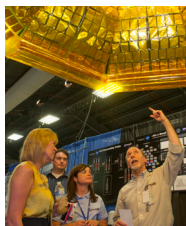




Serving the Marshall Space Flight Center Community [www.nasa.gov/centers/marshall/about/star/index.html](http://www.nasa.gov/centers/marshall/about/star/index.html) September 18, 2013

**Inside This Issue:**  
**Marshall Center Hosts**  
**Annual Innovation &**  
**Technology Day** *page 3*



**Three Marshall Team**  
**Members Receive Federal**  
**Women's Program Awards**  
*page 6*



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## RS 25: The Clark Kent of Engines for the Space Launch System

*By Megan Davidson*

In the iconic comic-book series, "Superman," the main character, Clark Kent, looks like your average Joe. Under the ruse of a three-piece suit and glasses, Kent's true identity is "Superman," who transforms into his mighty persona to do battle for the good of mankind. In the rocket engine world, the RS-25 is Clark Kent.

Four RS-25 engines will power the

*See RS-25 on* *page 2*



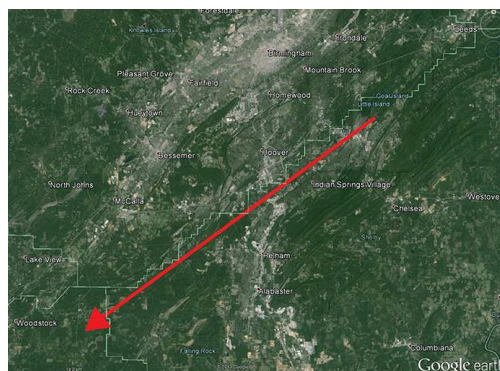
*Four RS-25 engines, like the one pictured undergoing a hot-fire test, will power the core stage of the SLS. (Aerojet Rocketdyne)*

## Fireball Streaks Across Alabama Sky

*By Janet Anderson*

On Sept. 9, at 8:18 p.m. CDT, a baseball size fragment of a comet entered Earth's atmosphere just above Alabama, moving southwest at a speed of 76,000 mph. At such speeds, fragile cometary material will not last long -- just 3 seconds after hitting the atmosphere, the meteor disintegrated 25 miles above the town of Woodstock, just southwest of Birmingham. The meteor produced a flash of light

*See* *Fireball* *on* *page 3*



*Map of the meteor's trajectory. (NASA/Meteoroid Environment Office)*

core stage of NASA's Space Launch System (SLS) -- NASA's new heavy-lift launch vehicle. Towering more than 200 feet tall with a diameter of 27.6 feet, the [core stage](#) will store cryogenic liquid hydrogen and liquid oxygen that will feed the vehicle's RS-25 engines.

SLS will be the most powerful rocket in the world with the greatest capacity of any launch system ever built to support any destination, any payload and any mission, including NASA's plans to send humans to a captured and relocated asteroid. The 70-metric-ton (77-ton) configuration will stand at 321 feet -- taller than the Statue of Liberty.

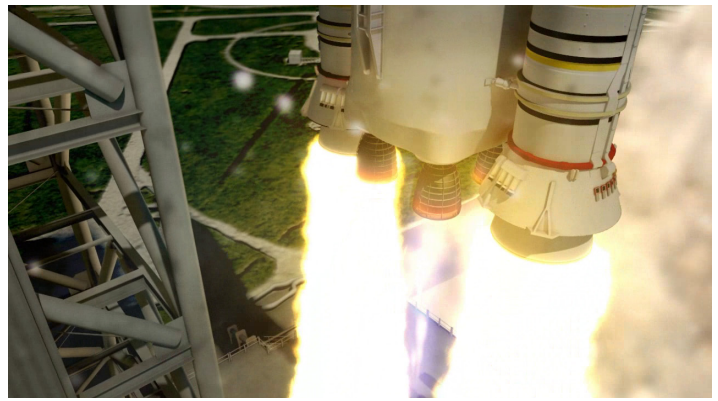
The RS-25, also known as the space shuttle main engine, is the first reusable rocket engine in history.

"During the 30-year run of the Space Shuttle Program, the RS-25 achieved very high demonstrated reliability," said Garry Lyles, chief engineer for the Space Launch System Program Office at NASA's Marshall Space Flight Center. "And during 135 missions and numerous related engine tests, it accumulated over 1 million seconds -- or almost 280 hours -- of hot-fire experience. With that kind of reliability, we knew it would be the best engine to power SLS."

The RS-25s may look like that Clark-Kent-average-Joe persona from the outside, but when ignited, the engines will reveal their "Superman" identity -- pushing the SLS 73 times faster than an Indianapolis 500 race car.

And if that doesn't seem superhero enough:

- The fuel turbine on the RS-25's high-pressure fuel turbopump is so powerful that if it were spinning an electrical generator instead of a pump, it could power 11 locomotives; 1,315 Toyota Prius cars; 1,231,519 iPads; lighting for 430 Major League baseball stadiums; or 9,844 miles of residential street lights -- all the street lights in Chicago, Los Angeles or New York City.
- The four RS-25 engines on the SLS launch vehicle gobble propellant at the rate of 1,500 gallons per second. That's enough to drain an average



*Artist rendering of the RS-25 engines powering the liftoff of the SLS from the pad. (NASA)*

family-sized swimming pool in 60 seconds.

"The RS-25 is very high-performance, proven reliable and can take the SLS from the ground all the way to orbit," said Mike Kynard, SLS Liquid Engines program manager at the Marshall Center. "There's only one engine in the United States with enough thrust combined with high performance like that, and it's the RS-25."

Modifications were needed on the heritage engines to prepare them for the new heavy-lift vehicle. "We need more thrust on the SLS than the shuttle, since we have a heavier payload," Kynard said. "The core stage is a good bit larger than the external tank on the shuttle. To accommodate the higher thrust level, we increased the number of engines we had from three to four, and increased the power level of each engine."

A total of 16 RS-25 flight engines are stored at NASA's Stennis Space Center until testing begins in 2014 on its A-1 test stand.

For the full version of this story, click [here](#).

*Davidson, an Analytical Services Inc. employee, supports the Office of Strategic Analysis & Communications.*



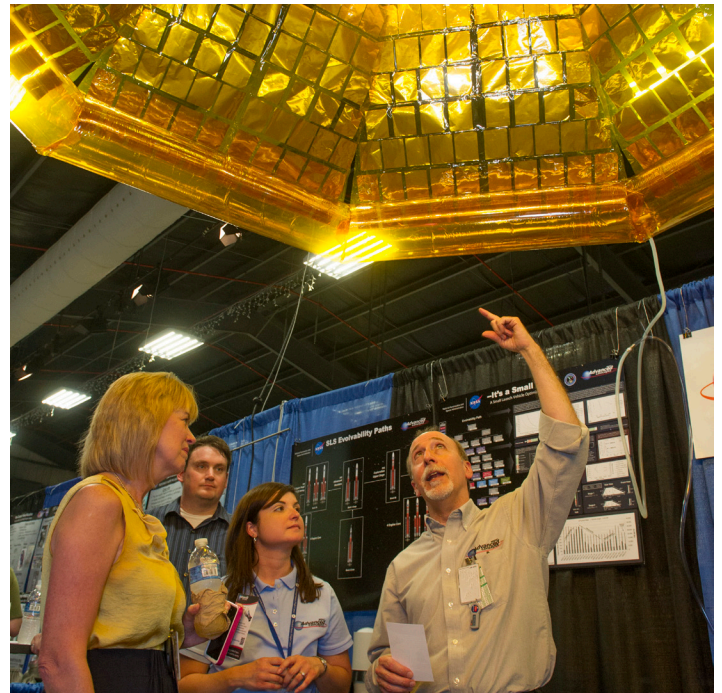
# Marshall Center Hosts Annual Innovation & Technology Day



Marshall Center Director Patrick Scheuermann, right, discusses the finer points of using additive manufacturing to build engine parts with David Eddleman, a component engineer with the Engineering Directorate, during Innovation & Technology Day. The use of additive manufacturing, or 3-D printing, was a common theme among many of the departments exhibiting at the event, using the production method to build scale models and even parts that are undergoing intense testing for possible use on future space vehicles -- like the part Scheuermann is holding. (Image: MSFC/Emmett Given)

Teresa Vanhooser, left, deputy director of the Marshall Space Flight Center, listens as Advanced Planning Analyst Steve Lambing, right, provides details about a proposed inflatable solar array with, from left, Andrew Schnell with the Advanced Concepts Office and Stefanie Justice, a project engineer with Jacobs Engineering Group. The display was part of the Advanced Concepts booth at the annual Innovation & Technology Day event Sept. 12 at the Activities Building 4316. More than 80 different organizations from across the center exhibited their latest advances at the event, sharing their innovations with the hundreds who attended throughout the day. (Image: MSFC/Emmett Given)

See *The Marshall Star Asks: What Did You Learn at Innovation & Technology Day?* on [page 4](#)



## Fireball *Continued from [page 1](#)*

rivaling the waxing crescent moon. Because it penetrated so deep into Earth's atmosphere, sonic booms were produced, which were heard by some eyewitnesses.

The meteor was not a member of any known meteor shower.

A fireball is a meteor brighter than the planet Venus -- the fireball seen Sept. 9 was 15 times brighter than Venus.

"This particular meteor was bright enough and high enough that it was seen pretty much all over the Southeast, from Atlanta to Tennessee," said Bill Cooke, lead of NASA's Meteoroid Environment Office at the Marshall Space Flight Center. "It

also happened pretty close to right on top of Birmingham."

Cooke mentioned officials are checking Doppler radar sites to see whether any meteorites were detected near the ground.

"I doubt there are any meteorites on the ground from this event," Cooke said. "It was kind of a spectacular fireworks show, but I don't think at this time there are any meteorites on the ground."

To see a video of the fireball, click [here](#).

*Anderson is a public affairs officer in the Office of Strategic Analysis & Communications.*

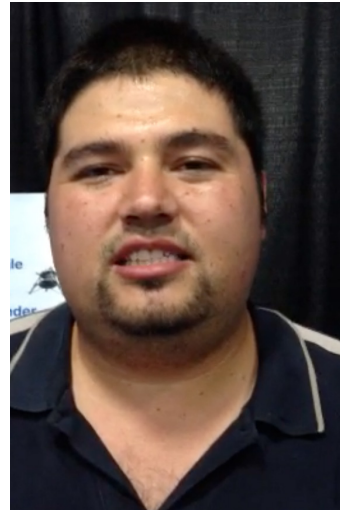
# The Marshall Star Asks: What Did You Learn at Innovation & Technology Day?



*"The expo has been very interesting, learning about the different technologies being pursued here at Marshall. It's been an illuminating experience." -- Adam Irvine, Aerospace Engineer with Onyx Aerospace supporting the Advanced Development Office, Chief Engineers Office*



*"I came to look at the advances being developed by Marshall and how to apply that to the projects I'm working on. I also looked to see how to become involved in some of those new technologies and get some new ideas developed. I've met a lot of interesting people today." -- Leonardo Barreda, Structures and Analysis Branch, Propulsion Department*



*"Today showed me that Marshall is doing more in technology that I expected. I usually only get to see what is in my little area, but to be able to walk around here and see what is going on makes me proud of the many things Marshall is doing in regards to technology and excellence." -- Erick Ordonez, Lead Systems Engineer for Mighty Eagle, Space Systems Department*



*"Innovation & Technology Day has been really inspiring to all of us this year, especially to me because we're showcasing all of our new buildings." -- Sherry White, Administrative Support with Deltha-Critique Joint Venture in the Planning & Facilities Utilization Office, Office of Center Operations*



*"I've learned about all the cool stuff going on here -- from manufacturing to friction stir welding to the nanolauncher. All sorts of things!" -- John Peugeot, Liquid Engine Systems Branch, Propulsion Systems Department*



*"It was awesome and I learned a lot. Everyone exhibiting here did a great job explaining what they do to those of us who are not scientists or engineers." -- Ann Yelle, Communications Integration Team Lead with Analytical Services Inc., supporting the Office of Strategic Analysis & Communications*



*"Today I got to meet some new people and find out a bit more about what new developments we're working on here at Marshall." -- Erin Betts, Propulsion Engineer in the Engine Systems Branch, Propulsion Systems Department*



# NASA has 'HUNCH' about Student Success in Engineering

By Laura Niles, ISS Program Science Office, Johnson Space Center

Several young science, technology, engineering and mathematics professionals entering the workforce right now are likely to have been motivated to enter those fields by the High school students United with NASA to Create Hardware, or HUNCH Program.

In its 10th year, HUNCH is an instructional partnership between NASA, high school and intermediate/middle school students to build cost-effective hardware and soft goods both for use on the International Space Station and for training of NASA astronauts and flight controllers.

"It gives trainees a hands-on opportunity to see what they're really working with in space," says Bob Zeek, HUNCH co-founder at NASA's Marshall Space Flight Center, describing the benefit of the training hardware and soft goods.

The Huntsville Center for Technology was one of the first schools to sign up for the program and continues to participate today.

"The program allows students to get out of a textbook and work on the STEM -- science, technology, engineering and mathematics -- activities," says Mike Evans, a drafting teacher at the Huntsville Center for Technology. "These are the engineering skill sets that they need to be successful later in life."

The popularity of HUNCH has grown to include 53 schools across 18 different states. Curriculum areas include computer electronics, 3-D printing for rapid



*European Space Agency astronaut Paolo Nespoli observes a can crusher, built by students in HUNCH Program, during Expedition 26 aboard the International Space Station. (NASA)*

prototype development, machine shop and welding. Schools can get involved through online application on the HUNCH website.

To highlight the 10th anniversary of HUNCH, ISS commentator Lori Meggs, an Analytical Services Inc., employee supporting the Office of Strategic Analysis & Communications at the Marshall Center, interviewed Zeek and Evans during a recent episode of "Space Station Live." To see the interview video, visit [here](#).

Watch the full "Space Station" Live broadcast weekdays on NASA TV at 10 a.m. CDT.

## Three Marshall Team Members Receive Federal Women's Program Awards

By Rick Smith

Three team members at NASA's Marshall Space Flight Center have been presented [Federal Women's Program Outstanding Achievement Awards](#) in commemoration of [Women's Equality Day](#).

The awards recognize outstanding achievement and exceptional service to NASA's mission and the work of

the Marshall Center in three categories -- professional, supervisory and administrative.

Terrie M. Gardner, a flight systems engineer and technical manager within a division of the Marshall Engineering Directorate's Spacecraft and Vehicle Systems Department, received the professional achievement award.

*See Women's Program Awards on [page 6](#)*

## Women's Program Awards *Continued from page 5*

Gail H. Gordon, branch chief of the Materials Test Branch within Marshall's Materials and Processes Laboratory, received the supervisory achievement award.

Carole C. Valenti, Marshall's emergency management director and continuity-of-operations coordinator in the Office of Center Operations, received the administrative achievement award.

Gardner, Gordon and Valenti received their Women's Equality Day awards July 30 during the annual [NASA/Marshall Center Honor Awards](#) ceremony. The event recognizes hundreds of Marshall team members who made significant contributions to NASA and Marshall over the previous 12 or more months.

Women's Equality Day, celebrated each Aug. 26 by presidential proclamation, honors certification of the 19th amendment to the U.S. Constitution on Aug. 26, 1920, granting women the right to vote.

Gardner began her NASA career in 1990 as a materials engineer, spending 16 years performing materials, selection and control duties for mission-critical activities in support of the [Chandra X-ray Observatory](#), the International Space Station [Materials Science Research Rack](#) and other Marshall-managed science hardware and systems. Most recently, she was the review director for the [Space Launch System Preliminary Design Review](#) -- a newly completed milestone which validates the detailed design and integration of NASA's next-generation heavy-lift launch vehicle and ensures the program -- pending agency approval -- is ready to begin implementation for the first full-scale test flight in 2017.

Gordon joined NASA in 1980 as a materials engineer. She has assisted with and led numerous materials investigations and planning efforts, conducting more than 19,000 chemical and mechanical tests to ensure NASA launches and flies the safest, most cost-efficient vehicles and hardware possible. She provides critical materials support for high-profile projects across NASA and its industry partners, most recently the [J-2X engine](#) development effort. An update of the powerful engine that helped lift NASA's [Saturn V](#) rockets to the moon, J-2X development is part of NASA's work on the Space Launch System, set to lift new exploration missions beyond Earth orbit in years ahead.



*Marshall flight systems engineer Terrie M. Gardner. (NASA/MSFC)*



*Engineering Directorate branch chief Gail H. Gordon. (NASA/MSFC)*



*Marshall Emergency Management Director Carole C. Valenti. (NASA/MSFC)*

Valenti, a 26-year veteran of the U.S. Army and a staffer at the [Department of Homeland Security](#) from 2003 to 2010, joined Marshall in 2010. Not long after she assumed Marshall's new emergency management leadership position, the center faced a number of severe weather-related emergency-response activities -- most notably the April 27, 2011, tornadoes which claimed 249 lives across Alabama and left thousands homeless or without power. Valenti and her team worked with Marshall administrators and local and state officials around the clock, helping to restore power and resume full operations 11 days after the catastrophe. She continues to work to improve Marshall's emergency response capabilities.

Learn more about each of these exemplary Marshall team members here: [Gardner](#); [Gordon](#); [Valenti](#).

*Smith, an Analytical Services Inc. employee, supports the Office of Strategic Analysis & Communications.*

# Marshall Center's REDSTAR Library Serves the NASA Cost Community and Beyond

By Jena Rowe

Have you ever thought about what happens to all of the research that goes into developing a rocket engine part, or to determine how much it would cost to send a spacecraft into orbit? The Resource Data Storage and Retrieval System (REDSTAR) Library at NASA's Marshall Space Flight Center may be able to help answer your questions.

The REDSTAR Library, located in Building 4200, Room G35, is a NASA-wide repository of cost, programmatic and technical data pertaining to the space program. Starting in 1971 with six filing cabinets of documents, the library has grown to contain more than 38,000 documents. REDSTAR receives, catalogs and archives raw data, organizing it in a way that is easily accessible and user friendly for predicting the development and production costs of new space programs.

However, this data is helpful to the technical community as well. "Not only is there cost data, there is also technical information," said Mary Ellen Harris, REDSTAR librarian. "We are finding that many engineers are interested in looking for what tests have already been done and see what lessons have already been learned. If they can provide the correct terminology, I can use the resources I have within

REDSTAR to do some research for them so that they can continue working instead of using their time drowning in research."

REDSTAR's document content includes approximately 200 manned and unmanned spacecraft missions. Cost, technical and programmatic data ranging from total program to the subcomponent level can be found pertaining to the spacecraft bus, attached payload, engines, launch vehicles, upper stages, scientific instruments and aircraft. Additional data pertaining to cost models and cost estimating, schedules, ground and launch operations, mission operations and business strategy is also found in the database library.

"We are available to help all Marshall Center employees with their research in the best way we can," said Harris. "In addition to other great Marshall libraries and repositories, REDSTAR is another resource to consider."

The following special collections are found in REDSTAR: External Tank Performance Measurement Reports; HST POP Collection; Launch Vehicles, Lessons Learned; Manned Missions; Mission Operations; NASA HQ Collection; POP's Collection - MSFC, GSFC, and JPL; Schedules Collection; Shuttle Projects Schedules

See **REDSTAR Library** on [page 8](#)

## More Than 100 Former Marshall Workers Attend Retirees Association Luncheon



More than 100 retired team members from NASA's Marshall Space Flight Center -- including former employees Mary Harris, left, and Patsy Parmer -- gathered at The Ledges in Huntsville for a Marshall Retirees Association luncheon Sept. 5. Speakers for the event were Jim Hudson, cofounder of HudsonAlpha Institute for Biotechnology in Huntsville; and Dr. Debra Barnhart, director and CEO of the U.S. Space & Rocket Center in Huntsville. Event organizers said the luncheon drew the most retirees in the history of the association, which sponsors similar gatherings approximately four times a year. To learn more about the Marshall Retirees Association, contact Linda Posey, president, at [linda.m.posey@nasa.gov](mailto:linda.m.posey@nasa.gov). (NASA/MSFC/Ola Metcalfe)



# Space Station Astronaut Chris Cassidy Thanks Marshall Payload Operations Integration Center for its Support

By Lori Meggs

When an astronaut spends 166 days in space aboard the International Space Station, you can bet hundreds of hours are consumed on research. That was the case for Expedition 36 crew member Chris Cassidy who returned to Earth Sept. 10, after living more than six months on the station. Much of his time in space he spent talking to Marshall Space Flight Center team members in the Payload Operations Integration Center, which coordinates and assists with all research aboard the station.

Before leaving the station, Cassidy videotaped and downlinked a message to those team members with whom he worked so closely. He thanked them for their hard work in helping to accomplish the many experiments that will have benefits for future human spaceflight and life on Earth. To view the video, visit [here](#).

“Hello to all my friends in Huntsville at the Payload Ops Center,” said Cassidy. “This is Chris obviously here in the space station. I’ve got the glovebox right behind me to my left; I’ve got MELFI to my right, so I thought it’s appropriate to say hello, say thank you to all of you for the support. It’s just been a really fun time up here and to be part of all the experiments that I’ve had the opportunity to do has just been pretty incredible.”

Cassidy went on to talk about some of the experiments he performed and his valuable training.

“It’s with the support of everybody there in Huntsville that makes it all a success. So I just wanted to take a minute or two...I just have like 11 days left I guess before undocking, and I just wanted to take a minute or two and

say thanks, and it’s been a lot of fun and I look forward to coming by Huntsville in the not-too-distant future and saying hello in person and thank you in person to each and every one of you. So from the final days of Expedition 36 take care and bye bye. See you soon,” he added.

Cassidy also had pizzas delivered to the team for lunch one day.

“It was a pleasure to work with Chris during his time on station,” said Rick Rodriguez, payload operations manager for Expedition 36. “We really appreciate him taking the time to recognize the work we do 24/7 to support the mission. Crew members like him make our job easier.”

Cassidy launched to the station March 29 along with fellow crew members Pavel Vinogradov and Alexander Misurkin of the Russian Federal Space Agency. They completed 2,656 orbits of Earth and traveled more than 70 million miles when they safely landed in Kazakhstan.

Cassidy has accumulated 182 days in space on his two spaceflights. Vinogradov now has logged 547 days in space on three spaceflights. This puts him 10th on the all-time endurance list. This was Misurkin’s first flight, for a total of 166 days.

For information on the International Space Station, visit [here](#).

*Meggs, an Analytical Services Inc. employee, supports the Office of Strategic Analysis & Communications.*

## REDSTAR Library *Continued from [page 7](#)*

Status Reports 1973-1986; Space Station; SRM Performance Measurement Reports 1981-1989; ICEAA Cost Society; and Spacecraft Project Data Manuals.

REDSTAR Library data is available for use by all NASA employees and members of cost groups from all NASA centers. A password-protected database of

8,000 full-text documents is available online. Questions concerning access to the REDSTAR database should be directed to [Mary Ellen Harris](#) at 256-544-2320.

*Rowe, an Analytical Services Inc. employee and the Marshall Star editor, supports the Office of Strategic Analysis & Communications.*