

Spaceport News



John F. Kennedy Space Center - America's gateway to the universe

GSDO tests roller bearings on crawler 2

By Linda Herridge
Spaceport News

The crawler-transporter that will carry NASA's Space Launch System (SLS) and Orion spacecraft to Launch Pad 39B for launch on Exploration Mission-1 in 2017 recently passed the first phase of an important milestone test at Kennedy Space Center in Florida.

The Ground Systems Development and Operations Program completed testing of the new traction roller bearings on crawler-transporter 2 (CT-2), on two of the massive vehicle's truck sections, A and C, in late January.

During the test, CT-2 was driven unloaded on crawler-way C, between the Vehicle

Assembly Building and Ordnance Road.

As the crawler moved along, the left- and right-hand steering was tested in both directions. Workers performed visual inspections of the roller bearing pumps, valves and lines to ensure that the grease injectors worked properly and provided the required flow of grease to the new roller assemblies.

"The temperature of the roller assemblies were monitored and recorded using newly-installed thermocouples," said Mike Forte, a senior project manager with QinetiQ on the Engineering Services Contract. "We were looking for any anomalies and establishing a baseline operating temperature

for the new roller assemblies."

Forte said temperature data on the surface of the roller assemblies also was collected using handheld infrared temperature monitoring devices. "We also closely monitored the system for any unanticipated vibrations or noise, which are indications of problems," Forte added.

The test was a collaborative effort that involved about 30 NASA and contractor engineers and technicians from Kennedy and Ames Research Center in Moffett Field, Calif.

Upgrades to CT-2 include 88 new traction roller bearing assemblies, a modified lubrication delivery system, and a new temperature monitoring system

that includes 352 new thermocouples.

Forte said subsequent tests will be used to establish permanent operational warning and shutdown limits for a fully-loaded crawler-transporter.

CT-2 returned to the VAB on Jan. 31 to install new roller bearing assemblies on the B and D truck sections. Another test is scheduled for November, after installation of the second set of bearings has been completed.

Upgrades to CT-2 are necessary in order to increase the lifted-load capacity from 12 million to 18 million pounds to support the weight of the mobile launcher and future launch vehicles, including the SLS and Orion.



NASA/Kim Shifflett

Crawler-transporter 2 (CT-2) arrived back at the Vehicle Assembly Building on Jan. 31 after successfully completing a test of the new roller bearing assemblies that were installed on one side. Work continues to upgrade CT-2 to ensure its ability to transport launch vehicles to the pad, including NASA's Space Launch System and Orion spacecraft.

Day of Remembrance highlights importance of lessons learned

By Steven Siceloff
Spaceport News

Kennedy Space Center continues to make strides in exploration without forgetting the hard-learned lessons of the past, former astronaut Bob Cabana, director of NASA's primary launch site, said during a ceremony marking Remembrance Day.

"I think it's really important that we take time to remember those who paid the ultimate sacrifice in the quest to explore," Cabana said. "We want to make sure that we learn from the mistakes we made in the past so we don't make the same mistakes again as we move forward. We've gotten better and their sacrifice was not in vain because we've gone on and done better things and we're going to continue that as we continue to explore."

Cabana was joined at the Space Mirror Memorial by Janet Petro, Kennedy's deputy director. The two walked a wreath beneath umbrellas to the base of the mirror at Kennedy Space Center's Visitor Complex during a brief ceremony. The 42.5-foot-high, 50-foot-wide black granite memorial is engraved with the names of 20 people who were lost in the cause of space exploration, including the crews of Apollo 1, Challenger's STS-51L and Columbia's STS-107 missions.

Charles Bolden, NASA administrator and also a former astronaut, marked the day at Arlington National Cemetery in Virginia, the resting place of some of the lost astronauts.

Bolden said today's missions show that the promise of



NASA/Dimitri Gerondidakis

Flowers are placed at the Astronauts Memorial Foundation's Space Mirror Memorial at the Kennedy Space Center Visitor Complex on Jan. 31, the 28th anniversary of the space shuttle Challenger accident. The 42.5-foot-high, 50-foot-wide black granite memorial is engraved with the names of 20 people who were lost in the cause of space exploration, including the crews of Apollo 1, Challenger's STS-51L and Columbia's STS-107 missions. To read the astronauts' NASA biographies, click on the photo.

exploration is being fulfilled thanks in part to the sacrifices made by the crews.

"Today, their legacy lives on as the International Space Station fulfills its promise to help us learn to live and work

in space and move farther into the solar system," Bolden said in a statement. "We honor them by making our dreams of a better tomorrow reality and by acting to improve life for all of humanity."



Health, wellness activities in full gear

Care to take the President's Active Lifestyle Challenge? Want to learn more about the seven dimensions to personal health and wellness? During the month of February, topics such as these will coincide with wellness activities and training across Kennedy.

KSC Health & Wellness Fair
Feb. 19 from 9 a.m. to 3 p.m.
OSB II 5th floor
Conference Rooms

Participating Organizations

- KSC Health Education and Wellness Program
- KSC Fitness Center
- KSC Employee Assistance Program
- KSC Ergonomics Program
- KSC RehabWorks
- KSC Massage Therapy Clinic
- KSC Weight Watchers Group
- KSC Sports Groups: Running, Scuba, Ski, Soccer, Bicycling and Tennis
- NASA Safety Reporting System (NSRS), NASA Safety Center (NSC) and Government Industry Data Exchange Program (GIDEP)
- Acupuncture, Healthy Healing Acupuncture
- American Heart Association
- Assistance Dogs for Independent Living, Canine Companions
- Bike Touring, Bike Florida
- Bicycle Rules (Safety and Routing), Florida Bicycle Association
- Diabetic Care Group, Health and Fitness, Orthopedic Group, and Sleep Apnea, Parrish Medical Center
- Go Native, Surfing, Fishing, and Swimming
- Appleseed Health Foods
- Holistic Approach to Mental Wellness, Holistic Mental Wellness
- Running Shoes, Apparel, Safety and Events, Running Zone
- Senior Care, A Place for Mom
- Water and Boating Safety, Titusville Sail and Power Squad
- Water Safety, Health First
- Boating Regulations and Public Small Watercraft, Coast Guard Auxiliary
- Continuing Education
- Eastern Florida State College
- Webster University
- Keiser University

Transportation

Bus transportation will be available from the main (northside) entrance of the SSPF, O&C and Headquarters at 30-minute intervals beginning at 9 a.m. with the last bus departing at 2 p.m.



NASA/Daniel Casper

Kennedy Space Center's Special Rescue Operations firefighters practiced vehicle rescue operations using special tools, including the Jaws of Life, on Jan. 10 at an auto salvage yard near the center.

Firefighters add 'Jaws of Life' to repertoire

By Linda Herridge
Spaceport News

Kennedy Space Center's Protective Services Office considers the safety of each employee and visitor on the center a top priority every day. In order to ensure that safety, Kennedy's Special Rescue Operations firefighters conducted training using the Jaws of Life and other advanced rescue tools at a facility nearby.

Recently, Kennedy's firefighters achieved Pro Board Certification in aerial fire truck operations. Now, with the completion of the Jaws of Life training, the Protective Services Office is one step closer to achieving certification in vehicle machinery extrication.

"One of the missions of the Protective Services Office is to oversee fire rescue services,"

said Tim Moore, Fire Rescue Emergency Management specialist in the protective services office. "Our main goal is life. Our second goal is mission. Our third goal is the property itself."

"The type of training we completed was vehicle and machinery extrication," said Dave Seymour, battalion chief. "We practiced extrication skills using a vehicle that had been damaged in an accident."

During the training, firefighters wearing full gear used very simple tools, such as axes, to highly specialized tools to clear away windows. They also used a hydraulic cutting tool, capable of up to 50,000 pounds of force, to remove the roof of the vehicle. Then they practiced using the Jaws of Life on the vehicle in order to simulate the rescue of a trapped and injured person. Seymour said that in re-

sponse to a motor vehicle accident on the center, a fire engine would be dispatched with basic life-saving tools. If, after an assessment of the scene, it is determined that the rescue is more complicated, then a squad truck would be dispatched that carries more advanced rescue tools.

"The type of equipment that we have available to us on the squad truck can range from a very simple center punch for clearing windows, all the way up to the Jaws of Life, which is a hydraulic tool that has up to 100,000 pounds of spreading force," Seymour said.

Michael Hayes, the assistant chief of Safety and coordinator for the Special Rescue Operations Team, said there are several types of rescue scenarios.

"The special rescue team is a diverse group of individuals

that are trained at a higher level than the standard firefighters," Hayes said. "We train to provide rope rescue, which would be an elevated rescue from the side of a building or tower; confined space rescue, which would be rescuing somebody from a manhole or vault; and vehicle extrication using the Jaws of Life."

Hayes said for vehicle extrication, the firefighters have to complete a 40-hour operational class, which is compliant with the National Fire Protection Association. Then they will advance to the technician level 2, which is an additional 40 hours of training.

"The Kennedy Space Center Fire Rescue Services is second to none," Moore said. "We require all of our firefighters to be certified in each discipline they perform in."

Efforts underway to develop better batteries for electric vehicles

By Bob Granath
Spaceport News

Electricity producing batteries are a vital part of daily life on Earth and in space. Power storage devices keep spacecraft operating, cars running, cell phones connected and flashlights lit. The Advanced Research Projects Agency-Energy (ARPA-E) now is funding 22 projects across 15 states with a total of \$36 million to develop better, more efficient power sources for electric vehicles (EV).

The Robust Affordable Next Generation Energy (RANGE) Storage Systems effort kicked off when NASA and ARPA-E officials along with representatives from other agencies, industry and universities gathered at the Kurt H. Debus Conference Facility at the Kennedy Space Center Visitor Complex on Jan. 28 and 29. The project aims to accelerate widespread EV use by dramatically improving driving range and reliability using innovative chemistries, architectures and designs. The result would provide low-cost, low-carbon emission alternatives for today's cars and other vehicles.

"The breadth and volume of technology approaches embodied in the RANGE projects demonstrate ARPA-E's commitment to transformational innovation," said the organization's deputy director, Cheryl Martin, in announcing the program on Aug. 21, 2013. "The success of RANGE battery technologies will reshape our thinking on EV storage and help reduce U.S. dependence on foreign energy sources, decrease emissions and help maintain our technological lead in research and development."

In welcoming those gathered, Karen Thompson, NASA's chief technologist at Kennedy, pointed out that the space agency has a long history of collaboration in developing technologies to satisfy NASA needs as well as needs of partners, including commercial applications.

"As I present some of the current technology work we are performing, please understand that almost every project I will describe involves not just NASA and not just the Kennedy Space Center," she said. "We work in cooperation with many partners across other NASA centers, with other government agencies, with industry, and with academia. Some of our partners are international partners."

Chuck Taylor, a principal investigator within NASA's Space Technology Mission Directorate's (STMD) Game Changing Development (GCD) Program, reminded attendees that throughout the agency's history, battery-powered devices have been crucial to both human and robotic space missions. In discussing STMD's plan to release an advanced energy storage solicitation in the near future, he invited the ARPA E RANGE participants to propose.

"Our hope is that some of you folks respond with proposals that will transition over to what we're doing for devices such as astronaut extravehicular activity (spacewalking) suits and for our next generation robotic rovers," he said.

Similar to ARPA-E, GCD is designed to investigate innovative ideas and approaches that have the potential to revolutionize future space missions and provide solutions to significant national needs.



Left: In an effort to reduce gasoline consumption and conserve energy, NASA's Kennedy Space Center added several low speed electric vehicles, or LSEVs, to its fleet. Right: An electric car taking part in a program to investigate potential ways to lower emissions is seen plugged in at Kennedy's Headquarters Building on Jan. 23, 2014. Early figures from a pilot program at Kennedy show that electric cars are reducing greenhouse gas emissions by a far greater amount than expected.

ARPA-E was authorized in 2007 and first funded in 2009. The agency invests in high-potential, high-impact energy technologies that are too early for private-sector investment. According to Eric Rohlfing, Ph.D., ARPA-E's deputy director for Technology, his organization is changing what's possible by thinking big, thinking bold and thinking differently about energy innovation.

"We are trying to bridge from basic science into prototype engineering technology and then bridge that technology, if successful, into some marketable transition," he said.

As part of the forum, Robert Huggins, Materials Science professor emeritus at Stanford University in California, reviewed the development of batteries and recent research into new technologies for use in electric vehicles. He noted that many are looking for the next big step in the technology's evolution.



NASA photos

"We are waiting for the next pleasant surprise," he said.

The term "battery" was first used by Benjamin Franklin in 1748 to describe a group of devices linked together for his experiments with electricity. He used the term as an analogy to a battery of cannon in describing multiple Leyden jars that stored static electricity. However, Italian physicist Alessandro Volta is credited with inventing the first true battery in 1800. It was known initially as the voltaic pile which consisted of pairs of copper and zinc discs piled on top of each other, separated by a layer of cloth or cardboard and soaked in a solution of salt in water.

In the ensuing years, batteries have become crucial to many forms of technology from inexpensive batteries for simple electronic devices to large storage cells for complex equipment. Spacecraft have operated on many forms of battery power from

America's first satellite, Explorer 1 in 1958, to all human spacecraft including Mercury, Gemini, Apollo, Skylab, the space shuttle and the International Space Station.

All batteries are limited in life, and over time, even rechargeable batteries will eventually fail. Many of the current power systems available are heavy, bulky, inefficient and cannot function properly in some extreme environments.

NASA is looking for new power technology that will provide systems with significant mass and volume savings, increased efficiency and enable operation at low and high temperatures and extreme radiation environments.

Thomas Miller, a research engineer at NASA's Glenn Research Center in Ohio, noted that electricity-producing fuel cells became the primary power source during Gemini and continued through the Space Shuttle Program.

Fuel cells convert chemical energy from a fuel, such as hydrogen, into electricity through a chemical reaction with oxygen. Fuel cells are different from batteries in that they require a constant source of fuel and an oxidizer to sustain the chemical reaction. Fuel cells can, however, produce electricity continually, but are limited by supplies of fuel and oxygen.

Miller also noted that the Apollo Program's Lunar Roving Vehicle was battery-powered. The jeep-like car allowed the crews on Apollos 15, 16 and 17 to drive more than 22 miles on the moon.

While the space station's electricity is supplied primarily through large solar arrays, many systems on all of America's human-

rated spacecraft have depended on batteries. Additionally, batteries have served as supplementary power sources on probes such as the Mars Pathfinder rover, Sojourner, which landed on the Red Planet during 1997.

ARPA-E's RANGE program seeks to improve EV driving range and reduce vehicle costs by re-envisioning the total EV battery system, rather than working to increase the energy density of individual battery cells. Some of the projects selected will focus on developing robust, or strong, battery chemistries and architectures that would improve vehicle driving range and overall battery performance. For example, Solid Power located in Louisville, Colo., will receive approximately \$3.5 million to develop a solid-state Lithium-ion battery that requires less protective packaging, which reduces cost and overall vehicle weight to improve driving range.

"All these considerations such as the cost of materials matter to us too," Taylor said. "Every gram that I try to get from the Earth's surface up into orbit takes eight to nine grams of propellant. Anything you can do to reduce mass is of importance to NASA."

RANGE projects also will focus on multifunctional energy storage designs that use these robust storage systems to simultaneously serve other functions in a vehicle, further reducing an energy storage system's effective and overall EV weight. For one of the projects, the University of California, San Diego, will receive approximately \$3.5 million to engineer a low-cost, low-weight battery and to redesign vehicle frames so the battery becomes an integral part of a vehicle's support structure.



NASA file/ 1965

The Gemini VII spacecraft is seen from Gemini VI during their rendezvous in space Dec. 15, 1965. Gemini was the first spacecraft to use electricity producing fuel cells in addition to batteries. Photo credit: NASA



NASA/Harrison Schmitt

Apollo 17 commander Eugene Cernan checks the Lunar Roving Vehicle (LRV) during the early part of the first Apollo 17 extravehicular activity at the Taurus-Littrow landing site Dec. 11, 1972. The LRV was a battery-powered four-wheeled rover used on the last three missions of the Apollo program allowing travel up to 22 miles on the moon.



NASA/ Jet Propulsion Laboratory/United States Geological Survey

The Mars Pathfinder's Sojourner takes an X-ray spectrometer measurement of a rock on the Red Planet during July 1997. Batteries served as supplementary power sources on probes such as the Sojourner rover.

More online

For more on how electric cars are reducing greenhouse emissions at Kennedy Space Center, go to <http://www.nasa.gov/content/greenhouse-gas-reduction-program-thrives/>

For more about NASA's sustainability efforts, go to <http://www.nasa.gov/agency/sustainability>

Scenes around Kennedy and beyond...



NASA/Daniel Casper

Children and their parents enjoyed Wild Wild West Days at the Kennedy Child Development Center on Jan. 27-31. Activities centered around what it was like to live and survive in the Wild West. On Jan. 31, the children dressed up in western wear and enjoyed pony rides and a petting zoo, featuring rabbits, goats, a pig and a donkey.



NASA/Daniel Casper

Technicians attach a bridge crane to the Orion ground test vehicle Feb. 3 to prepare for heat shield removal inside the Vehicle Assembly Building. The test vehicle is being prepared for its move to Langley Research Center in Hampton, Va., for a water drop test.



NASA/Randy Beaudoin, VAFB

Technicians move a solid rocket motor to a different transporter inside the Solid Rocket Motor Processing Facility on Dec. 19, 2013, at Vandenberg Air Force Base in California. The motor will be attached to the United Launch Alliance Delta II rocket slated to launch NASA's Orbiting Carbon Observatory-2, (OCO-2) spacecraft in July 2014.

NASA names Ralph Roe chief engineer

Spaceport News Report

NASA's new chief engineer is a familiar face around Kennedy Space Center: Ralph Roe, a former space shuttle launch director. As the agency's chief engineer, Roe will be the principal advisor for the agency's programs and projects to make sure they meet proper requirements for technical risks and act on a sound engineering basis. Roe also will advise NASA's administrator on the execution of the agency's projects.

"His knowledge and expertise will be invaluable as we continue to develop technologies and systems for putting humans further into space, for developing spacecraft to advance our scientific knowledge of Earth and the solar system, and for advancing the nation's aeronautics



Ralph Roe

efforts," NASA Administrator Charles Bolden said.

Roe, who holds bachelor's and master's degrees in mechanical engineering and engineering management respectively, began his NASA career at Kennedy in 1983 as a propulsion systems test engineer.

He served as branch chief of the Environmental Control, Hypersonic and Hydraulic Systems

Branch for the Vehicle Engineering Directorate from August 1994 to October 1995. Between August 1991 and May 1994, he was the section chief in the Orbital Maneuvering and Reaction Control Systems Section and the Auxiliary Power Unit and Hydraulics Systems Section. In the summer of 1994, Roe was detailed to the position of deputy director of Shuttle Operations in the Shuttle Operations Directorate. Roe was made chief of the Fluid Systems Division in the Vehicle Engineering Directorate from 1995 to April 1996.

In 1996, Roe was named director of shuttle engineering, which gave him responsibility for engineering management and technical direction of all space shuttle integration, checkout, maintenance, launch, landing and recovery operations.

He became the space shuttle

launch director at Kennedy in 1998.

Roe moved to Johnson Space Center in Houston in 1998 as the manager of space shuttle vehicle engineering responsible for the design, production and testing of the space shuttle orbiters, flight crew equipment, remote manipulator system and flight software.

One of Roe's primary achievements was the origination and directing of the NASA Engineering and Safety Center at Langley Research Center in Virginia in the wake of the Columbia accident in 2003. The center was formed to give a specialized, independent look at the agency's biggest engineering problems. It has produced more than 500 engineering and safety assessments across all NASA projects during its 10-plus years of its existence.

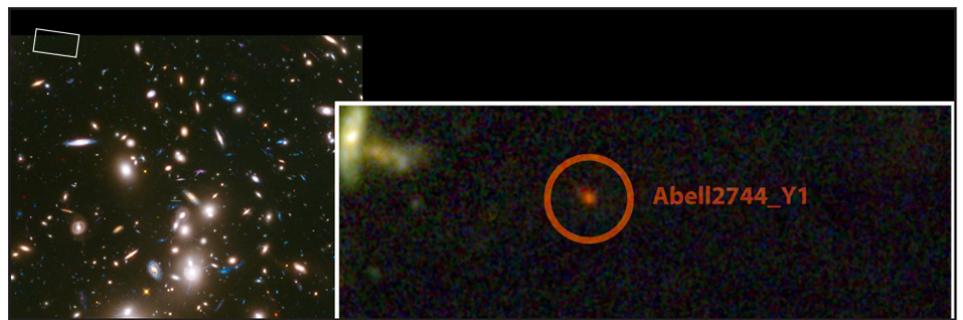
Spitzer, Hubble take epic look back in time

NASA News Report

NASA's Spitzer and Hubble Space Telescopes have spotted what might be one of the most distant galaxies known, harkening back to a time when our universe was only about 650 million years old (our universe is 13.8 billion years old). The galaxy, known as Abell2744 Y1, is about 30 times smaller than our Milky Way galaxy and is producing about 10 times more stars, as is typical for galaxies in our young universe.

The discovery comes from the Frontier Fields program, which is pushing the limits of how far back we can see into the distant universe using NASA's multi-wavelength suite of Great Observatories. Spitzer sees infrared light, Hubble sees visible and shorter-wavelength infrared light, and NASA's Chandra X-ray Observatory sees X-rays. The telescopes are getting a boost from natural lenses: they peer through clusters of galaxies, where gravity magnifies the light of more distant galaxies.

The Frontier Fields program will image six galaxy clusters in total. Hubble images



NASA/ESA/STScI/AC

This image of the galaxy cluster Abell 2744 was obtained with NASA's Hubble Space Telescope.

of the region are used to spot candidate distant galaxies, and then Spitzer is needed to determine if the galaxies are, in fact, as far as they seem. Spitzer data also help determine how many stars are in the galaxy.

These early results from the program come from images of the Abell 2744 galaxy cluster. The distance to this galaxy, if confirmed, would make it one of the farthest known. Astronomers say it has a redshift of 8, which is a measure of the degree to which its light has been shifted to redder wavelengths due to the expansion of our uni-

verse. The farther a galaxy, the higher the redshift. The farthest confirmed galaxy has a redshift of more than 7. Other candidates have been identified with redshifts as high as 11.

"Just a handful of galaxies at these great distances are known," said Jason Surace, of NASA's Spitzer Science Center at the California Institute of Technology, Pasadena. "The Frontier Fields program is already working to find more of these distant, faint galaxies. This is a preview of what's to come."

Beware: Do not overlook threat of winter tornadoes

*45th Weather Squadron
For Spaceport News*

The winter tornado season in central Florida typically peaks from February to April. However, as Palm Coast saw last month, winter tornadoes can strike here as early as December. Are you prepared?

Tornadoes are notorious for touching down during strong cold fronts moving into the area. The stronger the cold front, the higher the chance intense tornadoes will spawn. Because these cold fronts are fairly easy to predict, the potential for these tornadoes usually can be forecasted a day or more in advance; but it's always best to be prepared.

Tornado safety is an easy two-step process.

Step No. 1, Have A Plan:

Identify the safest room in your building and ensure everyone knows where it is located. The safest rooms are on the lowest floor, away from windows, farther inside and smaller with solid construction, such as restrooms, closets and basements.

A strong table and thick pads can protect against falling debris and motorcycle, bicycle and skateboard helmets can prevent head injuries.

People in mobile homes or other weak portable buildings should seek proper shelter elsewhere. Also, a common myth is to open windows and let the building "breathe." Houses do not explode from decompression in a tornado and opening a window actually increases the danger.

Step No. 2, Stay Informed:

The 45th Weather Squadron signals the potential for severe weather at Kennedy Space Center and Cape Canaveral Air Force Station in their daily 24-hour and weekly planning

forecasts, which are available at: www.patrick.af.mil.

If a threat continues, the squadron issues a severe-weather watch with a desired lead time of four hours. If tornadoes are imminent or observed, the squadron issues a tornado warning with a desired lead time of five minutes. If you receive a warning, follow local adverse weather procedures.

At home, purchase a NOAA All Hazards Radio, formerly known as a NOAA Weather Radio. One of the main reasons late night tornadoes are so dangerous is that people are sleeping and not aware of weather warnings. However, a NOAA All Hazards Radio will sound an alarm if the National Weather Service issues a weather warning for your area.

This is essential if you live in an area where there is no tornado siren. Even if you live near a siren, it may not be loud enough to wake you inside your house.

NOAA radios also provide alternatives for the hearing and visually impaired.

Be aware that NOAA radios don't cover 2 percent of the country, so test the reception of new radios to be sure you're covered.

If severe weather is likely, review your safety plan, include your family and remind everyone where the safe room is located. If there is time before the high winds start, store loose outside materials and close protective shutters.

If a tornado or severe weather watch is issued, listen for weather warnings and be ready to act.

Always go to your safe room if threatening weather approaches -- there may not be time for an official warning.

Looking up and ahead . . .

** All times are Eastern*

Feb. 27

Mission: Global Precipitation Measurement (GPM) Core Observatory

Launch Vehicle: H-IIA

Launch Site: Japan Aerospace Exploration Agency (JAXA) Tanegashima Space Center, Tanegashima Island, Japan

Launch Time: 1:07 to 3:07 p.m.

Description: GPM is an international satellite mission led by NASA and JAXA to provide next-generation observations of rain and snow worldwide.

March 16

Mission: SpaceX 3 Commercial Resupply Services flight

Launch Vehicle: Falcon 9

Launch Site: Cape Canaveral Air Force Station

Launch Pad: Space Launch Complex 40

Launch Time: 4:41 a.m.

Description: SpaceX 3 will be the third commercial resupply mission to the ISS by Space Exploration Technologies (SpaceX).

March 25

Mission: Expedition 39

Launch Vehicle: Soyuz 38

Launch Site: Baikonur Cosmodrome, Kazakhstan

Launch Time: TBD

Description: Soyuz 38 will carry Russian cosmonauts Alexander Skvortsov and Oleg Artemyev, both Expedition 39/40 flight engineers, and NASA astronaut Steve Swanson, Expedition 39 flight engineer and Expedition 40 commander, to the International Space Station.

April 28

Mission: Progress 55

Launch Vehicle: Russian Soyuz

Launch Site: Baikonur Cosmodrome, Kazakhstan

Launch Time: TBD

Description: Progress 55 will deliver cargo and crew supplies to the International Space Station.

May 1

Mission: Orbital 2 Commercial Resupply Services flight

Launch Vehicle: Antares

Launch Site: Wallops Flight Facility

Launch Pad: Mid-Atlantic Regional Spaceport Pad-0A

Launch Time: TBD

Description: Orbital 2 will deliver cargo and crew supplies to the International Space Station.

To watch a NASA launch online, go to <http://www.nasa.gov/ntv>.



John F. Kennedy Space Center

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