<td>SBT</td>
<td>Special Boat Team</td>
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<tr>
<td>SDN</td>
<td>Software-Defined Networking</td>
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<td>SRTA</td>
<td>Short-Range Training Ammunition</td>
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<tr>
<td>SSC</td>
<td>Stennis Space Center</td>
</tr>
<tr>
<td>TARDEC</td>
<td>Tank Automotive Research Development and Engineering Center</td>
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<tr>
<td>TC</td>
<td>Type Certificate</td>
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<tr>
<td>TCD</td>
<td>Thermal-Conductivity Detector</td>
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<tr>
<td>TGA</td>
<td>Thermal Gravimetric Analysis</td>
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<tr>
<td>TMS</td>
<td>Transportation Management System</td>
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<tr>
<td>TOPS</td>
<td>Taylor Opportunity Program for Students</td>
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<tr>
<td>TPS</td>
<td>Thermal Protection System</td>
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<tr>
<td>UAS</td>
<td>Unmanned Aircraft System</td>
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<tr>
<td>UNO</td>
<td>University Of New Orleans</td>
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<tr>
<td>UPS</td>
<td>United Parcel Service</td>
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<tr>
<td>USDA</td>
<td>United States Department of Agriculture</td>
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<tr>
<td>UT</td>
<td>Ultrasonic Testing</td>
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<td>UTRS</td>
<td>Universal Technical Resource Services, Inc.</td>
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<tr>
<td>VPDA</td>
<td>Variable Polarity Plasma Arc</td>
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<tr>
<td>VOTECH</td>
<td>Vocational-Technical</td>
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<tr>
<td>WMS</td>
<td>Warehouse Management System</td>
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<tr>
<td>XPS</td>
<td>X-Ray Photoelectron Spectroscopy</td>
</tr>
</tbody>
</table>
Appendix I – Equipment List

Universal Friction Stir Weld System 6 Axis (UWS1)
NCAM owned

- 16 ft. x 21.5 ft. x 10 ft. XYZ travels
- 2 axis of gimbal motion weld head
- 30 ft. rotary table or 6 ft. rotary table (table-on-table)
- Large scale complex contour friction stir weld capability
- Self-reacting pin tool capability
Universal Friction Stir Weld System (UWS2)
NCAM owned

- MTS Systems 6 axis of motion weld head
- 40 ft. 10 in. (X) x 22 ft. 8 in. (Y) x 12 ft. 2 in. (Z) of linear motion
- 2 axis of gimbal motion of the weld head
- 22 ft. rotary table with one rotational degree of freedom
- 40 ft. x 20 ft. flat weld area with T-slots
- Self-reaction pin tool technology
- Combined axis of motion allows for complex curvature welding
- Latest controller/programming system
- Floor level turntable
- Self-reacting pin tool capability
Universal Friction Stir Weld System (RWT3)
NCAM owned

RWT3 has two weld machines that share the common X-axis with the following specifications:

- MTS Systems 6 axis integrated weld system
- 2 axis of gimbal motion of the weld head; pitch: +5° to 95°, roll: ±15°
- Three 20 ft. annular ring rotary tables, each with one rotational degree of freedom
- Capable of fixed pin / retractable pin / self-reacting Friction Stir Welds
- Combined axis of motion allows for complex curvature welding
- Control system provides coordinated motion for all 7 axis of the UWS3
- 20 ft. outer diameter, 15 ft. inner diameter annular turntables with unlimited rotary motion and locking capability
- Three floor level turntables
- Two columns each with an independently operated weld head
- 7 degrees of freedom (DOF) delivered through 5 physical axis
- Work envelopes of each weld machine:
  - X-axis – 93 ft
  - Y-axis – 22 ft, 5 in
  - Z-axis – 12 ft
- Large scale complex contour friction stir weld capability
- Self-reacting pin tool capability
Fiber Placement Machine #1 – 7 axis (FPM1)
NCAM owned

FPM1 is used for the manufacture of small to medium-scale complex structures composed of composite materials. It features state-of-the-art robotics with a next generation delivery head, able to manufacture complex tight radii components previously undoable by other fiber placement machines.

- 7-axis, 24 tow, bi-directional capability
- Used in manufacture of small to medium-scale structures
- Work envelope 8 ft. high x 20 ft. long
- 450°F head maximum lay down temp
- 40,000 lb. maximum mandrel weight
- “Domes on” capability
- Advanced dexterity, streamlined head
- Capable of complex shapes and female tools
- Advanced Composite Programming Software (CPS) offline programming
  - 16.4 ft. x 40 ft. part capacity (80,000 lb.)
  - 24 tow, bi-directional, 450°F head
  - Cantilevered tool and “Domes on” capability
The 7-axis Large Scale Advanced Fiber Placement Machine is used for the manufacture of large-scale, complex-shaped structures composed of composite materials. This machine uses state-of-the-art robotics to place composite material onto a tool surface in multiple layers. The machine features high temperature and “domes on” capabilities.

- 7-axis, 24 tow, bi-directional capability
- Used in manufacture of large-scale structures
- Work envelope 16.4 ft. high x 40 ft. long
- 450°F head maximum lay down temp
- 80,000 lb maximum mandrel weight
- Cantilevered tool and “domes on” capability
- Offline programming and simulation software
- Double material redirect system at the head
- Closed loop programmable systems (nitrogen, heating, compaction force, tow tensioning)
- Add and drop tows “on the fly” (min. 250 in. /min.)
- High temperature capability
- 8 ft. x 20 ft. part capacity (40,000 lb.)
- 24 tow, bi-directional, 500°F head
- "Domes on” capability
- Advanced dexterity, streamlined head
- Capable of complex shapes and female tools
- New advanced CPS offline programming software
Placement Machine Enclosure
NCAM owned

Both of the FPMs are located in an enclosure with the following features:

- Temperature controlled at 70°F, ± 5°
- 45% Relative Humidity, ± 5% humidity control
- Two 20-ton bridge cranes
- Two 20 ft x 20 ft roll up doors
- 2,500 sq. ft. (roughly 111 ft x 22.5 ft) preparation / lay-up area outside of the “pit” where the FPMs are located

Additionally, a 20 ft x 30 ft freezer for the storage of resin pre-impregnated fiber on spools is attached to the FPM enclosure. It will maintain a temperature range of -10 to 0°F. Currently the freezer’s capacity is completely used with NASA material.

Universal NDE System –10 Axis – NCAM owned
NCAM’s Non-Destructive Evaluation System applies nondestructive evaluation techniques in the testing of composite materials by employing a twin 5-axis traveling column configuration and multiple inspection system capability.

- Twin 5-axis traveling column configuration
- 24 ft. diameter x 12 ft. x 10 ft. of XYZ travel
- Multiple inspection system capability:
  - Pulse echo Ultrasonic Testing (UT) inspection
  - Through transmission UT inspection
  - Spectroscopy inspection
  - Manipulation of a 37 element Jentec eddy current probe for weld inspection
**Autoclave – 10 ft. Diameter**

NCAM owned

The 10 foot autoclave located at NCAM functions in support of the Advanced Fiber Placement Machines. The Autoclave applies heat and pressure in a controlled environment, providing the conditions needed to manufacture many of today’s composite materials. The 10 x 20-foot autoclave cures parts made from the fiber placement machines and other composite manufacturing processes.

- 10 ft. dia. x 20 ft. long
- 200 pounds per square inch (psi)
- 525°F
- PC based controls and data collection
- Self-reacting pin tool technology
- Combined axis of motion allows for complex curvature welding
- Latest controller/programming system

**Pressure Capabilities:**

- Pressurizing medium: Nitrogen (200 psi max.)
- Pressure control accuracy: ± 2 pounds per square inch gauge (psig)
- Pressurizing rate: 0-10 psi/min
- Vent rate: 0-15 psi/min

**Temperature Capabilities:**

- Design temperature: 525°F max.
- Constant temperature control accuracy: ± 5°F
- Heating medium: Electric
- Minimum heating and cooling rate (average free air): 10°F/minute, ambient to 525°F
- Temperature uniformity of working space: ± 5°F at steady state
- Cooling medium available: cooling water at 85°F and Plant Air
- Maximum Set point Overshoot: 10°
High-speed Gantry Machining System – 5 Axis (HSMC1)
NCAM owned

- The HSMC1 is a 5-axis, machining system that is able to machine complex components using multi-axis capability. This technology is capable of machining both composite and metal materials.
- Forest-Liné high speed milling Gantry, Minumac, 5-axis
- 23 ft. x 11 ft. x 5 ft. of XYZ travel (8 ft. under the spindle)
- 24,000 revolutions per minute (RPM), 60 horse power (HP) spindle
- 790 inches/minute feed rates
- Siemens 840D CNC control w/Siemens digital drives
- Hollow Shank Taper (HSK) type high-speed tooling system w/20 position automatic tool changer
High-speed Gantry Machining System – 7 Axis (HSMC2)
NCAM owned

- 32.8 ft. x 13.0 ft. x 11.4 ft. of XYZ travel
- C-axis (Head Rotation) ± 400 Degrees
- A-axis (Spindle Rotation) ± 110 Degrees
- 984 in. /min. feed rates

The HSMC2 is an Ingersoll Horizontal Milling Machine PowerMill H 4.0 with two axis milling head, horizontal rotary table, and headstock/tailstock.

- X axis (longitudinal travel of the column): driven by rack and double preloaded pinions
- Y axis (vertical travel of head saddle): driven by two ball screws with double preloaded nuts
- Z axis (ram): driven by ball screw with double preloaded nut
- A & C axis: tilting and rotation of 2 axis head
- Headstock/Tailstock with maximum swing of 18 feet
- 20 ft. diameter rotary table
- Milling head with variable frequency motor spindle and digital drive
- Digital drives for all axes
- Feedback by Heidenhain linear scales: resolution of .001 mm (.00004”)
- 40 positions tool magazine
- Laser tool probe
- Part probe
- Siemens 840D controller
- Spindle Data
  - Two axis head for aluminum and composite materials
  - 80 kilowatt (kW) (108 HP) – 24,000 RPM high speed spindle
  - Tool Taper HSK 63 B
  - Tool Clamping Force 1,800 daN 3,960 lbs
  - Spindle Speed 500 – 24,000 RPM
  - Maximum Spindle Power available from 12,000 RPM: 80 kW (108 HP)
  - Maximum Spindle Torque up to 12,000 RPM: 63.7 Nm (45.9 ft.lbs)
Machine Shops
MAF-owned

MAF contains 37 machine shops on site dedicated to machining all shapes and sizes of aluminum, steel and composite structures. The largest of these shops is nearly 40,000 square feet. The broad range of equipment included in these shops is considered a shared resource for use by MAF’s tenants either on an as-needed or a dedicated basis.

The machine shop has multiple capabilities including two 5-axis mills, a 4-axis mill, three horizontal mills, a 3-axis vertical mill (230 inch travel), four small vertical mills, two CNC vertical turret lathes, several manual lathes, a grind shop, and a sheet metal shop.

- MAF machine shops includes equipment such as:
  - Lathes (small, medium, large, vertical, CNC)
  - Mills (small, medium, large, large CNC),
  - Grinders, saws and a full complement of sheet metal forming tools (sanders, shears, presses, rollers)
- Computer Numerically Controlled (CNC) Equipment
- Computer-Aided Design (CAD) / Computer-Aided Manufacturing (CAM) capability
- Five (5)-ton bridge crane coverage with 32 ft.-hook height

Equipment List

**Small Lathes – MAF owned**

<table>
<thead>
<tr>
<th>Brand</th>
<th>Model</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colchester</td>
<td>VMO 782</td>
<td>1</td>
</tr>
<tr>
<td>Monarch Lathe</td>
<td>610</td>
<td>1</td>
</tr>
<tr>
<td>Monarch Lathe</td>
<td>EE</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

**Large Lathes – MAF-owned**

<table>
<thead>
<tr>
<th>Brand</th>
<th>Model</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Century-Detroit</td>
<td>CD-RT216-PMPR</td>
<td>1</td>
</tr>
<tr>
<td>Niles</td>
<td>27 foot 27/42</td>
<td>1</td>
</tr>
<tr>
<td>Niles</td>
<td>40 foot</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

**Vertical Lathes – MAF-owned**

<table>
<thead>
<tr>
<th>Brand</th>
<th>Model</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bullard</td>
<td>VTL 54” CUTMASTER 54</td>
<td>1</td>
</tr>
<tr>
<td>Bullard</td>
<td>VTL 64” CUTMASTER 64</td>
<td>1</td>
</tr>
<tr>
<td>G&amp;L</td>
<td>VTL 54” 514</td>
<td>1</td>
</tr>
<tr>
<td>Lagun-Republic</td>
<td>VMC-6030</td>
<td>1</td>
</tr>
<tr>
<td>Monarch</td>
<td>VMC175B</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>5</td>
</tr>
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</table>
### CNC Lathes – MAF-owned

<table>
<thead>
<tr>
<th>Brand</th>
<th>Model</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cincinnati Milacron</td>
<td>AT/1210</td>
<td>1</td>
</tr>
<tr>
<td>HAAS Lathe</td>
<td>SL-10T</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

### Small Mills – MAF-owned

<table>
<thead>
<tr>
<th>Brand</th>
<th>Model</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridgeport</td>
<td>INT4</td>
<td>1</td>
</tr>
<tr>
<td>Bridgeport</td>
<td>Series I</td>
<td>1</td>
</tr>
<tr>
<td>Bridgeport</td>
<td>Series II</td>
<td>1</td>
</tr>
<tr>
<td>Clausing/Kondia</td>
<td>FV-300</td>
<td>1</td>
</tr>
<tr>
<td>Clausing/Kondia</td>
<td>TYPE FV-300</td>
<td>2</td>
</tr>
<tr>
<td>Kearney &amp; Trecker</td>
<td>2D</td>
<td>1</td>
</tr>
<tr>
<td>Lagun-Republic</td>
<td>DLX3L</td>
<td>1</td>
</tr>
<tr>
<td>Lagun-Republic</td>
<td>SPEC.NO.RFI880 REV.A</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>

### Medium Mills – MAF-owned

<table>
<thead>
<tr>
<th>Brand</th>
<th>Model</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cincinnati Mill</td>
<td>330-18DP</td>
<td>1</td>
</tr>
<tr>
<td>Cincinnati Mill</td>
<td>425-20</td>
<td>1</td>
</tr>
<tr>
<td>Cincinnati Mill</td>
<td>430-18DP</td>
<td>1</td>
</tr>
<tr>
<td>Cincinnati Mill</td>
<td>450-20-DP</td>
<td>1</td>
</tr>
<tr>
<td>Cincinnati Mill</td>
<td>550-20</td>
<td>1</td>
</tr>
<tr>
<td>Cincinnati Mill</td>
<td>550-20DP</td>
<td>1</td>
</tr>
<tr>
<td>Kearney &amp; Trecker</td>
<td>550TF-20</td>
<td>1</td>
</tr>
<tr>
<td>Pratt &amp; Whitney Mill</td>
<td>4E</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>

### Large CNC Mills – MAF-owned

<table>
<thead>
<tr>
<th>Brand</th>
<th>Model</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Devlieg</td>
<td>72&quot; 54K-72</td>
<td>1</td>
</tr>
<tr>
<td>Devlieg</td>
<td>96&quot; 5K96</td>
<td>1</td>
</tr>
<tr>
<td>GE</td>
<td>Computer/Keypad X2000CNCGCS Monarch 75</td>
<td>1</td>
</tr>
<tr>
<td>Giddings &amp; Lewis</td>
<td>Control Cabinet 505-05371-20</td>
<td>1</td>
</tr>
<tr>
<td>Giddings &amp; Lewis</td>
<td>HBM</td>
<td>1</td>
</tr>
<tr>
<td>Giddings &amp; Lewis</td>
<td>Orion LMMSS SPEC. RF1232</td>
<td>1</td>
</tr>
<tr>
<td>Giddings &amp; Lewis</td>
<td>PC-50 FANUC 1601</td>
<td>1</td>
</tr>
<tr>
<td>Gray Planer</td>
<td>Type 1</td>
<td>1</td>
</tr>
<tr>
<td>Monarch</td>
<td>VMC75</td>
<td>1</td>
</tr>
<tr>
<td>Sunstrand</td>
<td>OM-3 / OM-3-69</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>10</td>
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</tbody>
</table>

### Sanders – MAF-owned

<table>
<thead>
<tr>
<th>Brand</th>
<th>Model</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hammond Grinder</td>
<td>1000-VW VERT.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>1</td>
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</table>

### Shears – MAF-owned

<table>
<thead>
<tr>
<th>Brand</th>
<th>Model</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Famco Shear</td>
<td>1052</td>
<td>1</td>
</tr>
<tr>
<td>Lodge &amp; Shipley</td>
<td>606</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>
**Grinders – MAF-owned**

<table>
<thead>
<tr>
<th>Brand</th>
<th>Model</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasive Grinder</td>
<td>1000-D Monarch</td>
<td>1</td>
</tr>
<tr>
<td>Abrasive Grinder</td>
<td>3B Leblond</td>
<td>1</td>
</tr>
<tr>
<td>Arter Grinder</td>
<td>B-30</td>
<td>1</td>
</tr>
<tr>
<td>Balder Grinder</td>
<td>153M</td>
<td>2</td>
</tr>
<tr>
<td>Bijor Grinder</td>
<td>R8</td>
<td>1</td>
</tr>
<tr>
<td>Brown &amp; Sharp Grinder</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Cincinnati Grinder</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Cincinnati Grinder</td>
<td>OE ONOSET</td>
<td>1</td>
</tr>
<tr>
<td>Ex-Cell-O</td>
<td>14-814</td>
<td>1</td>
</tr>
<tr>
<td>GRINDER, TOOL POST</td>
<td>8526</td>
<td>1</td>
</tr>
<tr>
<td>Hammond Grinder</td>
<td>RW-2</td>
<td>2</td>
</tr>
<tr>
<td>Hammond Grinder</td>
<td>RW-2</td>
<td>2</td>
</tr>
<tr>
<td>Heald</td>
<td>273A</td>
<td>1</td>
</tr>
<tr>
<td>Leblond Makino</td>
<td>15IN</td>
<td>1</td>
</tr>
<tr>
<td>Mattison Grinder</td>
<td>NONE Betts 330-02</td>
<td>1</td>
</tr>
<tr>
<td>Regal</td>
<td>Max</td>
<td>1</td>
</tr>
<tr>
<td>Rockwell Grinder</td>
<td>23505</td>
<td>1</td>
</tr>
<tr>
<td>Sander</td>
<td>24-SD Heald</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>22</strong></td>
</tr>
</tbody>
</table>

**Rollers – MAF-owned**

<table>
<thead>
<tr>
<th>Brand</th>
<th>Model</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bertsch</td>
<td>Press 20-B</td>
<td>1</td>
</tr>
<tr>
<td>Roller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buffalo</td>
<td>Bending Roller</td>
<td>1</td>
</tr>
<tr>
<td>Buffalo</td>
<td>Roller OABR</td>
<td>1</td>
</tr>
<tr>
<td>Webb</td>
<td>R3L-R-6508</td>
<td>1</td>
</tr>
<tr>
<td>Wysong</td>
<td>336PR</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>7</strong></td>
</tr>
</tbody>
</table>

**Saws – MAF-owned**

<table>
<thead>
<tr>
<th>Brand</th>
<th>Model</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black &amp; Decker</td>
<td>Chop Saw 2730</td>
<td>1</td>
</tr>
<tr>
<td>Doall</td>
<td>Bandsaw 3612-24</td>
<td>2</td>
</tr>
<tr>
<td>Doall</td>
<td>Bandsaw C1216A</td>
<td>1</td>
</tr>
<tr>
<td>Everett</td>
<td>Cut-off</td>
<td>1</td>
</tr>
<tr>
<td>Grob</td>
<td>Bandsaw 4V-24</td>
<td>1</td>
</tr>
<tr>
<td>Marvel</td>
<td>Bandsaw 15A9</td>
<td>1</td>
</tr>
<tr>
<td>Max Sander</td>
<td>24-SD</td>
<td>1</td>
</tr>
<tr>
<td>Meltsaw</td>
<td>Cut saw</td>
<td>1</td>
</tr>
<tr>
<td>Meltsaw</td>
<td>Cut saw NF1214-T8</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>10</strong></td>
</tr>
</tbody>
</table>

**Presses – MAF-owned**

<table>
<thead>
<tr>
<th>Brand</th>
<th>Model</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bertsch</td>
<td>Press S-350-41-35ton</td>
<td>1</td>
</tr>
<tr>
<td>Press Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hannifin</td>
<td>Press 375HD10</td>
<td>1</td>
</tr>
<tr>
<td>Pacific</td>
<td>Shearing Press</td>
<td></td>
</tr>
<tr>
<td>Pacific</td>
<td>Shearing Press 375S12ARH</td>
<td>1</td>
</tr>
<tr>
<td>Verson</td>
<td>Bend Press H-625-22</td>
<td>1</td>
</tr>
<tr>
<td>Wysong</td>
<td>Metal Bender 150-6</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>7</strong></td>
</tr>
</tbody>
</table>
## Maximum Equipment Capabilities

<table>
<thead>
<tr>
<th>Type of Equipment</th>
<th>Maximum Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shears</td>
<td>12’ Width</td>
</tr>
<tr>
<td></td>
<td>3/8” thick ferrous metals</td>
</tr>
<tr>
<td>Bend Presses</td>
<td>22’ bend Length</td>
</tr>
<tr>
<td></td>
<td>625 ton</td>
</tr>
<tr>
<td>Saws (Ferrous/Non-Ferrous)</td>
<td><strong>Ferrous Material</strong> (i.e. aluminum)</td>
</tr>
<tr>
<td></td>
<td>50” Width x 12” Length</td>
</tr>
<tr>
<td></td>
<td>6” thick stock</td>
</tr>
<tr>
<td></td>
<td><strong>Non-Ferrous Material</strong> (i.e. steel)</td>
</tr>
<tr>
<td></td>
<td>12” Width x 20” Length</td>
</tr>
<tr>
<td></td>
<td>4” thick stock</td>
</tr>
<tr>
<td>Plate Rollers</td>
<td>21’ Length</td>
</tr>
<tr>
<td></td>
<td>3” thick stock</td>
</tr>
<tr>
<td>Flat Stock and Round Pipe Roller</td>
<td>Round Stock = 2.5” Diameter</td>
</tr>
<tr>
<td></td>
<td>Flat Stock = 3.5” Width</td>
</tr>
<tr>
<td></td>
<td>2.5” thick stock</td>
</tr>
<tr>
<td>Lathes (Both CNC and Manual)</td>
<td>16” swing (ability to turn 32” Diameter)</td>
</tr>
<tr>
<td></td>
<td>25’ Length</td>
</tr>
<tr>
<td>Vertical Turning Lathes</td>
<td>6’ Diameter x 6’ Height (with contouring)</td>
</tr>
<tr>
<td>4-Axis Mill</td>
<td>47” x 47” x 35”’ XYZ</td>
</tr>
<tr>
<td></td>
<td>360 degree full contouring capability</td>
</tr>
<tr>
<td>Surface Grinder</td>
<td>2’ Width x 2’ Height x 12’ Length</td>
</tr>
<tr>
<td>Precision Boring</td>
<td>4’ Width x 96” Height x 12’ Length</td>
</tr>
<tr>
<td></td>
<td>30” bore depth possible</td>
</tr>
<tr>
<td>Horizontal Boring/Mill Center</td>
<td>10’ Width x 96” Height x 12’ Length</td>
</tr>
<tr>
<td></td>
<td>30” bore depth possible</td>
</tr>
<tr>
<td>Various Small Scale Manual High Precision</td>
<td>Small scale manufacture requirements</td>
</tr>
<tr>
<td>Turning/Boring/Milling Machines</td>
<td></td>
</tr>
</tbody>
</table>
Additional NCAM Equipment/Tooling Rates

Through the State of Louisiana, NCAM combines education, research, and manufacturing to provide leadership in technology and offers advanced manufacturing techniques on-site.

In addition to the Michoud equipment listed above, NCAM also makes additional equipment available to Michoud tenants.

<table>
<thead>
<tr>
<th>Machine</th>
<th>Daily Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiber Placement Machine #1</td>
<td>$1,110</td>
</tr>
<tr>
<td>Fiber Placement Machine #2</td>
<td>$1,110</td>
</tr>
<tr>
<td>Universal Weld System #1</td>
<td>$1,110</td>
</tr>
<tr>
<td>Universal Weld System #2</td>
<td>$1,285</td>
</tr>
<tr>
<td>High-Speed Machining Center #1</td>
<td>$400</td>
</tr>
<tr>
<td>High-Speed Machining Center #2</td>
<td>$1,985</td>
</tr>
<tr>
<td>Robotic Weld Tool #2 (Friction Stir Welder)</td>
<td>$2,235</td>
</tr>
<tr>
<td>Robotic Weld Tool #3 (Friction Stir Welder)</td>
<td>$2,235</td>
</tr>
<tr>
<td>Non-Destructive Evaluation System</td>
<td>$350</td>
</tr>
<tr>
<td>Autoclave</td>
<td>$1,233</td>
</tr>
</tbody>
</table>

Notes: (1) All rates are machine time only and do not include operator. (2) Utility cost is included in daily rate.

Additional Advanced Manufacturing Capabilities

Michoud also offers fiber placement, heat treatment, chemical clean lines, paint shop facilities, freezers, water quench tanks, and oil quench tanks.

Fiber Placement – NCAM-owned

In the composite assembly area, Fiber Placement is an automated manufacturing process that applies resin pre-impregnated fibers on complex tooling surfaces. The fiber comes in the form of what is referred to as "tows". A tow is a length of bundled fibers that is approximately 0.125" wide by 0.005" thick and is packaged in spools. The tows are fed to a compaction roller and heater on the fiber placement machine head and, through robotic type machine movements, are placed in courses across a tool surface. The FPMs can place up to 24 tows at a time.

Courses are generally placed in orientations of 0°, +45°, -45° and 90° to build up plies which, in combination, have good properties in all directions. In addition, the machine can drop and add tows at any time to meet the specific circumstances of the shape upon which it is placing fiber. NCAM has two FPMs that are used in the manufacture of complex-shaped structures composed of composite materials.
Benefits of Advanced Fiber Placement

Composite materials, as compared to many traditional manufacturing materials, offer significant weight reduction potential, increased design flexibility, and superior performance in a corrosive environment.

In addition to these general benefits for composite structures, Advanced Fiber Placement processes offer the following:

- Complex Curvature Structures
- Thin and Thick Structures
- Small and Large Structures
- High Temperature Materials
- Sandwich Structures
- Reduced Material Scrap during Fabrication

Complex curvature fiber placement allows unidirectional tape to be placed on complex shapes without wrinkling. Difficult geometries, including tight male radii and concave features, are able to be produced without causing wrinkles or fiber bridging because of the heat and compaction applied by the FPM head to the material as it is being placed on a tool. Advanced controls at the FPM head also offer the ability to weave fibers by alternately adding and dropping tows during material lay down. A primary benefit of this process is to reduce weight.

Fiber placement processes have been developed for fabrication of sandwich structures using a variety of high performance, lightweight core materials, including: X-Core™, composite honeycomb, aluminum honeycomb, titanium honeycomb, foam-filled honeycomb, and foam.

Heat Treatment – MAF-owned

General use will be to stress-relieve and age-harden ferrous and non-ferrous alloys. The metal treatments will be within the above range equipment approval for use per SAE-AMS-2772E and SAE-AMS-H-6875A.

Jacobs Engineering is developing a pricing structure based on usage per tenant utilizing a metering system. The metering system is not currently in place. Therefore, pricing agreements will be made directly with Jacobs Engineering. The heat-treatment capabilities at MAF include:

- Two ovens located in the main manufacturing building
- The certified ovens are capable of heat treating materials between range 200°F to 1200°F and 1400°F to 2050°F
- The heat treat systems are on-line and ready for use by tenants
Chemical Clean Lines – MAF-owned

The Chemical Clean Line manufacturing is designed to support separate lines of ventilated immersion tanks in varying capacities that currently contain bath solutions used for alkaline cleaning, alkaline etching, acid deoxidizing, chemical film conversion coating, and demineralized water rinsing of aluminum parts, substrates, barrel panels and test panels.

The Chemical Clean Lines consist of three various sized operations based on the part size and process requirements.

- Large Line: 10 Tanks 26L x 7W x 15D, 10,000 lb. crane
- Medium Line: 12 Tanks 14L x 4W x 10D, 6,000 lb. crane
- Small Line: 9 Tanks 8L x 4.5W x 5D / 6 Tanks (3 Pairs) 4L x 4.5’W x 5D, 2,000 lb. crane

Currently, all three clean lines are inoperable and some of the systems need to be rehabbed prior to coming back on-line. The operating costs for the systems are significant and the repair costs are quite expensive. However, this is a process that could be utilized by a number of different industries as needed. The systems will be required for future programs at Michoud and making the clean line available for industry would help offset the repair and operating costs.

Paint Shop – MAF-owned

The paint shop is operational and is available to be scheduled for use. Currently, there is limited utilization and therefore is immediately available for occupancy. The Paint Shop has the following capabilities:

- Environmentally Controlled Booth, 24’ x 20’ x 20’
- Application of Paint and Primers
- Spray Painting, Epoxy Primer, Fire Retardant Primer

Freezer – MAF-owned

The prepreg materials utilized in the carbon fiber filament layup process usually include epoxy, which requires storage in a freezer.

- A 20 ft x 30 ft freezer for the storage of resin pre-impregnated fiber on spools is attached to the FPM enclosure.
- Maintains a temperature range of -10 to 0 F°.
- Currently the freezer’s capacity is completely met by NASA material’s storage needs.

Quench Tanks – MAF-owned

- There are two water quench tanks and two oil quench tanks located in the main manufacturing building.
- Quenching is a process of cooling a metal very quickly. This is most often done to produce a martensite transformation.
• In ferrous alloys, this will often produce a harder metal, while non-ferrous alloys will usually become softer than normal.

Laboratories – MAF-owned

The unique laboratories at MAF are equipped with the latest materials, processing, and production support for testing large structures, components, and full-scale hardware. These key technology laboratories offer a variety of support service capabilities from analytical chemistry, materials and process (M&P) testing, metallurgy, metrology and research and development.

The analytical chemistry laboratory specializes in fingerprinting (to characterize a critical, complex material and provide diagnostic capabilities), material and contamination identification, and failure analysis. The labs are equipped with the latest technologies of Gas Chromatography, Inductively coupled Plasma Spectroscopy, Fourier Transform Infrared Spectrometry, Thermal Gravimetric Analysis, Differential Scanning Calorimeter, High Performance Liquid Chromatography, Chemical Microscopy, and X-Ray Photoelectron and Fluorescence Spectroscopy.

The M&P laboratories specialize in physical testing, wet chemistry, organic and inorganic process analysis, non-destructive evaluation and inspection, contamination, composite testing and large structures testing. The M&P laboratory is capable of providing evaluations of various types of materials in environmental conditions ranging from -425 to +2000 degrees F, loads to 550,000 lbs tension or compression and up to 30 Hz fatigue. Test engineers develop a wide range of mechanical tests specifically designed to customer requirements providing complete end-to-end test capability. Structural test capabilities include single and multi-axis tensile testing, loads up to 3,000,000 lbs, 10,000 psig, 30-inch deflections with computer controlled data acquisition systems capable of handling 500 channels of test instrumentation with acquisition rates up to 250,000 samples per second. The machine lab is capable of machining ferrous and non-ferrous materials and composites. The weld development lab provides assessments of weld equipment, development of production weld processes and specializes in the joining of aluminum, aluminum-lithium and other metal alloys. Weld capabilities include automatic variable polarity plasma arc (VPPA) and machine gas tungsten arc (GTA). A 5-axis rectilinear gantry robot system permits the welding of unusual shapes and configurations in a multitude of welding positions.

The Metallurgical Laboratory specializes in plating thickness, plating material identification, material hardness and conductivity.

The Technology Laboratories encompass a combined area of more than 100,000 sq ft at MAF and provide a broad range of critical technical and analytical services to multiple government and commercial programs including research and development of production and inspection processes.
Support Service Capabilities

- Analytical Chemistry
- Material fingerprinting
- Failure analysis
- Material identification
- Receiving Acceptance testing
- Materials and Process Testing
- Receiving Acceptance testing
- Physical testing
- Wet Chemistry
- Organic/inorganic process analysis
- Contamination identification

- Non-destructive evaluation
- Metallurgy
- Failure analysis
- Microstructure evaluation
- Plating type and thickness
- Research and Development
- Real time process monitoring systems
- NDE Systems
- Thermal Protection Systems
- Composites
- Welding

Equipment and Detailed Capability Listing

- Technology Labs – MAF-owned
  - Analytical Chemistry
    - Gas Chromatography (GC)
      - Multiple GC units with a variety of detectors including Mass Selective Detector (MSD), Thermal-Conductivity Detector (TCD), Nitrogen Phosphorus Detector (NPD), and Flame Ionization Detector (FID)
      - Material fingerprinting, mass spectroscopy interpretation, quantitative analysis, head space analysis, gas analysis, solvent purity analysis
    - Inductively Coupled Plasma (ICP) Spectroscopy
      - Multiple ICP units featuring a variety of detectors including Atomic Emission Spectrometry (AES), Collision-Induced Dissociation (CID), and MSD
      - Analytical capabilities include: Quantitative elemental analysis, Direct analysis of conductive solid materials, Capability in viewing the entire emission spectrum simultaneously
    - Fourier Transform Infrared (FTIR) Spectrometry
      - Multiple FTIR units
      - Analytical capabilities include: Receiving inspection analyses, Contamination analyses for organic materials, Failure analyses, Material fingerprinting, infrared (IR) Microscopy
    - Thermal Gravimetric Analysis (TGA)
      - Fingerprint analysis of material (Thermal stability of material, Determination of composition)
    - Differential Scanning Calorimeter (DSC)
      - Thermal properties of materials (Melt point, Glass point, Crystallization point)
      - Analyses to determine: Oxidative stability, Specific heat, Percent cure
    - High Performance Liquid Chromatography (HPLC)
      - Multiple HPLC units
Analytical capabilities include: Gel Permeation Chromatography (GPC) measurement of molecular weight distributions, HPLC measurement of component concentrations, Ultraviolet and refractive index detection, Quaternary solvent elution

- Chemical Microscopy
  - Multiple microscopes and imaging systems
  - McCrone Institute certification
  - Analytical capabilities include: Contamination identification, Particle failure analysis for engineering or direct customer support, Mineralogical and morphology analyses, Bulk asbestos analyses

- X-Ray Photoelectron Spectroscopy (XPS)
  - Surface analysis as shallow as 5nm and 30um spatial resolution with quantitation
  - Techniques on conductors and non-conductors (XPS, Monochromated Al and Mg/Zr sources, Angle resolved XPS, Depth profiling w/ Zalar rotation, Static secondary ion mass spectrometry, In Vacuuo fracture stage - Residual gas analysis)

- X-Ray Fluorescence Spectroscopy
  - Multiple XRF Systems
  - Analytical capabilities include: Bulk elemental analysis (> Na), Alloy identification, Typically non-destructive

- Scanning Electron Microscope
  - JEOL SEM with Energy Dispersive X-Ray capability
  - Analytical capabilities include: Topographical imaging, Compositional imaging, Micro-elemental analysis

- Analytical – MAF-owned
  - Rheology (study of flow and deformation of matter)
    - Relating molecular structure or morphology to the macroscopic rheological properties of materials
    - Measures Shear, viscoelasticity, thixotropy, yield, stress etc.
  - Fixtures include: Friction, Torsion Rectangular, Parallel Plates, Cone and Plate, Fiber and Film, Cylindrical Rod, Couette, Conical Cylinder, 3 Point Bend, Dual Cantilever, Shear Sandwich

- Materials and Process Testing – MAF-owned
  - Ion Chromatography (IC)
    - Multiple IC Units
  - Analytical capabilities include:
    - Material fingerprinting, chemical process solutions, and failure analyses
    - Anion quantification - fluorides, chlorides, nitrates, bromides, phosphates, and sulfates
    - Cation quantification - lithium, sodium, ammonium, potassium, magnesium, and calcium
    - Transition metal valence ion quantification, iron II, iron III, copper II, nickel II, zinc II, cobalt II, and manganese II
- **Wet Chemistry**
  - Receiving acceptance testing for potting agents, primers, sealing compounds, foams, tapes, adhesives, and room temperature vulcanization (RTV)
  - Analysis of two component polyurethane rigid foam systems
  - Analytical capabilities: Moisture analysis, Viscosity & specific gravity measurements, Titration (acid number, hydroxyl number, amine equivalent, etc.)

- **Orion Autotitrator**
  - Multiple autotitrator units
  - Analytical capabilities include: Automatic calibration, measurement, and result verification of chemical process solutions, pH calibrations and measurements, ion-selective electrode direct concentration measurements, Direct redox potential electrode measurements for chemical concentration determinations

- **Class IV Flow Bench**
  - Multiple flow bench units
  - Analytical capabilities include: Provides a particle free work surface with a 0.5 micron High Efficiency Particulate Air (HEPA) filter efficiency, Maintains positive air flow for morphometric analyses of particulate contamination supporting chemical processes, clean room, and receiving inspection testing

- **Ultrasonic Test**
  - Multiple UT inspection systems
  - Analytical capabilities include: Immersion, phased array, and hand scan techniques, Metals, specialty alloys, advanced materials (composite), and weld inspection techniques, C-scan and TOF methods

- **Salt Fog Chamber**
  - **Physical Testing – MAF-owned**
  - **Computer Controlled**
  - **Capabilities include:**
    - **Test Environment:**
      - -423°F to +1200°F
      - Loads to 550,000 lbs tension or compression
      - Up to 30Hz Fatigue
    - **Specimen Types:**
      - Simulated Service / Cryoflex
      - Tensile / Compression
      - Bearing / Double Shear
      - R-curve / da/dN
      - Crack Growth Rate
      - Bend Test / 4pt & 3pt
      - Fatigue Test / Strain
      - Photo Stress / Crack and flaw simulation
Structure Test – MAF-owned
- Test Fixture Design and Fabrication
  - Detail / Subassembly fabrication
  - Test Fixture Final Assembly
  - Specimen Fabrication
  - Instrumentation
- Testing
  - Single and Multi-Axis Tensile Testing
  - Loads up to 3,000,000 pounds
  - 10,000 psig
  - 30 inch deflections
  - 500 data channels
  - 600 °F to (-300) °F Testing
- Machining
  - Ferrous and Non-Ferrous Machining
  - Composite Machining
  - CNC Machining Capability
Metallurgical Lab – MAF-owned
- Plating Thickness
  - X-Ray coating measurement instrument
  - Analytical capabilities include:
    - Determination of plating thickness
    - Plating material identification
    - Multiple point plating thickness analysis
- Metallurgical Inspection
  - Variety of metallographs, microscopes, prep equipment, and other test equipment
  - Analytical capabilities include: Failure analysis, Microstructure evaluation, Material hardness and conductivity, Photo documentation
Inspection Systems Research and Development (R&D) – MAF-owned
- Digital Radiography
  - Digital X-Ray system for production implementation
  - Capabilities: Replaces conventional film radiography, Enhances data storage, analysis and throughput capabilities, Provides foundation for future work in enhanced radiograph interpretation
- Backscatter Radiography
  - Defect Inspection System
  - Capabilities: Detection of defects in Thermal Protection Systems (TPS), Voids and defects to 0.25", Suitable for use on pressure vessels or applications where conventional radiography is not possible due to back side access restrictions
- Terahertz Imaging
  - Defect Inspection System
- Capabilities: Detection of defects in TPS, Voids and defects to 0.25”, Suitable for use on pressure vessels or applications where conventional radiography is not possible due to back side access restrictions

- **Phased Array Ultrasonic**
  - Portable (Phased Array Ultrasonic Testing (PAUT) inspection system
  - Capabilities: Performs UT analysis of a spectrum of hardware, Characterizes flaw depth, orientation, and geometry, Enhances productivity of weld repair processes

- **Eddy Current**
  - Meandering Winding Magnetometer
  - Capabilities: Detects “tight” surface flaws in metal components, Measures material conductivity, Improves flaw detection capability for difficult flaws
Appendix II – Michoud Tenants

Government Agencies and Government Contractors Operating at the Michoud Assembly Facility

National Aeronautics and Space Administration

NASA is responsible for the manufacture and assembly of large aerospace systems and structures supporting the space shuttle external tank and NASA exploration programs and projects. A component of NASA’s Marshall Space Flight Center in Huntsville, Alabama, Michoud includes one of the world’s largest manufacturing plants and a port with deep water access, permitting transportation of large space systems and hardware.

http://www.nasa.gov/centers/marshall

Department of Agriculture

U.S. Department of Agriculture National Finance Center

The National Finance Center serves the U.S. Department of Agriculture (USDA) and other federal customers, providing reliable, cost-effective, employee-centric systems and services. The center is designated as a Federal Shared Services/ePayroll provider and supports more than 170 federal organizations with payroll and human resources management applications and related services. In addition, the center provides financial systems and services to the USDA including accounting, financial statements and administrative payments.

http://www.nfc.usda.gov

Department of Defense

Defense Contract Audit Agency

The agency is responsible for all contract audits for the DoD, and provides advice on accounting and financial services regarding contracts to all DoD components responsible for procurement and contract administration. These services include procurement, accounting and other financial advice used in the negotiation and administration and settlement of contracts and subcontracts. The agency also provides contract audit services to other government agencies.

http://www.dcaa.mil

Defense Contract Management Agency

The agency is the DoD component that works directly with suppliers to help ensure DoD, federal and allied government supplies and services are delivered on time, at projected cost and meet all performance requirements. The agency directly contributes to the military readiness of the United States and its allies, and helps preserve the nation’s freedom.

http://www.dcma.mil
U.S. Coast Guard Integrated Support Command

The command is the primary provider of facilities engineering, training, housing and health services for the nation’s leading maritime law enforcement agency in the New Orleans area.

http://www.uscg.mil/mlclant/iscneworleans

Lockheed Martin Corporation
Lockheed Martin Michoud Space Systems

Lockheed Martin is NASA’s prime contractor for the manufacture and assembly of the space shuttle external tank at the Michoud Assembly Facility. Lockheed Martin also will build spaceflight hardware for the Orion crew exploration vehicle, the successor to the space shuttle, and play an active role in NASA’s Commercial Orbital Transportation Services (COTS) project.

http://www.lockheedmartin.com

Boeing Company
Boeing Space, Defense, and Security

Boeing is the prime contractor for the Upper Stage Production Contract (USPC) elements of the next heavy lift launch system. The upper stage is the second stage of the rocket. Boeing currently is working on manufacturing process development and design support, tooling design, fabrication and installation, and component design. Boeing is ready to support NASA’s plans for a beyond earth orbit launch vehicle.

http://www.boeing.com/defense-space/space/els/index.html

BK Manufacturing

BK is a small manufacturing company currently producing torpedo training rounds for the Navy at its Michoud facility, and it also is a preferred supplier for larger Michoud tenants, including Boeing, for whom it is producing specimens for tooling and fixturing.

http://www.b-kmfg.com

Vivace

Vivace is a small aerospace manufacturer of pressurant tanks for satellites.

http://www.vivacespacetron.com

Louisiana Center for Manufacturing Sciences (LCMS)

LCMS serves as a knowledge repository for its membership’s background and capabilities and coordinates and manages the subcontracted technical services of its consortium members. These members and subcontractors, from non-competitive businesses, offer a wide range of solutions from manufacturing process engineering, materials tracking, life cycle management, systems design, process improvement and supply chain management to training, software development and information technology.

http://www.lacenter.org
Appendix III – State of Louisiana Incentives

State of Louisiana Incentives and Services for Businesses

How can Louisiana give your business a competitive edge?
Louisiana offers competitive incentives to help your business thrive. Louisiana Economic Development’s team of industry experts ensures a seamless application process to help you determine your company’s eligibility.

Economic Incentives for Businesses of All Sizes

- ENTERPRISE ZONE PROGRAM
  Provides a one-time $2500 tax credit per certified net new job and either a 4% sales/use tax rebate on qualifying expenses or an investment tax credit equal to 1.5% of capital expenditures, excluding tax-exempted items.

- QUALITY JOBS
  Provides a 5% or 6% rebate on annual payroll expenses for up to 10 years and either a 4% sales/use tax rebate on capital expenditures or an investment tax credit equal to 1.5% of qualifying expenses.

- RESTORATION TAX ABATEMENT
  Provides five-year 100% abatement for the rehabilitation of an existing structure based on assessed valuation of property prior to beginning of improvements.

- INDUSTRIAL TAX EXEMPTION
  Provides a 100% property tax abatement for up to 10 years on manufacturer’s qualifying capital investments.

- RESEARCH AND DEVELOPMENT TAX CREDIT
  Provides up to a 40% tax credit for Louisiana businesses (based on employment) that conduct research and development activities in Louisiana.

- LED FASTSTART™
  Provides workforce recruitment, screening and training for new and expanding Louisiana companies at no cost.

- DIGITAL INTERACTIVE MEDIA AND SOFTWARE INCENTIVE
  Provides a refundable tax credit of 30% on qualified production expenditures and an additional 5% tax credit for Louisiana resident labor expenditures.

- MOTION PICTURE INVESTOR TAX CREDIT
  Provides a tax credit of 20% on qualified production expenditures and an additional 5% tax credit for Louisiana resident labor expenditures.

- MUSICAL AND THEATRICAL PRODUCTION TAX INCENTIVE
  Provides a tax credit up to 35% on qualified production or infrastructure development expenditures; additional credits available for payroll and transportation expenditures.

- SOUND RECORDING INVESTOR TAX CREDIT
  Provides a 20% refundable tax credit on qualified expenditures for sound recording productions.

- COMPETITIVE PROJECTS PAYROLL INCENTIVE
  Provides a payroll rebate of up to 15% in target sectors for up to 10 years and either a 4% sales/use tax rebate on capital expenditures or a facility expense rebate equal to 1.5% of qualifying expenses.

- MODERNIZATION TAX CREDIT
  Provides a 5% refundable state tax credit for manufacturers modernizing or upgrading existing facilities in Louisiana.

- COMPETITIVE PROJECTS TAX EXEMPTION
  Provides a 10-year property tax abatement on qualifying capital investments of at least $25 million in targeted non-manufacturing industry sectors. The abatement is for the ad valorem taxes in excess of $10 million or 10% of the fair market value of the property, whichever is greater.

- CORPORATE TAX APPORTIONMENT PROGRAM
  Provides single-sales factor apportionment to highly competitive projects in order to secure jobs and business investment in targeted industry sectors.

- TECHNOLOGY COMMERCIALIZATION CREDIT AND JOBS PROGRAM
  Provides a 40% refundable tax credit on costs related to the commercialization of Louisiana technology and a 6% payroll rebate for the creation of new direct jobs.

- CORPORATE HEADQUARTERS INCENTIVE PROGRAM
  Provides a rebate of up to 25% of facilities and relocation costs, to be claimed in equal parts over five years.
Day One Guarantee

Our colleges and universities guarantee that a graduate of any of our certificate or associate degree programs will have the knowledge, skills and abilities expected by employers on day one or we will retrain them.

This is about guaranteeing quality and market relevance to our graduates and our employers. This guarantee is posted in every college and listed in every college catalog, and we stand behind it.

The goal is to ensure that both students and employers know that there is guaranteed value in every educational dollar they spend.

Work force development in Louisiana has been given one of the highest priorities in state government. To live up to the “Day One Guarantee”, the state has created the FastStart program.

Louisiana FastStart

Louisiana FastStart is a single-source, world-class workforce solutions provider that works with qualifying new and expanding enterprises to anticipate and address the company’s workforce needs early in the start-up or expansion process. FastStart’s services are provided at no cost to the employer. This program is available to manufacturing concerns, corporate headquarters, warehouse and distribution, research and development or other strategic facilities that commit to creating at least 15 new jobs or to any service-related operation that commits to creating at least 50 new jobs. The FastStart process works as follows:

- **Project Evaluation:** Examination of the new or expanding enterprise’s operations and documentation of the required knowledge and skill sets of the new workforce.
- **Workforce Solutions Plan:** Development of project lead-time schedules and training plans for the specific skill sets needed to staff the new or expanding operation. Consultation with company human resources and training officials regarding appropriate training delivery mechanisms, to include media, classroom and other activities required for a successful launch of operations.
- **Material Development:** Develop an instructional system design plan along with both pre- and post-employment classes customized to the new or expanding company’s operations.
- **Pre-Employment Identification:** Coordination of testing services, classroom and job simulation exercises to identify the best candidates for potential employment at the new or expanded operation.
- **Course Delivery:** Delivery of instructional services wherever and whenever needed to provide the best employees possible for the company’s operation.
- **Evaluation and Feedback:** Conduct post-delivery evaluations with the employer in order to ensure continuous improvements in the process.
Business Facilities, a trade publication, calls it the “gold standard” for workforce training. Moreover, FastStart has removed the uncertainty about workforce quality for companies looking to relocate.

When you couple the FastStart program with the state's academic research community, in terms of supporting the manufacturer industrial base, a clear and strong attractant is created for companies looking to expand or build satellite manufacture facilities.
Appendix IV – Works Cited

- 2012 National Defense Authorization Act and FAA Modernization and Reform Act
- Conversations with the MS AUUVI chapter
- GigaPort’s Next Generation Innovation Engine; Kees Neggers, 2003
- Greater New Orleans, Inc. (GNO) http://gnoinc.org
- http://lasigma.loni.org
- Internet2 Innovation Platform V1, 2012
- Interview with Crescent Unmanned, LLC email September 2012
- James M. Halik, Ph.D. and Superintendent of Schools at the Community School Corporation of Southern Hancock County
- Lexington Institute/Congressional Research Service (CRS)
- LONI Institute
- Louisiana Association of Business and Industry
- Louisiana Community and Technical College System Day One Guarantee Brochure
- Louisiana Economic Development (LED) http://www.louisianaeconomicdevelopment.com
- LSU College of Engineering press release August 2012
- Mississippi Optical Network http://mission.mississippi.edu
- Mr. Stephen Luckowski - Chief, Materials, Manufacturing and Prototype Technology Division & Mr. Andrew Perich - RDAR-ME - Associate for Manufacturing
- National Lambda Rail (Lights the Future) Article July 2005
- OpenFlow/SDN: A New Approach To Networking; Guru Parulkar et al
- Unmanned Systems Integrated Roadmap FY2011-2036/Under Secretary of Defense for Acquisition, Technology and Logistics