National Aeronautics and
Space Administration

marshall

FY2013
Economic Impact

NASA Marshall Space Flight Center

Launching the Future of Science and Exploration

A note from the Marshall Center Director:

Together, we make **BOLD** things happen.

PATRICK SCHEUERMANN
Director,
Marshall Space Flight Center

It is the spark of genius that leads to great discoveries. In the midst of exploring, we often discover much about ourselves, and discover that we can, and do, make positive impacts on people, on the planet, and on the economy.

Our mission and our passion at Marshall Space Flight Center is space exploration, technology, and science. Our crosscutting expertise provides NASA with unique and critical capabilities vital to the nation's space program. We are making bold advances for the aerospace industry with programs like our Space Launch System (SLS), which is now under construction. As America's link to deep space, SLS will maintain the nation's leadership in space exploration while also sustaining our propulsion and rocketry industrial base.

Regionally and nationally, Marshall drives the economy. Our collaborations and partnerships extend outside of the greater metropolitan areas of Huntsville, Alabama, and New Orleans, Louisiana, and make impacts throughout the United States. Our programs are diverse and involve almost every category of engineering, technology, manufacturing, and science, creating tens of thousands of jobs.

Our research leads to significant advancements in agricultural resources, communications, weather forecasting, computer technology, medicine, healthcare, and other fields, resulting in jobs and life-enhancing products.

President John Kennedy said it's "time for a great new American enterprise — time for this nation to take a clearly leading role in space achievement, which in many ways may hold the key to our future on earth." Perhaps he knew at the time what great advances we would make in this quest.

Our story continues to be as exciting to tell as it was when NASA was created in 1958. I invite you to explore our positive economic impacts and to continue our journey as we take the next small steps and giant leaps in space exploration.

Thank you for being part of our bold success.

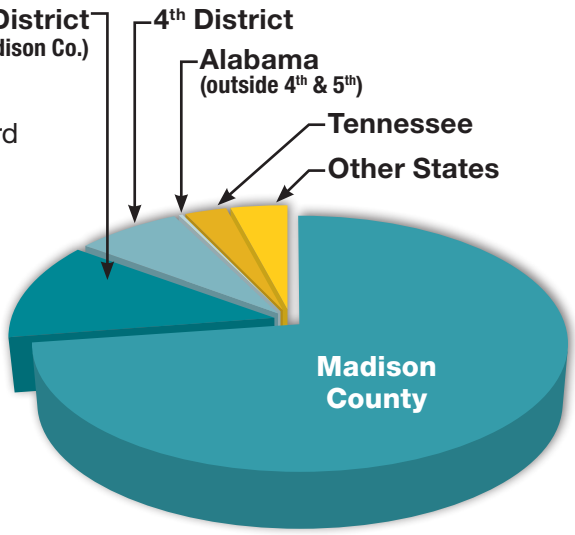
INSIDE:

economicimpact

Marshall's economic Impact

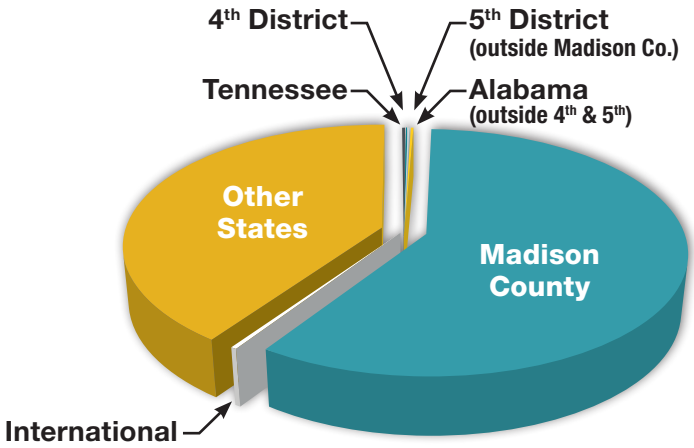
As Marshall Space Flight Center delivers on NASA's bold space missions, it infuses millions of dollars into research and development. This drives an innovation-based economy in Alabama and across the U.S. From the dollars flowing into institutions for research and higher education, to well-paying jobs in the aerospace and technology sectors, Marshall has a significant impact on the region and the nation.

Locally, Marshall is the third largest employer in the Huntsville metro area, with approximately 6,000 employees and on-site contract workers. The center's activity in Madison County generates more than **14,000 jobs** and a corresponding $1.1 billion in income. With $1.2 billion in contracts sourced within the county, Marshall's total impact in Madison County is **$2.5 billion**.



Marshall Employees and Associated Labor Income Totals $354 million.

Marshall Procurement Totals $1.9 billion.



In Alabama's 5th Congressional District,

Marshall is responsible for about **16,000 jobs** and contributing more than $62 million in state and local tax revenues annually. The total economic impact in the 5th District is **$2.8 billion**, with 43% resulting from SLS program activities.

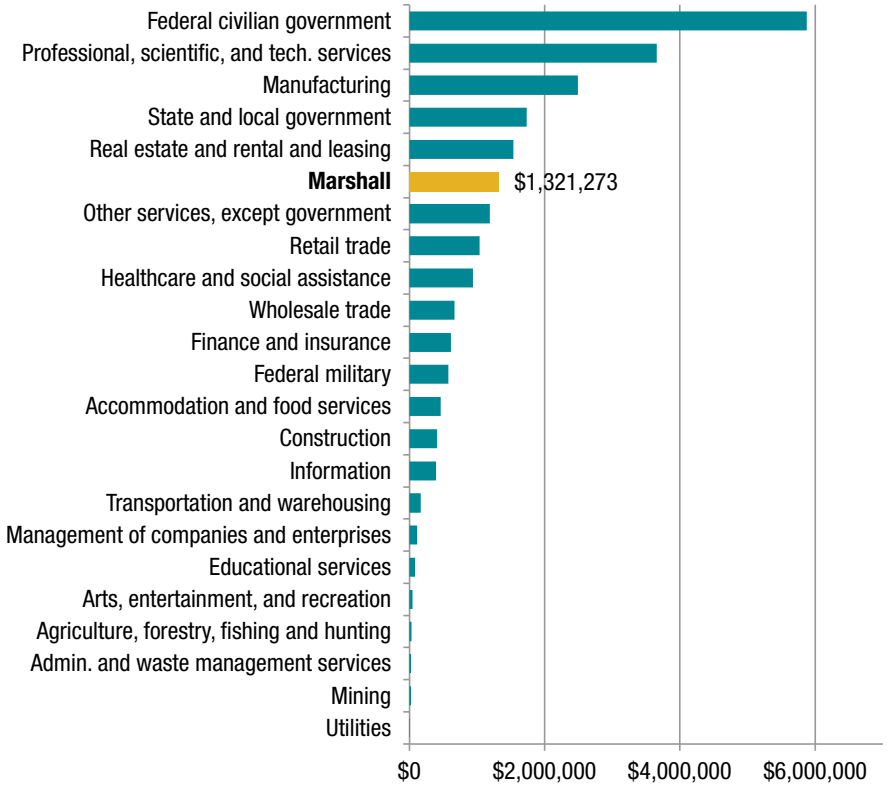
In Alabama's 4th Congressional District,

Marshall accounts for **319 jobs**, approximately $30 million in labor income, and $1.3 million of state and local tax revenues each year. The total economic impact in the state's 4th District is **$132.2 million**.

Marshall's output in comparison to top industry sectors

In 2013, Madison County's gross product was $22 billion. With more than $1.3 billion of local value added, Marshall constituted **6% of Madison County's gross product** in that year. This chart shows how Marshall's value added would rank among the major economic sectors in Madison County in 2013 according to gross product. Marshall's share of gross product ranks among the top ten sectors and exceeds the share of many important sectors including retail trade, healthcare, and finance and insurance.

Marshall Value Added Compared to the Gross Product of Major Economic Industry Sectors in Madison County (thousands)



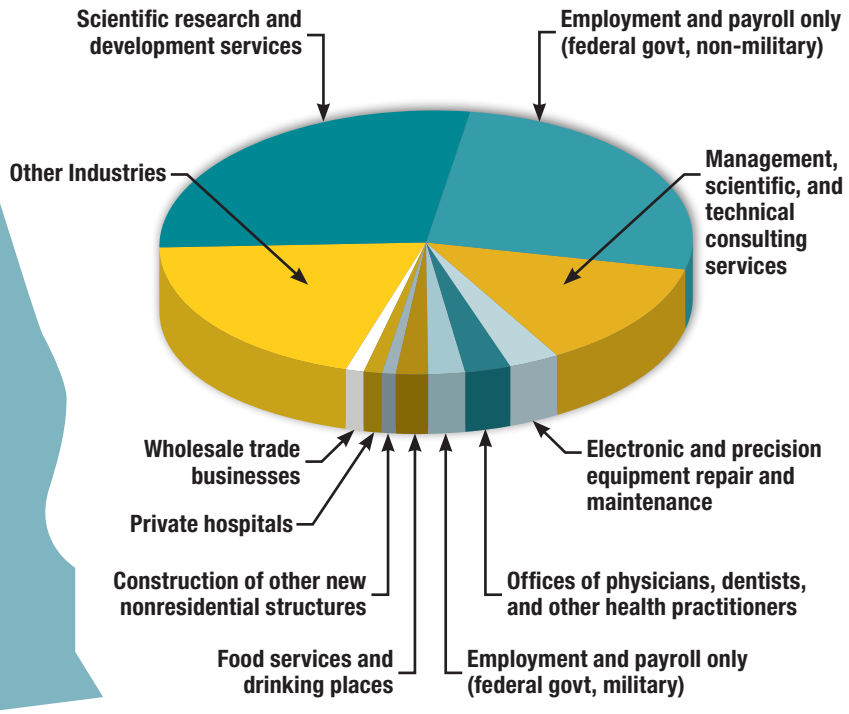
*The economic impact analysis presented here is based on research conducted by the University of Illinois – Chicago: The Nathalie P. Voorhees Center for Neighborhood and Community Improvement:

Across Alabama,

the total employment impact from Marshall's activities is nearly **20,000 jobs**. Marshall's total economic impact on the state is **$3.3 billion**. This impact is greater than the economic output of the entire agricultural industry, including the hunting and fishing industries.

In terms of labor income, Marshall's impact in Alabama was strongest in the technical industries, including Scientific R&D; Management, Scientific and Technical Consulting Services; and Electronic and Precision Equipment. Besides science and technology areas, the medical industry is the most impacted, with more than $46 million flowing into physician offices and private hospitals across the state.

Ten Most Impacted Industries by Labor Income in Alabama



The industry most impacted by labor income in Alabama is Scientific R&D. As of 2011, the average employee compensation in this industry was more than $72,000. That is 170% of the average compensation across Alabama.

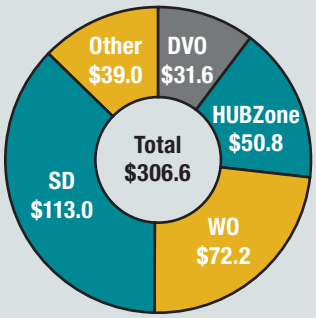
Tennessee

is home to 80 Marshall civil service employees. Combined with contracting activity in the state, Marshall supports about **170 jobs** and $13.4 million in labor income in Tennessee annually, generating nearly $589,000 in state and local tax revenues. The total economic impact in Tennessee for FY13 was **$34.7 million**.

FY13 Small Business Contracts Distribution

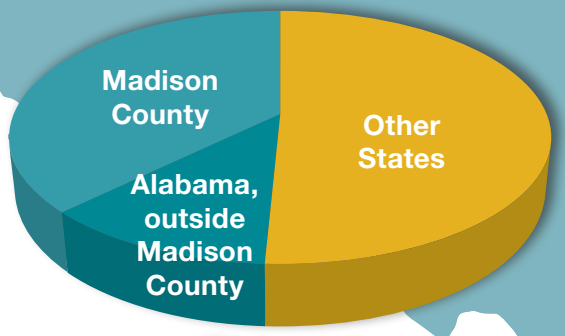
Nationally, Marshall supports small business with more than $306 million in contracts:

Small Disadvantaged (SD)
Disadvantaged Veteran Owned (DVO)
Historically Underutilized Business Zone (HUBZone)
Women-owned (WO)

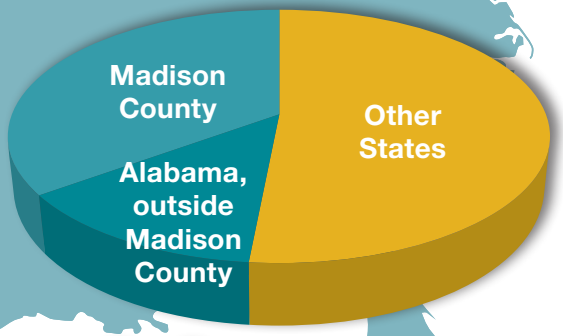


Across the nation, for every civil service job at Marshall, nearly 14.2 full-time-equivalent jobs are generated, totaling more than **40,000 jobs**. The center generates an estimated $808 million in federal, state, and local tax revenues annually, and has a total economic impact of **$6.73 billion**.

Total Economic Impact Distribution



$6.7 billion



40,000+ jobs

The Michoud Assembly Facility is located in New Orleans East and is managed by Marshall. Michoud's 832 acres and **3.8 million square feet** of infrastructure incorporates rail access, close proximity to Interstate highways, and a deep-water port with access to the Mississippi River and the Gulf of Mexico. The facility also contains one of the world's largest manufacturing plants with 43 acres under one roof.

NASA has used this facility to manufacture the Apollo program's Saturn rockets, the external tanks that boosted the space shuttle's 135 flights, and is now used for building elements of the Space Launch System.

Space not currently in use by NASA is leased out under management by Jacobs Technology to tenants such as the following:

- U.S. Department of Agriculture's National Finance Center
- U.S. Coast Guard Integrated Support Command
- Department of Defense Contract Auditing Agency and Contract management Agency
- Lockheed Martin Corporation
- Boeing Space Operations
- Blade Dynamics

The total impacts from NASA and the activities of firms operating at Michoud in 2010 may be viewed as a representative estimate of Michoud's annual recurring impacts on business sales, household earnings, jobs and taxes.

NASA spending in Louisiana

- $1 billion since 2009; $95 million in FY 2013*
- NASA's Michoud Assembly Facility brings 3,600 jobs to the New Orleans area.

*Source: NASA Acquisition Internet Service (NAIS) data

SLS impact

Space launch System

Designed in Alabama, **Built** Around the Nation, **Headed** Toward Mars

Marshall manages the Space Launch System (SLS), an entirely new capability for taking humans and science missions beyond Earth orbit. Marshall and the SLS program support tens of thousands of jobs, creating a significant economic impact to the full spectrum of industries from manufacturing to food service.

Headed Toward Mars

NASA's SLS is an advanced launch vehicle for a new era of exploration beyond Earth's orbit. The world's most powerful rocket, SLS will launch astronauts on missions into deep space and eventually to Mars, while providing an unrivaled capability for robotic scientific missions and other payloads. With the tenets of safety, affordability, and sustainability in mind, NASA is building the versatile SLS to carry the Orion spacecraft, as well as important cargo, equipment, and science experiments.

Within only two years of the official announcement of the SLS architecture, NASA completed the preliminary design of the Space Launch System and moved into production of the vehicle. The program continues to make rapid progress toward being ready for its first launch in 2017.

With unparalleled payload mass and volume capability and unmatched energy to speed robotic missions through space, SLS will be the most powerful rocket in history and is designed to be flexible and evolvable, to meet a variety of crew and cargo mission needs.

Economic Impact

Nationwide

- The total economic impact of the SLS Program is **$4.29 billion invested** across the nation.
- For every SLS job, at least a corresponding **26 full-time-equivalent jobs** are supported in the U.S. economy.
- SLS generates more than **25,000 jobs nationwide**, and contributes nearly half a billion dollars in tax revenues throughout the U.S. annually.
- Approximately **60% of all Marshall impacts** on the national level are due to the SLS program.

Alabama

- Across Alabama, more than **8,600 jobs** result from the SLS Program.
- The total impact of the SLS Program in Alabama is nearly **$1.4 billion**.

Designed at Marshall

The Space Launch System Program Office based at Marshall is implementing innovative solutions to deliver a powerful, versatile, and capable new rocket for exploration in a way that is affordable for the nation. With a streamlined management structure, an architecture designed to leverage proven systems, and hands-on efforts to push the envelope in manufacturing, the Program continues to look for ways to make the most of the nation's investment in this vehicle.

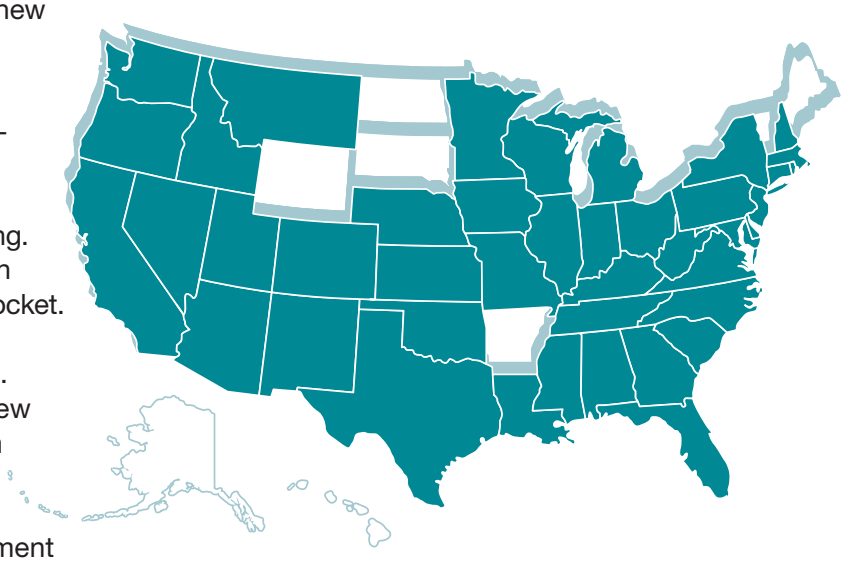
3-D Printed Rocket Injector Prepped for Hot Fire Test

Building Expertise for Orion and SLS Flight Hardware

Built Around the Nation

The Space Launch System represents a vital new national capability, and the work of a nation is involved in creating it.

- SLS is being supported by four prime contractors with decades of experience in the aerospace industry – Aerojet Rocketdyne, ATK, Boeing, and Teledyne Brown Engineering.
- Currently, more than 500 subcontractors in 42 states are engaged in the building of the rocket.
- Every NASA center has contributed to the Space Launch System development effort.
- Following a clean Preliminary Design Review in 2013, the Program has now moved from the formulation phase to implementation.
- The Space Launch System Program now has hardware representing every major element of the vehicle.



SLS Core Stage at Michoud Assembly Facility

A-1 Test Stand Prepares for RS-25 Rocket Engine Testing

Smoke Flow Visualization for SLS

SLS Boosters Centered on Qualification Test

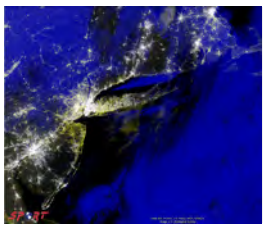
highlights

2013

Aug

10 Years of Accomplishments by Microgravity Science Glovebox

Nov



SPoRT Helps Identify Scope of Hurricane Sandy Power Outages

Feb

Marshall Scientists Upgrade Materials Science Research Rack on Space Station

Feb

Alabama Innovation Fund supports UAHuntsville, Boeing, Marshall partnership: Charger-1 Pulse Power Generator

May

Adapter 'Flips' for Progress toward 2014 Exploration Flight Test

May

Marshall's Upgraded Payload Operations Integration Center Enhances Station Work

Aug

Hot-Fire Tests Show 3-D Printed Rocket Parts Can Stand the Heat

July

First Liquid Hydrogen Tank Barrel Segment for the SLS Core Stage Completed at Michoud

2014

Aug

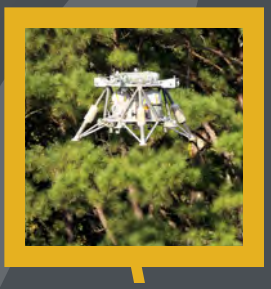
Marshall Interns Take 'One Small Step' Toward Aerospace Careers

Aug

James Webb Space Telescope Backplane Arrives for Cryotesting

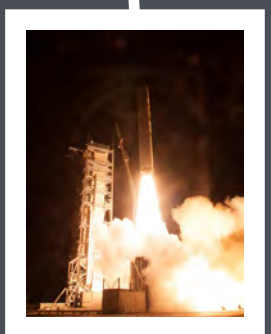
Sept

Marshall's Mighty Eagle Improves Autonomous Landing Software with Successful Flight



Sept

Lunar Atmosphere and Dust Environment Explorer (LADEE) Spacecraft Launches



Nov

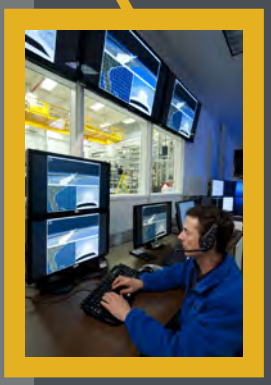
Engineers Crush Giant Fuel Tank to Improve Rocket Designs

Jan

Space Station Investigators from Around the World Visit Marshall

Jan

SLS Avionics System Sees First Light

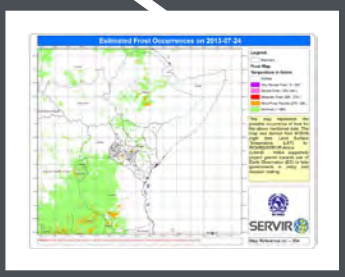


Feb

Space Station Sensor to Capture 'Striking' Lightning Data

Mar

SERVIR Project Helps African Farmers Combat Frost



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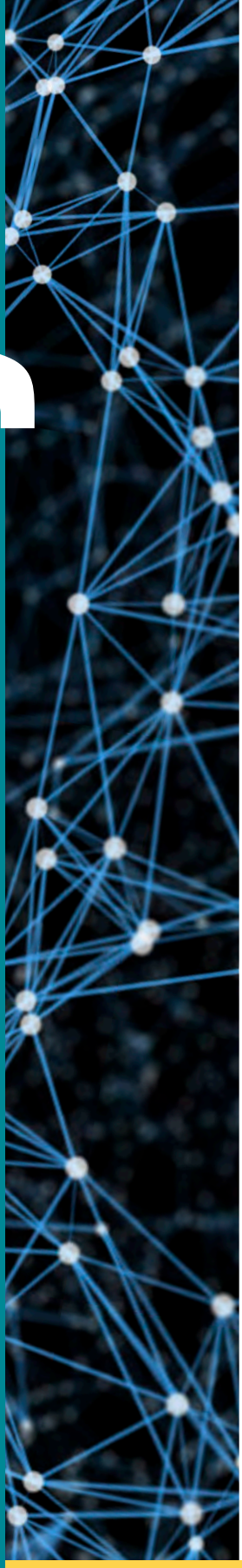
Marshall Kicks Off Game Changing Composite Cryotank Testing

Living and Working in Space

Traveling To and Through Space

Exploring Our World and Beyond



Attracting community Expertise

Marshall is a major economic development asset and technology magnet for the southeast. The center draws numerous private-sector technology companies to the area, creating thousands of high-paying jobs and attracting the talented people needed to fill them. Marshall's economic impact reaches across North Alabama and the nation.

Redstone Arsenal

Marshall's close proximity to the Army's space and missile defense hub at Redstone is ideal for sharing resources and working partnerships in space vehicle and propulsion technologies. For more than 50 years, Redstone has been the heart of the Army's rocket and missile programs. The combined expertise of these Army agencies with NASA creates a unique environment to support our nation's space endeavors.

Redstone Arsenal—home to:

- U.S. Army Aviation and Missile Command (AMCOM),
- Space and Missile Defense Command (SMDC),
- numerous program executive offices (PEO),
- and major components of the Defense Intelligence Agency and the Missile Defense Agency.

Cummings Research Park

Located adjacent to Marshall's home on Redstone is one of the world's leading science and technology business parks, Cummings Research Park. CRP is a model for transforming research into business success. The park incorporates a vibrant mixture of Fortune 500 companies, local and international high-tech enterprises, U.S. space and defense agencies, a thriving business incubator, and competitive higher-education institutions.

CRP Key Industries

- Aerospace & Defense
- Computers & Electronics
- Engineering & Government Services
- Hardware & Software Development
- Information Technology
- Life Sciences & Biotechnology
- Modeling & Simulation
- Research & Development

CRP BUSINESS by the numbers

4th largest >

2nd largest >

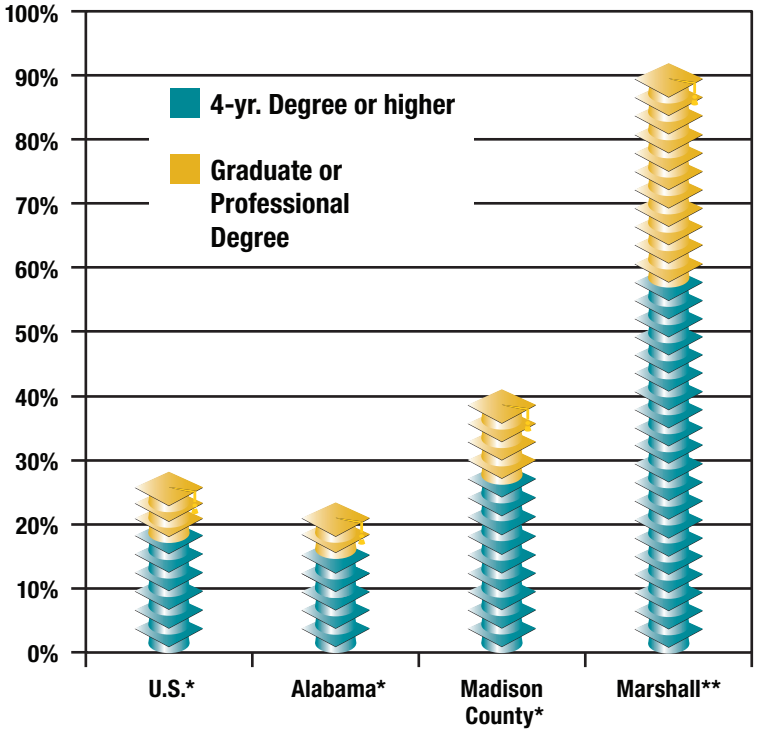
300+ companies >

29,000+ People >

1.3% of Alabama's Total Employment

Marshall is a Smart Place to Work

Marshall's influence on area education levels is significant. The highly technical skills employed at NASA require a well-educated workforce of both civil service employees and contractors. More than **91%** of the center's civil service employees hold a bachelor's degree or higher. Of those, 27% have a master's degree and 7.75% hold a doctorate degree.



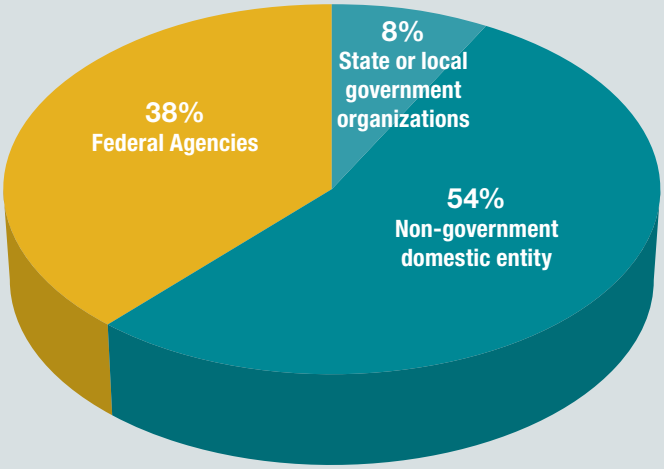
* Education level from the Census data (ACS est.) (age 15+). "Graduate or Professional Degree" includes designations such as RN, LPN, DMV, etc.

** Marshall education levels from MSFC Office of Human Capital. "Graduate or Professional Degree" at Marshall represents a Masters or PhD.

Space Act Agreements

(SAAs) are a primary method NASA uses for partnering with the external community. Through the SAA, Marshall makes its facilities, services, knowledge and skills available to industry, universities and other government agencies. These agreements represent a vast array of opportunities for the external community to utilize the center's unique resources, including laboratories and test facilities, research and development, analytical capabilities, and technical expertise. Likewise, SAAs enable Marshall to access technologies from partner organizations to help meet NASA's overall missions.

Marshall currently has 240 Space Act Agreements in progress.



Building a **bold legacy** of Successful Partnerships

Marshall is building on a long legacy of successful, mutually beneficial partnerships to lead NASA and the nation into a rewarding future in space. The Center's collaborations with other NASA centers and federal agencies, academia and industry aid programs and projects across all business lines — supporting technology development, research, testing, and ground and flight operations.

The Partnerships Office is available to help potential partners explore opportunities by listening to your needs, conveying relevant Marshall capabilities, and ultimately connecting partners to the right technical points of contact for more in-depth collaboration.

Small Business Innovation Research (SBIR) + Small Business Technology Transfer (STTR)

These programs provide small, high-tech companies and research institutions opportunities to participate in government-sponsored research and development efforts in key technology areas, facilitating innovations that also have potential commercial applications and thereby contributing to the overall NASA Mission. As small businesses work to meet NASA's research and development needs, they stimulate growth in local economies and nearby business communities.

SBIR/STTR programs are guided by the following principles:

- To stimulate U.S. technological innovation
- To increase private sector commercialization of technologies developed through federal research and development programs
- To increase small business participation in federal research and development
- To foster and encourage participation by socially disadvantaged businesses

IMPACT of NASA Investments in SBIR/STTR

$159M Investment > 3,784 Jobs Generated > $632M Economic Impact

NASA SBIR/STTR 2012 Economic Impact Report: http://sbir.gsfc.nasa.gov/

Patenting a Bold Future

- MSFC currently has **159** patents
- FY13 Patents: **18**
- FY13 Patents Applications: **11**

Technology Transfer

Marshall's valuable innovations in technology are made accessible to the public for scientific, academic, industrial, and commercial use. Technologies are routinely evaluated for commercial potential so that the technologies best suited for commercialization are patented, marketed and made available. Licensees that successfully integrate a Marshall-patented technology towards the development of a commercial product become spinoff technologies.

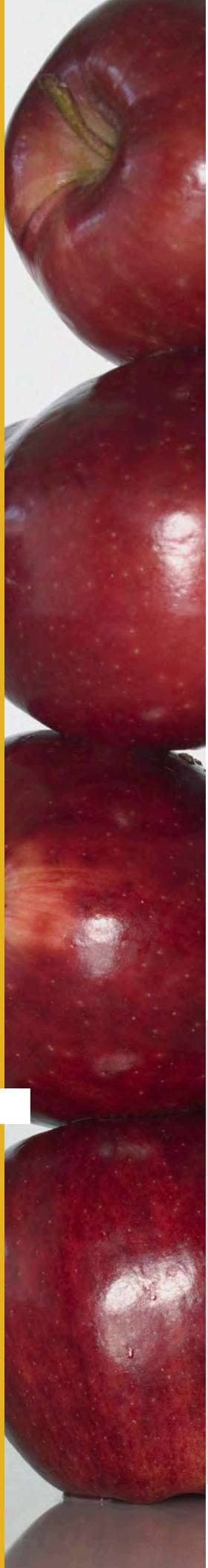
BioServe Space Technologies — a nonprofit, NASA-sponsored research partnership center — developed a leaf sensor that can monitor plants using electrical pulses, allowing anyone from astronauts to farmers to measure plant water levels directly. Berthoud, Colorado-based AgriHouse Brands Ltd. has commercialized the technology, which allows "thirsty" plants to send text messages to farmers asking for more water.

To better detect aluminum compounds, Marshall Space Flight Center partnered with KeyMaster Inc. (later acquired by Madison, Wisconsin-based Bruker AXS Inc.) to develop a vacuum pump system that could be attached to X-ray fluorescence (XRF) scanners. The resulting technology greatly expanded XRF scanner capabilities, and hundreds of museums now use them to authenticate artifacts and works of art.

Spinoff Facts

- In the last five years alone, Marshall generated more than 60 technologies featured as NASA spinoffs.
- Marshall research has benefited firefighters, farmers, plumbers, healthcare providers, soldiers, teachers, pilots, divers, welders, architects, photographers, city planners, disaster relief workers, criminal investigators, and even video-gamers and golfers.
- Marshall's Technology Transfer Office was recognized as one of Alabama's Top Ten Patent Leaders in 2013 by Economic Development Partnership of Alabama.

http://spinoff.nasa.gov



Preparing students for a **bold future**

Marshall bolsters America's future by nurturing students' interest in the fields of Science, Technology, Engineering, and Mathematics (STEM). To support the education pipeline, Marshall provides activities and programs that touch students from elementary school through college, and into their early careers.

Inspire

NASA's Speakers Bureau program puts engineers and scientists in touch with community and classroom opportunities to inspire young and old. Marshall employees voluntarily reached out to more than 18,000 students and community leaders through the Speakers Bureau program in FY2013.

Marshall also provides stimulating experiences for STEM learning outside of formal classroom environments through media, exhibits and community-based programming.

Educate

In supporting Elementary and Secondary Education, Marshall provides educators with tools, experiences, and opportunities to enhance their knowledge of science, technology, engineering, and mathematics and inspire pursuit of STEM careers.

HUNCH (High schools United with NASA to Create Hardware) is a collaboration between Marshall and 14 high schools in Alabama, Louisiana, Mississippi, Montana, and Tennessee.

Students in participating Technology classes work with NASA engineers while studying realistic hardware designs and fabricating simulated hardware based on equipment used on the International Space Station. NASA uses the relatively high-fidelity student-produced hardware in mockups used for training astronauts and ground support personnel at Marshall's full-size Space Station Mockup and Lab Training Complex.

Engage

Marshall supports institutions of higher education to strengthen their research capabilities and provide opportunities that attract and prepare increasing numbers of students for NASA-related careers.

The first annual **Human Exploration Rover Challenge**, formerly known as "The Great Moonbuggy Race," was held in April 2014, at the U.S. Space & Rocket Center. This year's competition engaged 38 high school and 46 college students and provided valuable experiences in the technologies and concepts that will be needed in future exploration missions.

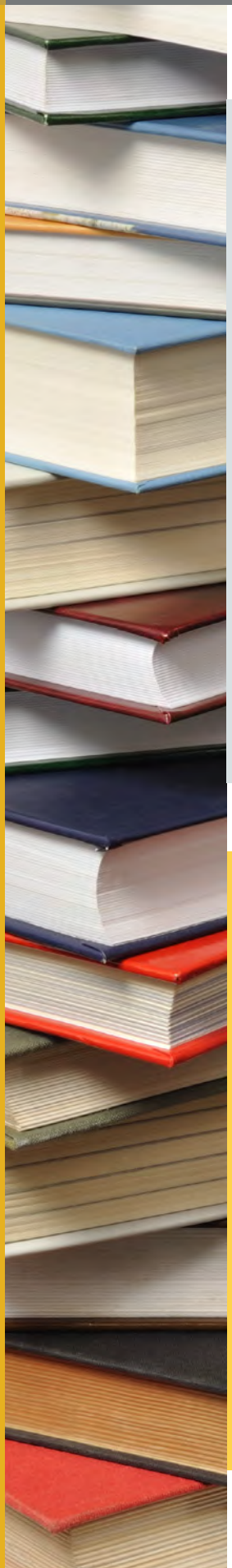
Student Launch is a research-based, competitive, and experiential exploration project that provides relevant and cost-effective research and development to support the Space Launch System. The project engaged more than 20 colleges and universities across the nation in an eight-month commitment to design, build, and fly payloads or vehicle components that support SLS.

Employ

The NASA Pathways program provides a career path for students to engage in NASA work while in school in preparation for employment after graduation. Completion of each program may lead to temporary or permanent jobs with NASA. Three programs help students bridge the gap between education and long-term STEM careers:

- Internship Employment Program
- Recent Graduates Program
- Presidential Management Fellows Program

educate

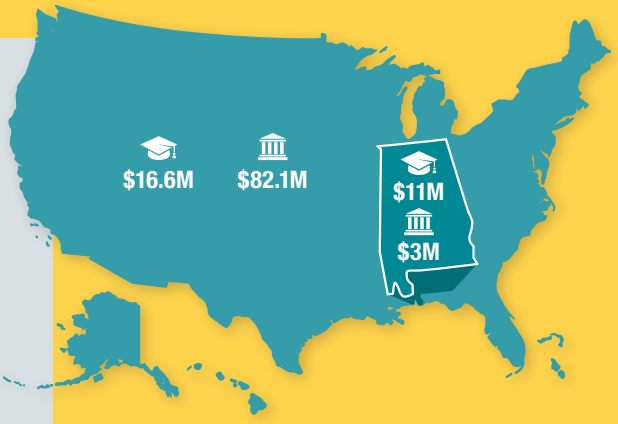


The **Innovative System Project for the Increased Recruitment of Emerging STEM Students (InSPIRESS)** is an outreach project providing the opportunity for high school students to develop and design a scientific payload to be accommodated on a spacecraft designed by undergraduate students participating on the University of Alabama in Huntsville Integrated Project Team.

High school students collaborate with the undergraduate engineering students to understand the engineering requirements, design process, and role a customer plays in design. InSPIRESS teams compete for selection by the undergraduate engineering teams. The student teams explore STEM fields by investigating a spacecraft payload to travel to a planetary body. The competitions are sponsored by NASA's Discovery and New Frontiers Program Office.

Marshall's Investment in Research Grants

By maintaining a highly educated workforce in North Alabama, NASA enhances economic growth and provides a valuable resource for businesses and the local community. To foster this growth, the agency provides educational institutions with procurements and grants for research that supports the agency's mission.



Educational Institutions
Nonprofit Organizations

Marshall: A Bold **impact** in the Community

In addition to supporting the community through improved education and technology development, employees at Marshall are boldly generous throughout their communities. Marshall team members contribute to the Combined Federal Campaign (CFC) financially and by volunteering their time to help local nonprofits as part of the CFC Community Days. The CFC dollars help support nonprofit organizations as they provide health and human service benefits throughout the region and the world.

Marshall employees participate through the Tennessee Valley CFC, which also includes the Army's Aviation and Missile Command and other federal agencies at Redstone Arsenal and in surrounding Alabama and Tennessee counties.

Marshall is the third largest organization in the Tennessee Valley CFC, yet contributes more than the two largest organizations combined. Nearly 30% of the Tennessee Valley CFC dollars come from Marshall employees. Marshall's total contribution was more than **$678,000**.

Members of the Marshall team gather plates to feed the homeless by serving meals at the Huntsville Downtown Rescue Mission.

Teams from Marshall framed houses for Habitat for Humanity during CFC Community Service Days.

Together, we make **bold** things happen.

For more information visit:
www.nasa.gov/marshallimpact

National Aeronautics and Space Administration

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www.nasa.gov

NP-2014-07-16-MSFC
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