

Spaceport News

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



NASA, energy group team to pursue space, energy opportunities

By **Bob Granath**
Spaceport News

Officials with NASA and the Space Coast Energy Consortium recently signed a five-year Space Act Agreement to help transition the Kennedy Space Center from a historically government-only launch facility to a multiuser spaceport. The partnership defines how Kennedy will serve government and commercial renewable energy initiatives.

The Cape Canaveral-based consortium is an industry-led nonprofit association founded to identify and create innovative energy opportunities for the Space Coast and the state. The organization was formed by community and industry leaders to assist with the post-space shuttle transition by building networks among local businesses with resources across the country. The objective is to help Florida diversify its economy with energy-related engineering, manufacturing and service activities.

"The Kennedy Space Center appreciates our relationship with the Space Coast Energy Consortium and looks forward to the

positive impact this agreement will have," said Kennedy Director Bob Cabana.

Mike Aller, executive director of the consortium, joined Cabana in signing the agreement at Kennedy on March 11.

A major goal of the agreement is to jointly develop the Space and Energy Regional Innovation Center (RIC) that will sponsor, support and accelerate the commercialization of emerging energy products. RIC also hopes to leverage Kennedy's technical expertise and facilities to develop sustainable energy products and services.

"The Kennedy Space Center is a world-class institution for making complex technologies work reliably under extreme conditions," Aller said. "The skills necessary to maintain and launch a high-pressure turbo pump used on rocket engines are skills similar to those necessary for developing and testing new turbine systems for energy."

Scott Lewit, chairman of the consortium's board, continued with that theme.

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NASA/Frankie Martin

Kennedy Space Center Director Bob Cabana visits with a team of high school students taking part in the FIRST Robotics Competition's 2013 Orlando Regional on March 8 in the University of Central Florida arena.

FIRST robotic teams overcome accident

By **Steven Siceloff**
Spaceport News

The road to this year's FIRST robotics competition proved unusually rough for a pair of teams when their robots were severely damaged in a car accident on the way to the University of Central Florida arena.

The high school students and their engineering mentors spent overnight hours salvaging usable pieces and the working components of the broken machines. The teams that had

taken months to build the originals, rebuilt the pieces into a pair of new robots.

"Some of the students and one of the mentors stayed up all night," said mentor Paul Rammel. "(They) cobbled together two robots out of those parts and built other parts we didn't have."

The squads, called Horsepower and Bionic Tigers, competed in all their scheduled matches, using the

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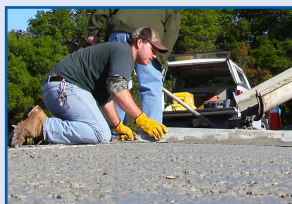
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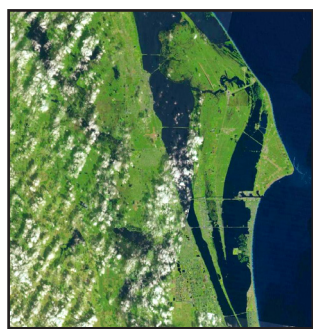
Interns research ecology along Space Coast

By Bob Granath
Spaceport News

A group of interns from NASA's Goddard Space Flight Center in Maryland recently visited Florida to conduct environmental research as part of the agency's DEVELOP Program. The effort is sponsored by NASA's Applied Sciences Program and is designed to foster interdisciplinary research opportunities for young professionals. They work under the guidance of NASA and partner science advisors on research projects focusing on the practical applications of Earth observations.

The Goddard team conducted its fieldwork in the Merritt Island National Wildlife Refuge, the Thousand Islands area of Cocoa Beach and the Pine Island Conservation Area on Merritt Island. The team is collecting ground-level data to compare with imagery returned from Earth-orbiting spacecraft.

"DEVELOP allows interns to lead research projects that focus on using NASA Earth observations to study community concerns and issues," said Katrina Laygo, a student at George Washington University. "The program is open



NASA/U.S. Geological Survey

As part of NASA's DEVELOP program, the agency interns used imagery such as this photograph taken by Landsat 7 on Nov. 10, 2011, to study environmental changes.

to students from the high school level up to Ph.D. candidates."

Since its establishment in 1998 at NASA's Langley Research Center in Virginia, the DEVELOP Program has grown to include 13 locations in North America and supported over 2,400 internship opportunities across the nation.

On March 14, the group discussed its work in ecological forecasting with Kennedy Space Center employees in a presentation at the center's Headquarters building. The team is working in partnership with the Smithsonian Environmental Research Center, the U.S. Geological Survey's National Wetlands Research Center and the Environmental Protection Agency's

National Wetlands Condition Assessment Project.

The interns are studying mangrove trees and salt marsh leaf areas to validate data received from NASA's STS-99 Shuttle Radar Topography Mission, Landsat 5 and Earth Observing-1 Mission satellites, as well as the Japan Aerospace Exploration Agency's Advanced Land Observing spacecraft.

Melanie Rosenberg, a student at the University of Maryland, noted that imagery from space, such as infrared photography, shows that mangrove forests in Florida are moving northward, something that is not common for these trees.

"We believe our studies here on the coast will help us understand why this is happening," she said. "Since climate change continues to contribute to increases in temperatures and other factors, mangrove forests in Florida are a great place to study these impacts."

Mangrove forests only grow at tropical and subtropical latitudes near the equator because they cannot withstand freezing temperatures. There are about 80 different species of mangrove trees all growing in areas with low-oxygen soil, where slow-moving waters allow fine sediments to accumulate.

The DEVELOP team's fieldwork consisted of obtaining photographic samples, as well as soil and water salinity measurements, to be compared with satellite imagery. The data collected can then be incorporated into mangrove ecological forecasting models to contrast with climate variables associated with mangrove and salt marsh migration northward.

"It's our hope that this research will help us forecast how the mangrove migra-



NASA

NASA DEVELOP program interns Melissa Oguamanam, left, and Katrina Laygo record data during their research at the Merritt Island National Wildlife Refuge on March 12.

tion north may continue," said Brock Blevins, also studying at the University of Maryland.

Findings in this study could assist local land managers in future decision-making and policy development. Mangrove forests are important because they stabilize the coastline, reducing erosion from storm surges, currents, waves and tides. The intricate root system of mangroves also makes these forests attractive to fish and other organisms seeking food and shelter from predators.

Mangrove forests can be recognized by their dense tangle of roots that make the trees appear to be standing on stilts above the water. The roots allow

the trees to handle the daily rise and fall of tides, which means that most mangroves are flooded at least twice per day. The roots also slow the movement of tidal waters, causing sediments to settle out of the water and build up the fertile muddy bottom.

Other students participating on the DEVELOP team are Melissa Oguamanam and Kristopher Lasko, both students at the University of Maryland. Serving as advisors to the team are Dr. Lola Fatoyinbo of Goddard's Earth Sciences Remote Sensing Directorate and Frederick Policelli of Goddard's Office of Applied Sciences, as well as Dr. Beth Middleton of the U.S. Geological Survey.



NASA/Jim Grossmann

A group of NASA interns from the Goddard Space Flight Center visited Florida in early March to conduct environmental research as part of the agency's DEVELOP program. They are, left to right, Melanie Rosenberg, Kristopher Lasko, Katrina Laygo, Brock Blevins and Melissa Oguamanam.



NASA/Kim Shiflett

Workers pour a concrete mix that utilizes spent material from sandblasting projects at Kennedy Space Center on March 14. The experimental formula is being tested at the Propellants North facility at Kennedy and will undergo structural and other evaluations as part of a pilot project. Spent blast media (SBM) makes up much of the debris deposited at the center's landfill. Engineers are trying to develop ways to put the material to use in other ways instead.

By Steven Siceloff
Spaceport News

Construction engineers at Kennedy Space Center mixed a small amount of used sandblasting material into concrete to find out whether the debris can go into driveways and sidewalks instead of the landfill.

Workers mixed almost three tons of the sandblasting material, known in the industry as spent blast media, into the concrete and used it to make a driveway and ramp near the Propellants North facility near the Vehicle Assembly Building. The sandblasting material, basically sand pulverized into dust, replaced about 42 percent of ordinary sand in a typical concrete formula.

Though formal testing will not be completed until mid-April, the early signs are promising, said Mick Barth, Construction of Facilities design engineer.

"The concern is the final product wouldn't be as structurally sound as regular concrete, but I don't think that's a concern anymore," Barth said.



NASA/Kim Shiflett

A concrete mix that utilizes spent material from sandblasting projects at Kennedy Space Center is poured to create a ramp as part of a pilot project March 14.

The pilot project is intended to show whether the concrete with spent blast material is a suitable replacement in some instances for traditional concrete. At this point, it doesn't look like it would cost less, at least in small-scale cases, but it would help the center meet a presidential goal of cutting the waste that goes into landfills by 50 percent, Barth said.

"We want to see if this is going to be viable in a lot of different uses, not just at Kennedy, but across the agency for different applications," said Jahn Dussich, a senior engineer

with contractor ITB Inc. and project manager at the NASA Technology Evaluation for Environmental Risk Mitigation Principal Center office, or TEERM.

The alternative concrete would be a candidate for use in foundations, driveways and sidewalks, Barth said, but may not meet the demands of a runway or taxiway.

The spent media comes from large-scale refurbishments such as the cleaning of the water tower at Launch Complex 39B to the material used by specialized machines to cut metal precisely, Dussich said. Along

with the powdered sand, the media includes a tiny amount -- less than 1 percent -- of the paint chips or other material cleaned by the blasting. So only blast media deemed non-hazardous was used in these concrete mixes.

The amount of sandblasting residue created at Kennedy varies each year, Barth said.

The process has been used by the Defense Department and by some state departments of transportation, but not at Kennedy or other NASA facilities.

"I like the idea of limiting or eliminating waste streams," Barth said. "The challenge is in making it cost less or at least not making it cost more. I don't think we're there yet."

Barth said the center and NASA overall have grown increasingly receptive to creative ideas to recycle materials. For example, concrete chunks from demolition projects have been used to reinforce seawalls.

"It's more acceptable to do it now than even five years ago," Barth said. "Now it's not a new thing anymore, so it's easier."

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time between sessions to refine their rebuilt machines.

"None of them even thought, 'We're not going to be able to get it back together,'" said Paul Ranyek, a Team Horsepower mentor.

Students from other teams also joined in the effort to salvage the damaged robots.

"They had about a day to rebuild six weeks' worth of work," said Deanna D'Alessandro of the Bionic Bears. "We all came together and right now those two robots are working. It was a great sense of pride for everyone when we saw those two robots actually working."

The repaired robot squads were teamed up and made it to the quarterfinals.

As with all the teams, the robots had to do more than just function -- they had to be able to accurately fling Frisbees or climb up a steep pyramid, and be able to play a little defense against another robot trying to do the same thing.

Students faced many challenges, including devising machines that not only worked by remote control, but on their own as well.

"There's a lot of angles and speeds you have to take into consideration, so it was a little more difficult," said Abby Hall, a Pink Team



NASA/Frankie Martin

The Pit Area set up in the University of Central Florida arena is abuzz with teams of high school students preparing their robots for competition in the FIRST Robotics Competition's 2013 Orlando Regional on March 8.

participant who also hosted the VIP luncheon during the event.

The students receive support from mentors, including some who work at NASA. Kennedy Space Center worked closely with The Pink Team, NASA's Launch Services Program advised the Bionic Tigers, and NASA partnered with Horsepower in their development. Numerous engineering and technical companies worked with the teams, too.

The Pink Team finished the competition in second place.

Inside the arena, the atmosphere took on the feel of a basketball game. Flag-carrying students ran around the floor to lead their squad onto the court, teams dressed in their colors, some spiked their hair and painted their

faces before cheering loudly as their robots went head-to-head. The robots worked inside a 54-foot by 27-foot court for 2 minutes and 15 seconds. The match unfolded on video monitors around the arena hall and there was even a booth where an online show was recorded to showcase the competition.

FIRST is a privately funded competition that calls on high school teams to design and build machines that can accomplish complicated tasks. The research, design and construction are technical, but there is a heavy emphasis on teamwork. Students largely specialize in specific areas of development whether mechanical, electrical, software or control.

"It's really shown me this whole process of designing and building as a team," said Albert Halbing of The Pink Team. "I've done science fair projects but that's a more individual process. Here, it's a team."

The team-building and leadership aspects of the event stood out to NASA leaders from Kennedy who toured the event and the pit area before speaking to the students.

"When you go to engineering school you learn how to be an engineer, when you get into industry, everything is about team," said Ed Mango, manager of NASA's Commercial Crew

Program, based at Kennedy. "You're a piece of a bigger puzzle. That's really how we succeed is teamwork."

Mango, the keynote speaker for the event's luncheon, told his audience that exploration historically serves great civilizations well, allows them to prosper. It's up to each generation to make the discoveries that build on the success of earlier work.

"The talent in this room is unbelievable," Mango said. "You're going to make these vehicles better. Together, we're going to figure out how to make space accessible to the entire planet."

Bob Cabana, Kennedy's director and a veteran astronaut of four space shuttle missions, found himself signing autographs and posing for pictures with the students as he walked through the pit area where the students were fine-tuning their machines. Attending his fourth competition, Cabana told the participants at a luncheon that NASA's robotic explorers will continue to advance as the students move from school and university to employ their considerable knowledge in future missions.

"This is really something special, this is what NASA does," Cabana said. "If you look at where we're going as we explore into the future, what do we do first? We send robots as precursors.

Many of the same skills you use in developing your robots are the same skills that go into Curiosity. They're just a little more refined than what we're using on the floor today."

More than 60 teams took part in the Orlando competition, including squads from high schools in Brazil, Germany and the Dominican Republic. The finalists will compete in the national tournament later this year in St. Louis.

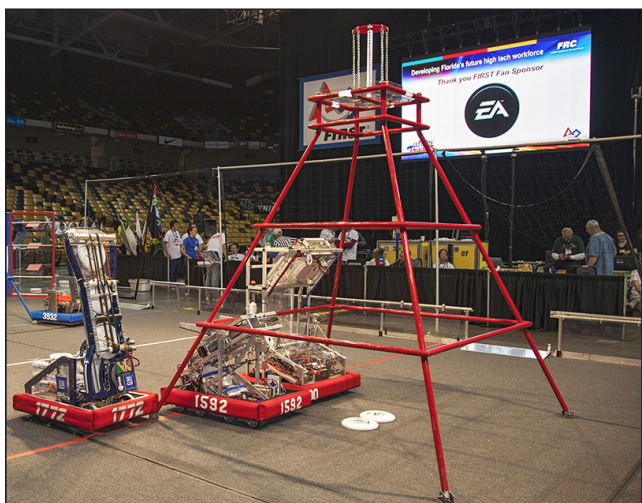
"Every year when we come here we have a lot of good robots," said Daiane Rodrigues of The Brazil Trailblazers. "It's a good experience because you make your robot, and you see how the other robots are different and you can learn how they do this, how the other teams think."

For the foreign teams, the event is a way to make friends and find out unusual things.

"At all the regionals, we make team friends and we have a good relationship with them," Rodrigues said. "We can learn American culture."

Regardless of rankings at the end of the four-day event, the students came away smiling with pride.

"They say it's the best real-life example of engineering that you can get," D'Alessandro said, "and I agree with that."



NASA/Frankie Martin

Robots scramble to score during the FIRST Robotics Competition's 2013 Orlando Regional on March 8.

Safety component arrives for Orion test flight

By Linda Herridge
Spaceport News

A critical segment of Orion's Launch Abort System, the launch abort motor, recently arrived at Kennedy Space Center for Exploration Flight Test (EFT)-1. Built by Alliant Techsystems (ATK), the abort motor will be used to pull the crew to safety and position the module for a safe landing in case of an emergency during future missions.

The other segments of the Launch Abort System are the fairing, the jettison motor and the attitude control motor. They will be assembled together horizontally in the Launch Abort System Facility (LASF) beginning in April. To prepare for EFT-1, the system will be attached to the top of the Orion crew module in the Astrotech processing facility in Titusville for the flight test, scheduled for September 2014.

During a media viewing of the launch abort motor, Brian Duffy, vice president and program manager for Exploration Systems with ATK Aerospace Group, said it is a one-of-a-kind piece of hardware that is uniquely engineered. The motor is loaded with inert solid fuel because EFT-1 will be an uncrewed flight test.

While only the jettison motor will be active during the 2014 test to enable the entire system to detach from Orion during ascent, the sys-



CLICK ON PHOTO

Brian Duffy, ATK Aerospace Systems' vice president and manager of Exploration Systems, talks with members of the media during a viewing of ATK's launch abort motor inside the Launch Abort System Facility at Kennedy Space Center. The abort motor is one of the components of Orion's Launch Abort System, which will be used for Exploration Flight Test-1. For more on Orion, click on the photo.

NASA/Dimitri Gerondidakis

tem will provide aerodynamics and environmental loads data.

"In the future, crews aboard the spacecraft are going to feel very comfortable with the abort motor and the entire abort system," said Duffy, who is a four-time space shuttle mission crew member.

"From the time the crew is on the launch pad, until they're in part of the flight profile, and they no longer need an abort system, they'll have this system on board," Duffy said. "And when it's no longer

required it will be jettisoned and won't be reused."

According to Duffy, the abort motor is designed to ignite at the top end, away from where it is attached to Orion for thermal and acoustic reasons and to protect the integrity of the crew module. The unique design of the attitude control system features a reverse flow and the half-million pounds of thrust would turn the 28,000-pound crew module about 180 degrees so that it would re-enter Earth's atmosphere with the

"In the future, crews aboard the spacecraft are going to feel very comfortable with the abort motor and the entire abort system."

Brian Duffy,
vice president and program
manager of Exploration Systems
for ATK Aerospace Group

heat shield facing down.

Duffy said if the motor was fired at the launch pad to escape a bad situation, it would actually extract Orion and move it about a mile in the air and a mile down-range so that it could reorient before its parachutes deploy.

"The crew would have the means to reach the ground safely from the time they get in the spacecraft," Duffy said. "It's a very smart and capable system."

For EFT-1, NASA will collect the data on the environment that the spacecraft, including the abort system, will experience during its ascent. It will be instrumented for data, Duffy said, even though there will be no humans aboard.

EFT-1 will be launched on a United Launch Alliance Delta IV Heavy rocket. NASA's Space Launch System, currently in development, will launch future Orion spacecraft with an active launch abort motor and system atop.



NASA/Jim Grossmann

Kennedy Space Center Director Bob Cabana, left, discusses a Space Act Agreement he just signed with Mike Aller, executive director of the Space Coast Energy Consortium (SCEC) on March 11. Looking on, from left, are Scott Lewit, chairman of the SCEC's board of directors; Bennett Boucher, SCEC board member; and Rodger Rees, SCEC chief financial officer.

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"Space and energy are closely connected," said Lewit, who also is president of Structural Composites Inc. in West Melbourne, Fla. "A rocket is a self-contained energy system. NASA's development of fuel cells, solar panels, auxiliary power units and other energy systems is too often undervalued."

The proposed regional innovation center will focus on enabling end-stage technology development and demonstration of renew-

able energy technologies that can lead to commercial applications. RIC presents an opportunity for NASA to apply Kennedy's roadmap strategies using its expertise and resources along with that of industry to pursue energy solutions. The development and demonstration of renewable and more efficient energy technologies also has the potential to benefit Kennedy operationally, helping NASA meet federal sustainability mandates and support space technology development.

The first project under-

taken with this new agreement is the loan of a deployable solar-powered truss adapted by Kennedy engineers.

The consortium and several local partners will help complete and test the prototype and return it to the space center for demonstration purposes. This technology was showcased on the national stage at the U.S. Department of Energy's Advanced Research Projects Agency-Energy (ARPA-e) Energy Innovation Summit near Washington, D.C., in February.



Kennedy Space Center Director Bob Cabana (center foreground) is among the runners at Kennedy Space Center's Shuttle Landing Facility on March 19.



Rollerbladers were among the participants who trekked around Kennedy Space Center's Shuttle Landing Facility on March 19.



Electronic timing tags were attached to participants' shoes to record their performance times.



At the starting line on the Shuttle Landing Facility runway, a few hundred runners are given the green light to begin the 19th Annual Kennedy Space Center Walk/Run on March 19.

2013 KSC WALK/RUN

By Cheryl Mansfield
Spaceport News

Leading additional meaning to the term "runway," the KSC Fitness Center sponsored the 19th Annual Kennedy Space Center Walk/Run on March 19 at the Shuttle Landing Facility (SLF) runway.

Despite clouds earlier in the day, 276 Kennedy employees gathered under a bright blue sky at the 5 p.m. race time to begin the trek. Whether running the 5K, 10K or walking a two-mile course, participants got to enjoy the event, knowing that the goal was fitness and better health.

"The KSC run is a great way to showcase the importance of health and fitness in our lives, and to support one another in our fitness goals," said Kennedy Director Bob Cabana, who ran in the event for the fifth time. "The runway at the SLF is a unique place to have it, and although they assure me they haven't, it sure seems like the distance between the runway markers has been increasing the last few years. Remember, speed isn't everything; participation is what counts."

Runners' results are clocked by an electron-

ic timing system that automatically records their times as they cross the finish line, and complete event results are available through the fitness center a few days later.

"The event encourages physical activity and positive spirit at Kennedy," said Veronica Komar, the fitness professional who organized the event. "It helps employees reach their health and wellness goals beyond the fitness center."

As an added bonus, the participants were treated to a spectacular launch view as a United Launch Alliance Atlas V lifted off from Space Launch Complex 41 on a U.S. Air Force mission, carrying the second Space-Based Infrared System (SBIRS) GEO-2 satellite into orbit.

In addition to the participants, the event drew more than 40 volunteers who assisted Komar with the race logistics.

Learn about a few NASA spinoffs that help people reach their fitness goals, Page 12



Some of the more than 40 volunteers hand out participant numbers at Kennedy Space Center's Shuttle Landing Facility on March 19.



Veronica Komar (holding microphone), event organizer from the KSC Fitness Center, welcomes employees to the 19th Annual Kennedy Space Center Walk/Run on March 19.

Photos by NASA/Jim Grossmann



Joy and relief overcome three "victors" as they cross the finish line of the 19th Annual Kennedy Space Center Walk/Run on March 19.

TAGES study gets to roots of station plant growth

By Steven Siceloff
Spaceport News

The Transgenic Arabidopsis Gene Expression System (TAGES) study conducted in November 2009 aboard the International Space Station, showed plant roots grow in different directions in space just as they do on Earth. This is an unexpected result researchers say will influence the way seeds and plants will be handled on space missions that could call on space-grown food to feed astronauts.

The finding, "Plant growth strategies are remodeled by spaceflight," was published in BMC Plant Biology 2012.

"It shows us that gravity just isn't essential in root orientation, and that is something that is novel for the scientific community in general," said Anna-Lisa Paul, Ph.D., a researcher at the University of Florida and one of the principal investigators of the experiment team. "We've always thought that these kinds of movements of plants depended on gravity."

Roots provide nutrients



NASA file/2009

Astronaut Jeffrey Williams, Expedition 22 commander, works on the payload Advanced Plant Experiments on Orbit-Cambium-Transgenic Arabidopsis Gene Expression System (APEX-TAGES) in the pressurized Japanese Experiment Module aboard the space station on Dec. 15, 2009.

and stability to plants on Earth. Varieties of plants, from fruit-bearing vines to tall trees, grow their root systems differently. It was thought, Paul said, gravity was the primary influence on plant cells to tell them how to change direction. It turns out that's not the case, the research found.

"The ability to get away

from where you are sown so you can go out and find the nutrients you need is something that's inherent in the programming of the plant, and that programming works just fine even when you don't have a gravity to drive it," Paul said.

Paul worked with University of Florida colleague Robert Ferl, Ph.D., on the experiment, which grew different varieties of Arabidopsis -- a mustard-like plant -- in an enclosure NASA calls the Advanced Biological Research System (ABRS) aboard the space station for several weeks. A camera documented the root growth of the plants, and the researchers compared the growth to that of identical plants kept inside the Orbital Environment Simulator in the Space Life Sciences Laboratory at Kennedy Space Center.

The scientists were surprised to find that the root patterns were basically identical for the two groups of plants. Whether the

plants grew in space or in a facility on Earth, the traits matched all the conditions of the space station, except for the weightlessness.

"These patterns of root growth, usually referred to as skewing and waving, have been well characterized on Earth as growth strategies the plant uses to avoid objects as it grows," Paul said. "It was always thought that the patterns were generated through a combination of a touch response between the root tip and whatever it is running into (a rock, a hard surface, etc.) and the force of gravity pulling on the root tip. So, the fact you can see those same patterns and behaviors on orbit, where there is no gravity to pull on the root, was very intriguing. This gives us, and the scientific community in general, fundamental insights into how plant roots work -- insights you could not get on the ground, as the natural force of gravity overwhelms the inherent response signals."

Paul, who has flown numerous investigations aboard shuttle and station missions, said the results show that mission planners can count on plants growing in space or possibly on other worlds.

"The better we are at making the spaceflight hardware in which we grow plants a benign habitat, the better gardeners in space we become," Paul said. "The fact that we have less and less impediment to growing plants on orbit makes it easier and easier to envision growing things either on long interplanetary trips or on other planetary surfaces."

As explorers head into deep space in the coming years, Paul said it is inevitable that they will take plants with them as a potential food source.

"When we leave Earth's orbit, we're going to take plants with us," Paul said. "We are explorers. It's what we do as a species, and it's exciting to be a part of it."



NASA

Crew image of the Advanced Plant Experiments on Orbit-Transgenic Arabidopsis Gene Expression System (APEX-TAGES) study during Expedition 23.

Scenes Around Kennedy Space Center



NASA/Cory Huston

The walls come down as demolition as the Base Operations Building is deconstructed in the Industrial Area at Kennedy Space Center on March 11. The two-story building was constructed in 1965 as office space for workers. Kennedy is deconstructing some of the older facilities due to their age and to reduce maintenance and repair costs.



NASA/Charisse Nahser

Molly Bauck, president of the Royal Rosarians from Portland, Ore., adds "Royal Water" to a rose planted March 11 to honor Kennedy Space Center contractor and civil service employees for dedicating their lives, skills and knowledge to the U.S. space program for the past 50 years. The ceremony took place in the Rocket Garden at the visitor complex.



NASA/Kim Shiflett

Workers off-load a component of a Saturn V first stage engine March 21 at Port Canaveral. It recently was recovered off the coast of Florida during an expedition funded by Jeff Bezos, founder and CEO of Amazon.com. Bezos also owns Blue Origin, a company NASA is working with as part of its Commercial Crew Program.



NASA/Jim Grossmann

Inside the Educator Resource Center at the Kennedy Space Center Visitor Complex, science teacher April Lanotte displays some of the materials used to demonstrate NASA's Museum in a Box activities for K-12 students. Lanotte, who is an Albert Einstein Distinguished Educator Fellow working in NASA's Aeronautics Research Mission Directorate, was at Kennedy on March 19 to train education specialists in a new series of lessons and activities.



NASA/Jim Grossmann

[CLICK ON PHOTO](#)

Workers from Canaveral Construction of Mims, Fla., continue to re-grade the lime rock in sections of the crawlerway leading to Launch Pad 39B at Kennedy Space Center on March 13. The crawlerway is being upgraded to improve the foundation and prepare it to support the weight of NASA's Space Launch System and mobile launcher on the crawler-transporter during rollout. For more on the Ground Systems Development and Operations Program, click on the photo.

Launch pad of the future takes shape

By Linda Herridge
Spaceport News

The launch pad of the future is taking shape at Kennedy Space Center as the Ground Systems Development and Operations (GSDO) Program, along with Center Operations, continues with upgrades and modifications to Launch Pad 39B.

Center Operations is providing several services to GSDO to manage and implement the upgrades. Systems engineers and construction managers are working on studies, designs and construction requirements for several Pad B projects.

Jose Perez Morales, the GSDO pad element project manager, said that many Pad B projects have been successfully completed.

"Center Operations has been an integral part of the pad team," he said. "Their dedication to the success of the team continues to be extremely important."

One of the most visible new features on the pad surface is a steel and concrete structure that houses two elevators and the associated machinery required to operate them. The elevators will provide access from the pad surface to the "0" level, or deck, of the mobile launcher.

According to Lori Jones, a project manager in the Construction of Facilities Division, when the



Photo courtesy of URS/Jeffrey Miller

Construction is nearly complete on the new hydraulic elevators on Launch Pad 39B at Kennedy Space Center. The Ground Systems Development and Operations Program and Center Operations continue to upgrade and modify the pad where NASA's Space Launch System with the Orion spacecraft atop it will send humans deeper into space than ever before.

rotating and fixed service structures used for the Space Shuttle Program were deconstructed, two of the old elevators also were removed. A single old hydraulic elevator was left on the pad surface.

"Center Operations performed a study of different design concepts," Jones said. "Ultimately, it was decided to replace it with two new traction elevators."

The elevators, which open toward the west, were designed to be similar to those on the mobile

launcher in size and capacity.

The contract to build the elevators was awarded in 2011 to Ivey's Construction Inc. of Merritt Island, Fla. The architectural and engineering firm that designed them is Reynolds, Smith and Hills, also of Merritt Island.

Other projects recently completed include minor modifications to the Pad Terminal Connection Room, replacing the old Halon fire system with a new sprinkler system, and removal of hypergol fuels and the oxidizer farms that were used for the Space Shuttle Program.

Interfaces on the mobile launcher's utility platform were modified; the water tower was refurbished and repainted; the liquid hydrogen and liquid oxygen spheres were repaired, sandblasted and repainted; and repair work was done on concrete slopes and surfaces around the pad.

Jones said the office currently is working to identify concepts for a new flame trench and flame deflector. The old flame trench and wall bricks, as well as Apollo-era rails that were part of a movable flame deflector, will be removed. Design work is not scheduled to begin until 2015.

Future work includes refurbishing or modifying the piping

"Center Operations has been an integral part of the pad team. Their dedication to the success of the team continues to be extremely important."

**Jose Perez Morales,
GSDO pad element
project manager**

that will interface with the mobile launcher and replacing the water lines and unused piping beneath the pad, in an area called the catacombs. Concrete repair to the catacomb roof will continue.

The liquid hydrogen, liquid oxygen and other interfaces on the pad or pad structures will be updated. Beneath the pad structure in the Environment Control Room, ducts that supported space shuttles will be removed, and a new system will be designed and built to replace them.

"It's been really interesting to be part of this project, because it's my first opportunity to be around at the beginning of a program and to help prepare the ground systems for the GSDO Program," Jones said. "We can be a gateway to space for NASA's Space Launch System and other launch vehicles."



NASA/Cory Huston

The mobile launcher nears the base of Launch Pad 39B at Kennedy Space Center, passing near one of three 600-foot-tall lightning towers, as it makes its way back to the park site near the Vehicle Assembly Building in November 2011.

New diagnostic tools may benefit patients in space

By Anna Heiney
Spaceport News

Imagine diagnosing a sick patient in space -- or halfway around the world.

Two new technologies in early development at Kennedy Space Center could send real-time information about astronauts' heart and lung health to doctors on the ground. Compact and portable, both technologies have the potential to provide advanced telemedicine capabilities not only for NASA, but for doctors and patients on Earth.

"If you get sick up there, the doctor can't put a stethoscope on you, take a picture of you, or get your blood-work analyzed," said Dr. David Tipton, NASA's chief medical officer at Kennedy.

"The doctor, who is on Earth, has to figure out what's wrong with you -- in a place where he can't reach you -- and then figure out how to treat you."

Still early in develop-



NASA/Glenn Benson

Early in development, this Radio Frequency Impedance Interrogation (RFII) device that may someday provide advanced telemedicine capabilities in space and for doctors and patients on Earth.

ment, Electrical Impedance Tomography Technology (EITT) is designed to provide images allowing doctors to monitor a patient's airflow or blood flow. While tools such as X-ray, magnetic resonance imaging (MRI) and ultrasound are well known, they don't work well in a space environment due to radiation, user training, size and power usage considerations. These same limitations exist in remote

locations on Earth.

The EITT device is a belt of electrodes worn around the portion of the body to be imaged. Once placed on a patient, it sends its observations to a computer, which then converts that signal to a still image or even a stream of live data. This information can be sent from space to the ground or from remote locations anywhere in the world.

Farther along in develop-

ment is the Radio Frequency Impedance Interrogation (RFII) technology, which provides information about a patient's cardiac performance using low-power radio frequency. It's about the size of a cell phone and uses only 1/100th the power.

"It just lies flat on the subject's chest, and it gives an indication of cardiac performance: how well the heart's beating, how fast it's

beating, and a number of other variables," explained Dr. Ken Cohen, a physiologist with InoMedic Health Applications at Kennedy. "A lot of these change in space and have a very big effect on astronaut physiology."

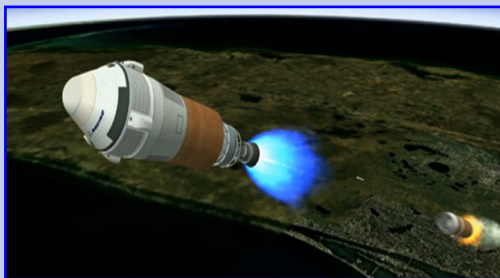
Because the RFII data can be monitored from a central location, multiple devices could be used to monitor several patients simultaneously, such as in a car accident with multiple injured victims.

"You put one of these on each person and you only need one or two people to monitor them," Tipton said. "The device can help point you to the individuals that need immediate care."

NASA and InoMedic Health Applications are working together to develop these technologies.

"I'm definitely excited about it," Cohen said. "It's technology development, and that's one of the things I think NASA is all about."

Spotlight on Commercial Crew Development



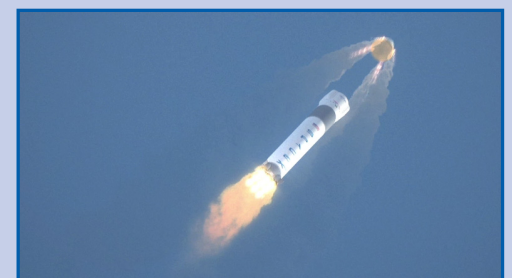
Boeing CST-100/Atlas V

The Boeing Company is working with its chosen CST-100 spacecraft launch provider, United Launch Alliance, toward testing a newly developed liquid oxygen feed line duct that will transfer the super-cold propellant from its onboard liquid oxygen tank to its dual-engine Centaur configuration. The Centaur is the rocket component that will navigate the spacecraft to its intended orbit. Boeing also is preparing for a series of wind tunnel tests, which are important steps toward ensuring its integrated crew transportation system can provide crews a safe ride to orbit.



Sierra Nevada Corp. Dream Chaser/Atlas V

Sierra Nevada Corp. (SNC) Space Systems recently hosted discussions with NASA about the Dream Chaser's non-toxic main and reaction control propulsion systems. The reaction control system will give the spacecraft the ability to steer in space by providing small amounts of directional thrust for docking with the International Space Station. The main propulsion system is much more powerful, and generally capable of providing thrust in one direction for aborts or orbital insertion burns. SNC also discussed with NASA its environmental control and life support systems that will be needed to support a crew.



SpaceX Dragon/Falcon 9

Space Exploration Technologies (SpaceX) continues to work with NASA on plans for a Dragon pad abort test at Cape Canaveral Air Force Station's Space Launch Complex 40. The test will help the company assess the spacecraft's integrated launch abort system, parachutes and supporting avionics. Throughout NASA's human spaceflight endeavors, pad abort tests have played an important role in evaluating the ability of a spacecraft's launch abort system to get an astronaut crew to safety in the event of an emergency on the launch pad.

NASA Employees of the Month: March



NASA

Employees for the month of March are, from left, Lois M. Clutter, Ground Processing; Michael C. Carbone, Engineering and Technology; Nicholas R. Moss, Center Operations; Timothy R. Lewis, Safety and Mission Assurance; Donna M. McFarr, Engineering and Technology; and Laura A. Ulrich, Launch Services Program. Not pictured is Alex J. Bengoa, Ground Systems Development and Operations.

Looking up and ahead . . .

** All times are Eastern*

March 28

Assembly Flight: 34S

Mission: Expedition 35/36

Launch Vehicle: Soyuz TMA-08M

Launch Site: Baikonur Cosmodrome, Kazakhstan

Description: Soyuz TMA-08M will carry three Expedition 35/36 crew members to the International Space Station (ISS).

No Earlier than April 16

Mission: Orbital Sciences Corp. Test Flight

Launch Vehicle: Antares

Launch Site: Wallops Flight Facility, Va.

Launch Pad: OA

Launch Window: TBD

Description: Orbital Sciences is scheduled to test its Antares rocket. Testing will enable the rocket to eventually carry experiments and supplies to the International Space Station.

April 18

Mission: ISS Automated Transfer Vehicle 4

Launch Vehicle: Ariane 5

Launch Site: Guiana Space Centre, French Guiana

Launch Pad: ELA-3

Description: The European Space Agency's ATV-4, also known as the "Albert Einstein," will deliver several tons of supplies to the ISS, docking with the Zvezda Service Module, on the Russian segment of the station.

April 24

Mission: ISS Resupply

Launch Vehicle: ISS Progress 51

Launch Site: Baikonur Cosmodrome, Kazakhstan

Description: Progress 51 will carry supplies, hardware, fuel and water to the ISS.

May 28

Assembly Flight: 35S

Mission: Expedition 36/37

Launch Vehicle: Soyuz TMA-09M

Launch Site: Baikonur Cosmodrome, Kazakhstan

Description: Soyuz TMA-09M will carry three Expedition 36/37 crew members to the ISS.

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

NASA Spinoffs: Did you know?

The 19th annual KSC Run/Walk took place earlier this week. Here are a few NASA spinoffs that have been helping us keep fit.



Technology originally developed for the boots worn on the moon has been applied to athletic shoes in the mid-sole section. A process known as "blow rubber molding" used in producing helmets was applied to create hollow athletic shoe soles designed to be filled with shock-absorbing materials.

Conditions such as motion sickness present a significant challenge to astronauts in space. Utilizing biofeedback training methods, NASA's research led to the invention of Zephyr's consumer device, the HxM, which monitors heart rate, speed, and distance for everyday fitness training.



The Orbotron, a tri-axle exercise machine patterned after a NASA training simulator, has three orbiting rings corresponding to roll, pitch and yaw. The user's stomach remains in the center of all axes, eliminating dizziness. Use of the machine can improve aerobic capacity, strength and endurance.

Studies into astronaut exercise in space have led to the development of a rehabilitation aid that applies air pressure to mimic the Earth's gravity on a patient's lower body in order to unload weight, which reduces the stress placed on the lower body during rehabilitation.



For more about NASA Spinoffs, go to <http://www.nasa.gov/spinoffs>.



John F. Kennedy Space Center

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