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## Message from the NASA Administrator; Pioneering Space: The Next Steps on the Path to Mars

Over the past four years, NASA has been implementing the NASA Authorization Act of 2010, which was enacted on a broad bipartisan basis and reflects agreement between Congress and the Administration on the nation's next steps in space. A new paper from our Human Exploration and Operations Mission Directorate (HEOMD) explains NASA's roadmap to send astronauts to an asteroid by

2025 and Mars in the 2030s. You can read HEOMD's "Pioneering Space" document at <http://go.nasa.gov/1mL911l>.

This human exploration roadmap calls on NASA to facilitate commercial access to low-Earth orbit to sustain foundational scientific research on the International Space Station (ISS); develop and evolve the Space Launch

*See Path to Mars on page 2*

## Marshall Center Preparing for 'Open House' in Downtown Huntsville; Plan to Attend 'NASA on the Square' June 21

*By Kenneth Kesner*

NASA's Marshall Space Flight Center is having an "open house" on the streets of downtown Huntsville on Saturday, June 21, complete with rockets, satellites, science, engineering, music, food and fun. Visitors can talk with former astronauts, kids can make their own rocket while learning about space, and Marshall engineers and

scientists will explain their missions to help study the Earth, sun and other worlds.

"NASA on the Square" will launch at 11 a.m. and fill the streets and sidewalks around the Madison County Courthouse until 4 p.m.

Exhibits and activities for all

*See NASA on the Square on page 3*

# NASA's Sample Return Challenge Kicks Off June 11

*Jim Rothrock of Wunderkammer Laboratory in Topanga, California, prepares his robot for the NASA 2013 Sample Return Robot Challenge at the Worcester Polytechnic Institute (WPI) in Worcester, Massachusetts. Wunderkammer is one of the 18 teams competing for a \$1.5 million NASA prize purse this week. Teams will be required to demonstrate autonomous robots that can locate and collect samples from a wide and varied terrain, operating without human control. The objective of this NASA-WPI Centennial Challenge is to encourage innovations in autonomous navigation and robotics technologies. Innovations stemming from the challenge may improve NASA's capability to explore a variety of destinations in space, as well as enhance the nation's robotic technology for use in industries and applications on Earth. You can watch the challenge via Ustream [here](#). (NASA/Bill Ingalls)*



## Path to Mars *Continued from [page 1](#)*

System (SLS) heavy-lift rocket and Orion spacecraft to enable human exploration in deep space; and to develop new technologies for tomorrow's missions, all leading the way on a path to Mars in the 2030s.

We've made great progress in all of these areas and continue to implement this exciting plan. Our stepping stone approach builds on our work living and working aboard the ISS to achieve scientific breakthroughs not possible here on Earth and serve as a springboard to NASA's next great leap in human exploration. We'll use the proving ground of cis-lunar space to demonstrate and mature various technologies and roadmap elements, and we will pursue the capture and redirect of an asteroid enabling astronauts to visit it and obtain samples. All this work will eventually enable astronaut missions to Mars.

Our pursuits are big – and the path to Mars is hard. Our work requires systematic and deliberate long range planning. Federal budgets can fluctuate, but our plan is strategic and sustainable. Developing and evolving our human exploration roadmap builds on our current capabilities as we move toward Earth independence on the path to Mars. All of our work is applicable across a wide range of missions and activities, and will further NASA's contributions to society, yielding applications to improve life here on Earth.

Building on today's investments in the ISS, the Commercial Crew Program, SLS and Orion, and Space Technology programs, as well as our robotic science endeavors around and on the surface of

Mars, the United States is poised to lead the next wave of missions and partnerships to pioneer the space frontier. Simply put: we aim to expand human presence and exploration in the solar system and on the surface of Mars.

Our progress in implementing this exciting roadmap has just begun. At the end of this year we send the Orion spacecraft to space for the first time on Exploration Flight Test-1. Soon, we'll contract for commercial crew services enabling us to once again launch astronauts from American soil by 2017. Next year, for the first time, we launch a crew for a one-year mission aboard the ISS. Our next science mission to Mars, MAVEN, will reach the Red Planet this September, to be followed by the InSight lander in 2016 and the Mars 2020 rover. Already, Curiosity's work has taught us much more about the Martian surface and what environment astronauts will encounter there. Our Space Technology Mission Directorate continues groundbreaking demonstrations that will further our nation's capabilities in entry descent and landing. The directorate also is working on solar electric propulsion and many other innovations vital to taking humanity into deep space and on the path to Mars. There is tangible progress across NASA -- on drawing boards, in manufacturing facilities, on launch pads and in space.

I hope you'll take a moment to read HEOMD's document. Together, we're accomplishing big things in this new era of exploration.

Charlie B.

## **NASA on the Square** *Continued from page 1*

ages will showcase everything from the center's work with the Space Launch System and Orion spacecraft -- the most powerful rocket ever built and the vehicle that will take astronauts on deep-space missions to asteroids and Mars -- to 3D printing and other advanced technologies that are revolutionizing space exploration and discovery.

The Marshall Center is partnering with Downtown Huntsville, Inc., for the free event. Visitors will find demonstrations, displays and activities reflecting the work of Marshall and NASA grouped into three broad categories around the Square and adjacent areas:

-- "Traveling To and Through Space" will feature an actual RS-25 rocket engine like those that will launch the Space Launch System; a display of a rocket propellant tank made of light-but-strong composite materials instead of much-heavier metals, that keeps gases so cold they become liquids; and the "Mighty Eagle" robotic prototype lander, which is testing technology to allow spacecraft to autonomously land and explore moons and other worlds; and much more.

-- "Living and Working in Space" allows visitors a glimpse into the Marshall-developed Environmental Control and Life Support System that provides astronauts aboard the International Space Station with water and oxygen and controls their environment. Displays will explain the work of people at the Payload Operations and Integration Center at Marshall, who manage the increasing number of science activities aboard the space station. You'll get the facts about the racks and sealed Microgravity Science Glovebox that allows station astronauts to safely handle materials for experiments. And you'll learn about work to design Deep Space Habitats for long-term missions.

-- "Understanding Our World and Beyond" will showcase Marshall's role in the orbiting Chandra X-ray Observatory, the world's most powerful X-ray telescope; the Lunar Reconnaissance Orbiter, a robotic mission that set out to map the moon's surface and, after a year of exploration, was extended with a unique set of science objectives; the ISERV Earth observation camera system aboard the space station; solar science experiments and many other programs. There will even be a "Sunspotter"

special telescope for viewing the sun.

Throughout the day, Marshall Center researchers, scientists and other team members will present short talks about their work. Bands featuring Marshall Center musicians will perform; the Marshall Exchange shop will have science-related kids' games for sale, as well as caps, T-shirts, tote bags, space shuttle mission coins and other NASA-logo merchandise; and visitors can have their picture taken in a spacesuit. There will be many educational activities for children, including being tethered to a simulated spacecraft to learn how astronauts make repairs or launch satellites during spacewalks, and "Peeps in Space," which uses marshmallow treats and a vacuum jar to show why astronauts need special spacesuits.

NASA partners, including Aerojet Rocketdyne, ATK, Boeing, Jacobs and Teledyne Brown will also have exhibits on the Square. Goodwin, Mills & Cawood is providing the stage and sound system. Other participants include the University of Alabama at Huntsville, American Institute of Aeronautics and Astronautics, U.S. Space & Rocket Center and the Huntsville-Madison County Convention and Visitors Bureau.

*Kesner, an ASRC Federal/Analytical Services employee, supports the Office of Strategic Analysis & Communications.*

# All Systems are 'Go' for Modern Control and Data Center at NASA's Landmark Test Facilities

By Molly Porter

Smoke and fire might be the first things people envision when they think about rocket testing, but information technology systems are just as important to the success of a test. To create a facility worthy of important NASA testing, a landmark building in the East Test Area at NASA's Marshall Space Flight Center has been transformed into a bustling information and control hub for test operations.

"By modernizing and consolidating our test control and data acquisition systems, we have improved the infrastructure while making it more affordable for our customers to conduct tests," said Chris Singer, director of Marshall's Engineering Directorate. "These systems also require less maintenance, reducing our long-term facility costs and allowing better use of our resources."

Engineers just began using brand new control and data acquisition systems for a series of tests on one of the largest composite rocket fuel tanks ever built. The new control and data acquisition hardware located in Building 4583 also is being used for the Space Launch System (SLS). This historic building -- now known as Marshall's Test and Data Recording Facility -- has played a role in testing for many American rockets and other space systems.

"We are excited about having a modern control center with the latest technologies to replace the



Engineers and technicians monitor test operations from a new control center at the Marshall Center. (NASA/MSFC/Emmett Given)

older, obsolete ones," said Ralph Carruth, director of Marshall's test laboratory. "By consolidating to one location we'll be able to operate much more efficiently and reduce costs."

Centralized operations lower the amount of energy that goes into powering network infrastructure at multiple locations and the associated systems for securing, cooling and maintaining them. New state-of-the-art data acquisition systems increase the amount and quality of test data collected. Safely testing and obtaining reliable data have been the key to the successful development of American rockets from the Redstone, Jupiter, Juno and Saturn, to the space shuttle main engine and boosters, to the current testing for SLS and other critical space technology.

With its high-speed video and supplement control systems, the smaller, more flexible control center is equipped to support a variety of NASA projects as well as those from other government agencies and commercial space efforts -- large and small.

Porter is a Pathways intern in the Office of Strategic Analysis & Communications.



A 1966 photograph of Marshall test area control and data acquisition hardware. (NASA)

# Chandra Captures Galaxy Sparkling in X-rays

Nearly a million seconds of observing time with NASA's Chandra X-ray Observatory has revealed a spiral galaxy similar to the Milky Way glittering with hundreds of X-ray points of light.

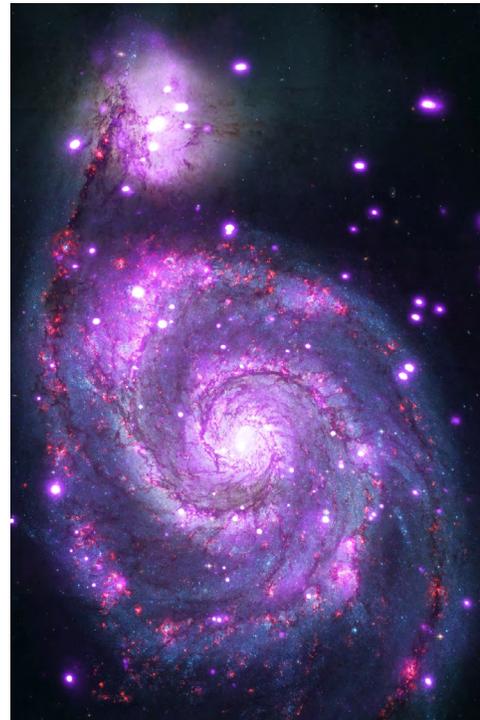
The galaxy is officially named Messier 51 (M51) or NGC 5194, but often goes by its nickname of the "Whirlpool galaxy." Like the Milky Way, the Whirlpool is a spiral galaxy with spectacular arms of stars and dust. It is located 30 million light years from Earth, and its face-on orientation to Earth gives us a perspective that we can never get of our own spiral galactic home.

By using Chandra, astronomers can peer into the Whirlpool to uncover things that can only be detected in X-rays. In this new composite image, Chandra data are shown in purple. Optical data from the Hubble Space Telescope are red, green and blue.

Most of the X-ray sources are X-ray binaries (XRBs). These systems consist of pairs of objects where a compact star, either a neutron star or, more rarely, a black hole, is capturing material from an orbiting companion star. The infalling material is accelerated by the intense gravitational field of the compact star and heated to millions of degrees, producing a luminous X-ray source. The Chandra observations reveal that at least 10 of the XRBs in the Whirlpool galaxy are bright enough to contain black holes. In eight of these systems, the black holes are likely capturing material from companion stars that are much more massive than the sun.

Because astronomers have been observing the Whirlpool galaxy with Chandra for about a decade, they have critical information about how X-ray sources containing black holes behave over time. The black holes with massive stellar companions are consistently bright over the 10 years of Chandra observations. These results suggest that the high-mass stars in these X-ray sources also have strong winds that allow for a steady stream of material to flow onto the black hole.

A difference between the Milky Way and the Whirlpool galaxy is that the Whirlpool is in the midst of merging with a smaller companion galaxy seen in the upper left of the image. Scientists think this galactic interaction is triggering waves of star formation. The most massive of the newly formed stars will race through their evolution in a few million years and collapse to form neutron stars or black holes. Most of the XRBs containing black holes



*(X-ray: NASA/CXC/Wesleyan Univ./R.Kilgard, et al; Optical: NASA/STScI)*

in the Whirlpool galaxy are located close to regions where stars are forming, showing their connection to the oncoming galactic collision.

Previous studies of the Whirlpool galaxy with Chandra revealed just over 100 X-ray sources. The new dataset, equivalent to about 900,000 seconds of Chandra observing time, reveals nearly 500 X-ray sources. About 400 of these sources are thought to be within the galaxy, with the remaining either being in front of or behind the galaxy itself.

Much of the diffuse, or fuzzy, X-ray emission in the Whirlpool comes from gas that has been superheated by supernova explosions of massive stars.

The new Chandra observations were presented at the 224th meeting of the American Astronomical Society in Boston, Massachusetts by Roy Kilgard of Wesleyan University in Middletown, Connecticut. NASA's Marshall Space Flight Center manages the Chandra program for NASA's Science Mission Directorate. The Smithsonian Astrophysical Observatory in Cambridge, Massachusetts controls Chandra's science and flight operations.

## Marshall Exchange Hosts Employee Appreciation Cajun Fest on June 5



NASA's Marshall Space Flight Center Director Patrick Scheuermann, left, helped serve a Cajun-style lunch to Marshall team members at the Cajun Fest sponsored by the Marshall Exchange in the Activities Building 4316 on June 5. The event also included live musical entertainment. (NASA/MSFC/Fred Deaton)

Although the weather outside was dampened by intermittent periods of rain, the spirits of the Cajun Fest participants June 5 were unaffected by the weather as evidenced by several Marshall team members and interns joining an impromptu line dance to the tunes of a live band at the Marshall Exchange-sponsored event. (NASA/MSFC/Fred Deaton)



## Marshall Center Full-Time and Part-Time Study Programs Undergo Significant Changes

The Full-Time and Part-Time Study Programs managed by the Office of Human Capital at NASA's Marshall Space Flight Center will now be called the Full-Time and Part-Time Degree Seeking Programs.

Along with the name change, the program has adopted new specifications that are effective immediately:

- The Personnel Management Advisory Committee will review and endorse candidates for both full-time and part-time study programs. In the past the committee only reviewed and endorsed candidates for the full-time study program.
- Full-time participants pursuing a master's or doctorate-level degree will be approved for one year with an annual cap of \$15,000.
- Part-time participants pursuing a bachelor's,

master's or doctorate-level degree will be approved for two years with a maximum of four classes per year and an annual cap of \$8,000.

For any questions regarding the Full-Time and Part-Time Degree Seeking Programs, contact [Veronica Williams](#) or 544-7489.