



KENNEDY SPACE CENTER'S
SPACEPORT
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BASALT
MARTIAN TOOL TEST

KENNEDY SPACE CENTER'S

SPACEPORT MAGAZINE

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Kara Beaton and Rick Elphic are shown during the “pre-sampling” phase of the Biologic Analog Science Associated with Lava Terrains Project, known as the BASALT project, at Mauna Ulu in Hawaii Volcanoes National Park. Photo credit: NASA

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THE SPACEPORT MAGAZINE TEAM

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NASA'S LAUNCH SCHEDULE

Date:

Dec. 9, 8:26 a.m. EST

Mission:

HTV-6 Cargo Craft

Description:

Launch of the Japan Aerospace Exploration Agency (JAXA) H-II Transfer Vehicle (HTV) unmanned cargo transfer spacecraft from Tanegashima, Japan. HTV-6 “KOUNOTORI6” will deliver supplies to the International Space Station. <http://go.nasa.gov/2eSn3IP>

Date:

Dec. 12, 8:19 a.m. EST

Mission:

Cyclone Global Navigation Satellite System (CYGNSS)

Description:

Launching from Cape Canaveral Air Force Station, Florida, on a Pegasus XL rocket, the CYGNSS mission will probe the inner core of hurricanes to learn about their rapid intensification. <http://www.nasa.gov/cygnss>

Date:

February

Mission:

Expedition 50 Undocking and Landing

Description:

NASA astronaut Shane Kimbrough and cosmonauts Sergey Ryzhikov and Andrey Borisenko of the Russian space agency Roscosmos undock their Soyuz MS-02 spacecraft from the International Space Station's Poisk module and land in Kazakhstan. <http://go.nasa.gov/2gMg3PR>

Date:

March

Mission:

Expedition 51 Launch

Description:

In March 2017, Expedition 51/52 crew members NASA astronaut Jack Fischer and cosmonaut Fyodor Yurchikhin of the Russian space agency Roscosmos launch to the International Space Station. Yurchikhin will be the Expedition 52 commander. <http://go.nasa.gov/2gMfdmx>

Want to see a launch?

All expendable vehicles launched in Central Florida begin their journeys on the launch pads of Cape Canaveral Air Force Station, next door to Kennedy Space Center. Launch Transportation Tickets are available for some, but not all, of these launches. Call the KSC Visitor Complex at (321) 449-4444 for information on purchasing tickets.



I am

KENNEDY

SPACE CENTER

LISA CHAPMAN

I am the Planning and Scheduling manager with the Test and Operations Support Contract (TOSC) Program Integration Team. My team works with NASA, TOSC, and other Kennedy Space Center contractors to develop and implement integrated plans for International Space Station and Launch Services Program payload processing, Kennedy facility and hardware operations and maintenance, the Spaceport Integrated Master Schedule, and Ground Systems Development and Operations facility and hardware verification and validation testing.

We also provide administrative support to these activities, including planning meetings, readiness reviews, and engineering panels and boards. We develop and support the Program Requirements Document process, ensuring support services are available to support operations at Kennedy.

One of the most exciting parts of my job is planning our work on the Exploration Mission 1 flight hardware processing and launch schedule. We work directly with NASA and TOSC flow managers and Engineering to detail the activities and work plans to process and launch the Space Launch System and Orion capsule. I am looking forward to seeing work completed to bring processing facilities and ground support equipment online and ready to receive flight hardware!

I am a second generation Kennedy worker. My family came to the Space Coast when my father got a job on the Apollo program. I grew up watching Kennedy launch rockets and was honored to join the KSC team during the shuttle program.

I am truly excited about being a part of and seeing the launch of Exploration Mission 1 and NASA's continued exploration of space.

A handwritten signature in blue ink that reads "Lisa".



BASALT

MARTIAN TOOL TEST



Mars



BASALT Mars Tool Test

BY FRANK OCHOA-GONZALES

NASA researchers spent 18 days in Hawaii recently “test-driving” many of the tools, techniques and processes astronauts may employ in the future during a Journey to Mars. Trying out backpacks designed and built at NASA’s Kennedy Space Center in Florida, researchers hope to gather data to understand the habitability of terrestrial volcanic terrains as simulated environments for early and present-day Mars.

The soil at Mauna Ulu in Hawaii Volcanoes National Park is blanketed with a thin, crumbly lava rock known as shelly pahoehoe — thought to be similar to the mostly basalt terrain of Mars. Mauna Ulu often serves as a simulator on Earth because of its early Mars history when volcanism occurred during wet conditions, creating minerals that also may lead to clues of early microbial life.

“Our team is seeking to understand the habitability potential of basalt-rich volcanic environments as an analog to early Mars,” said Dr. Darlene Lim, principal investigator of the BASALT program at NASA’s Ames Research Center. “However, we added a twist to our scientific fieldwork by conducting it under simulated Mars mission constraints.”

Although no spacesuits were used, scientists hiked with the backpacks that provide all of the technological capabilities an astronaut will have in a future space suit.

One goal of the Biologic Analog Science Associated with Lava Terrains Project, known as the BASALT project, is to develop rules and protocols that could be used on an actual Mars mission to identify and protect geologic samples that could contain life.

Michael Miller, lead electrical and communications engineer on the BASALT project, designed, fabricated, tested, and deployed the extravehicular backpacks that were used by the simulation crew members in an effort to optimize their science return.

Kennedy contributed the backpack, communications and networks, and some of the logistics. Miller designed the electronics and partnered with a company to design the backpack.

According to Miller, the backpacks performed very well and enabled collection of all data products needed for the project research publications. Overall, the hardware inside functioned accordingly.

“The backpack held up very well with minimal issues,” Miller said. “Every team was able to meet their objectives without needing any of the contingencies in the schedule.”

The backpacks provided real-time video, audio, position and heading, a wrist display full of data, and connectivity for in-situ scientific instruments to send data

The NASA BASALT (Biologic Analog Science Associated with Lava Terrain) simulation astronauts with their field support team are shown during a traverse to start a two-week Mars analog science and exploration mission. This photo was taken at Mauna Ulu, the Big Island of Hawaii, on Nov. 12. Photo courtesy of Andrew Hara



The Biologic Analog Science Associated with Lava Terrains (BASALT) team conducts scientific exploration of Mauna Ulu, Hawai'i, under simulated Mars mission conditions.



to the science team.

The Hawaiian island isn't the only Martian-resembling site. The BASALT team conducted a similar field simulation last year at Craters of the Moon National Monument in the Snake River Plain of Idaho. The site provided a resourceful lava flow and cinder cone-covered preserve

"All of the changes we made between Idaho and Hawaii gave us more stability and reduced the down time," Miller said. "Everything is going according to plan and we are all happy about that."

"Scientific data derived from the two field sites will provide a foundational understanding of the habitability of distinct geochemical, mineralogical and textural properties associated with Mars-like terrestrial basalts," Miller said. "As well, our unique contribution will include an evaluation of how our Concept of Operations and capabilities compare in their ability to support geological versus biological field approaches. This has not, to our knowledge, been previously examined or compared, particularly during a real (non-simulated) science mission."

Further increasing the realism of the tests, communications with a mission control room were delayed just as they will be during an actual mission to Mars. They used 5 and 15 minute delays for test conditions. The astronauts used wrist-displays that included a mission-planning tool called Playbook, to operate autonomously during lapses in communication.

The group already is preparing for one, or possibly two more deployments.

ALL GOES RIGHT

NASA successfully launches NOAA advanced geostationary weather satellite

BY STEVEN SICELOFF

NASA successfully launched for the National Oceanic and Atmospheric Administration (NOAA) the first in a series of highly advanced geostationary weather satellites Saturday from Cape Canaveral Air Force Station in Florida.

NOAA's Geostationary Operational Environmental Satellite-R (GOES-R) lifted off Nov. 19 on its way to boost the nation's weather observation capabilities, leading to more accurate and timely forecasts, watches and warnings.

"The launch of GOES-R represents a major step forward in terms of our ability to provide more timely and accurate information that is critical for life-saving weather forecasts and warnings," said Thomas Zurbuchen, associate administrator for NASA's Science Mission Directorate in Washington. "It also continues a decades-long partnership between NASA and NOAA to successfully build and launch geostationary environmental satellites."

After it reaches its final designated orbit in the next two weeks, GOES-R will be renamed GOES-16. The new satellite will become operational within a year, after undergoing a checkout and validation of its six new instruments, including the first operational lightning mapper in geostationary orbit.

"The next generation of weather satellites is finally here," said NOAA Administrator Kathryn Sullivan. "GOES-R will strengthen NOAA's ability to issue life-saving forecasts and warnings and make the United States an even stronger, more resilient weather-ready nation."

Forecasters will use the lightning mapper to hone in on storms that represent the greatest threats. The satellite's primary instrument, the Advanced Baseline Imager, will provide images of Earth's weather, oceans and environment with 16 different spectral bands, including two visible channels, four near-infrared channels, and 10 infrared channels.

Improved space weather sensors on GOES-R will monitor the sun and relay crucial information to forecasters so they can issue space weather alerts and warnings. In all, data from GOES-R

will result in 34 new or improved meteorological, solar and space weather products.

"NOAA and NASA have partnered for decades on successful environmental satellite missions," said Sandra Smalley, director of NASA's Joint Agency Satellite Division at the agency's Headquarters in Washington, which worked with NOAA to manage the development and launch of GOES-R. "Today's launch continues that partnership and provides the basis for future collaboration in developing advanced weather satellites."

"The launch of GOES-R represents a major step forward in terms of our ability to provide more timely and accurate information that is critical for life-saving weather forecasts and warnings."

Thomas Zurbuchen
Associate Administrator for
NASA's Science Mission Directorate

Beyond weather forecasting, GOES-R also will be part of the Search and Rescue Satellite Aided Tracking (SARSAT) System, an international satellite-based search and rescue network operated by NOAA. The satellite is carrying a special transponder that can detect distress signals from emergency beacons.

There are four satellites in the GOES-R series: -R, -S, -T and -U, which will extend NOAA's geostationary coverage through 2036.

NOAA manages the GOES-R Series Program through an integrated NOAA-NASA office. NASA's Launch Services Program, based at the agency's Kennedy Space Center in Florida, acquired and managed the United Launch Alliance Atlas V launch service and led the countdown. NASA's Goddard Space Flight Center in Greenbelt, Maryland, oversees the acquisition of the GOES-R series spacecraft and instruments.



The GOES-R satellite will be NOAA's most sophisticated weather observation spacecraft and is expected to improve forecasts and tracking substantially. Photo credit: NASA/ Kim Shiflett

For more information about GOES-R, visit:
<https://www.nasa.gov/content/goes-r/index.html> and <http://www.goes-r.gov>.

URT-5



U.S. Navy divers and other personnel in a small Zodiac boat secure a tether line to an attach point on a test version of the Orion crew module Oct. 31 during Underway Recovery Test 5 in the Pacific Ocean off the coast of California. Photo credit: NASA/Bill White

NASA, U.S. Navy practice Orion recovery procedures for Exploration Mission 1

BY LINDA HERRIDGE

When Orion returns from deep space missions and lands in the ocean, a team will be responsible for safely returning the capsule and crew back to land. That feat will be accomplished by a landing and recovery group that includes NASA and contractor engineers and technicians and U.S. Navy divers, along with a variety of water vessels and ground support equipment.

NASA's Ground Systems Development and Operations Program (GSDO), the U.S. Navy, U.S. Air Force and contractor employees recently wrapped up in late October a successful rehearsal of Orion recovery, called an Underway Recovery Test, aboard the USS San Diego in the Pacific Ocean off the coast of California. The USS San Diego is an amphibious ship with a landing platform/dock used to pull the Orion spacecraft into the ship, and underway is a US Navy term meaning that the ship is out to sea. This is the fifth such test with Orion, and previous underway recovery tests have helped contribute to the team's understanding of how to adjust for various water conditions and contingency scenarios.

"Our Orion recovery testing was our first chance to field test new ground support equipment and operational procedures," said Mike Bolger, GSDO director at Kennedy Space Center.

During the recovery test, the team demonstrated and evaluated in open water new recovery processes, procedures, hardware and

personnel that will be necessary to recover the Orion crew module into the well deck of a Navy ship based on what was learned during Orion's flight test in December 2014. New ground support equipment testing included attaching tow lines to five attach points, rather than three, on the crew module. Also, tow cleat assemblies were modified to include a tow pin insert that allows easier tow line connections in rocky waves.

The recovery team headed out to sea aboard the ship, along with a test version of the Orion crew module and recovery support equipment secured in the ship's well deck. During a series of tests over several days, the well deck was flooded with water and the test vehicle was allowed to float out to open water to rehearse various segments of recovery procedures, including attaching a collar and various lines on the module and pulling, or guiding it back into the ship.

U.S. Navy divers in inflatable Zodiac boats and other team members in rigid hull inflatable boats maneuvered to the test vehicle. They secured a flotation collar around Orion and attached tether lines to attach points on the module to keep it upright.

The team guided the test vehicle back to the ship, where a winch line was attached to pull it into the ship's well deck. A capture net was used to keep Orion inside the ship. The water was drained back

U.S. Navy divers and other personnel in a rigid hull Zodiac boat attached tether lines to a test version of the Orion crew module Oct. 27 during Underway Recovery Test 5 in the Pacific Ocean off the coast of California. NASA's Ground Systems Development and Operations Program and the U.S. Navy conducted a series of tests using the USS San Diego, various watercraft and equipment to practice for recovery of Orion on its return from deep space missions. Photo credit: NASA/Bill White



and Orion was secured on the crew module recovery cradle.

“We tested a new generation of prototypes for capsule recovery in the well deck. We also installed a new suite of instrumentation and cameras to gather data on the performance of this new hardware,” said Melissa Jones, GSDO Landing and Recovery director. “Our testing was very successful. Everything we learned will help us for future recovery testing.”

Other goals of the testing included assessing on-ship and ship-to-shore communications, as well as recording timing data for recovery activities to help provide future recovery methods for crewed missions.

“The team gained invaluable open water experience, validated the design of several pieces of ground support equipment, and accomplished the test objectives,” Bolger said.

The team will fine tune their strategy, make some equipment adjustments and return to the open water for another test late next year.

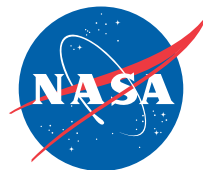
Orion is the exploration spacecraft designed to carry astronauts to destinations not yet explored by humans, including an asteroid and the agency’s Journey to Mars. It will have emergency abort capability, sustain the crew during space travel and provide safe re-entry from deep space return velocities.

NASA’s Orion spacecraft is scheduled to launch atop the Space Launch System rocket on its first deep space mission in late 2018. The mission will send Orion on a path thousands of miles

beyond the moon over a course of three weeks, farther into space than human spaceflight has ever travelled before. The spacecraft will return to Earth and safely splash down in the Pacific Ocean. The mission will advance and validate capabilities required for the Journey to Mars.



Winch team operators help guide a test version of the Orion crew module into the flooded well deck of the USS San Diego on Oct. 29 during Underway Recovery Test 5 in the Pacific Ocean off the coast of California. Photo credit: NASA/Bill White



FACES OF GSDD

GROUND SYSTEMS DEVELOPMENT & OPERATIONS



Melissa Jones

Landing and Recovery Director

Ground Systems Development & Operations Program

KENNEDY SPACE CENTER
Exploration Begins Here

Melissa Jones

Landing and Recovery Director

My name is Melissa Jones. I am the Landing and Recovery director for the Ground Systems Development and Operations Program (GSDO) at Kennedy Space Center. Currently, I'm working on the Orion recovery efforts for Exploration Mission 1.

My primary responsibility is leading an interagency team that will recover the Orion capsule when it returns to Earth during an end-of-mission landing, or if it needs to return for an emergency landing. The recovery will take place off the coast of San Diego in California. My responsibilities also include creating a system that can recover a future flight crew in the open water in the well deck of a ship with a landing platform/dock within two hours of landing.

I have worked at Kennedy since January 2004. I was hired for return-to-flight after Columbia.

The coolest part of my job is getting to work with a diverse team, including the Department of Defense, crew office and other NASA programs. Even though I worked in the Space Shuttle Program and the Commercial Crew Program, I've met and worked with so many different people in my short time in GSDO. It's great to work on a team where everyone is so focused on making Orion recovery successful. There is a lot of passion on the Landing and Recovery Team.

I'm most proud of how hard the Landing and Recovery Team has worked to get ready for Underway Recovery Test 5 (URT-5). The team has had about nine months to develop all the prototype hardware and operations required to perform URT-5. The work included getting the hardware designs and test plans approved by the U.S. Navy and training the Navy divers and other personnel. All of this work was done concurrently with trade studies, night recovery assessments and rescue working groups for Exploration Mission 2.

Working in GSDO gives me the opportunity to do something new and different that I've never done before. NASA's Journey to

Mars definitely qualifies. Also, I knew many people in GSDO and was impressed with the caliber of people that the program continues to attract.

I grew up with the space program. Both of my parents, my grandparents and my uncle all worked in different aspects of crewed and uncrewed space programs at Cape Canaveral. My first internship at Kennedy was during my junior year of high school. I worked in the group responsible for processing the Unity node (Flight 2A) for the International Space Station. I wanted to be an astronaut after that. I continued my career as an intern on the Titan IV program through college before I was hired to work in the Space Shuttle Program in 2004.

My hometown is Oak Hill, Florida. I graduated with a Bachelor of Electrical Engineering in 2003, and a Master's in engineering management in May 2016, both from the University of Central Florida in Orlando. I also participated in NASA's Professional Engineering Management Program.

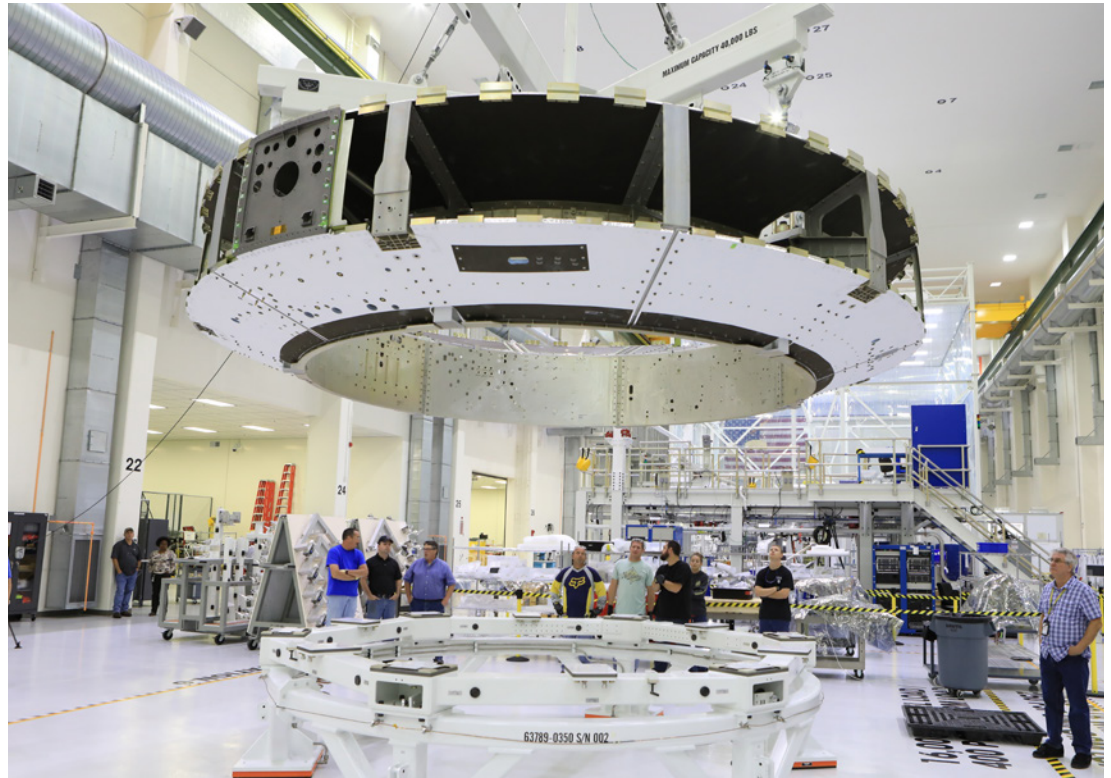
Regarding NASA's space exploration missions, there is so much to look forward to as we explore the unknown. I'm excited that my kids are going to live through the Journey to Mars and get to see firsthand what we learn and discover. My ultimate hope would be that we execute these missions successfully and safely.

The advice I would give to students looking to pursue a career similar to mine is work hard in school and take advantage of internships and networking opportunities. It's hard to make such an important decision about your future when you're so young. When I was in high school making choices about my college major, I was undecided about whether to go into medicine or engineering. Through several internships, I was able to make the decision to go into engineering, which was the right choice for me.

MOVING UP

Orion crew module adapter gets first, only lift

BY LINDA HERRIDGE



The Orion crew module adapter was lifted out of its work stand Nov. 11 and is now undergoing secondary structure outfitting in the Neil Armstrong Operations and Checkout Building high bay at Kennedy Space Center. Photo credit: NASA/ Glen Benson

Processing activity at Kennedy Space Center has ramped up in preparation for the agency's launch of the Orion spacecraft atop the Space Launch System (SLS) rocket on its first deep space mission, Exploration Mission 1 (EM-1).

The Orion crew module adapter (CMA) for EM-1 was lifted for the first and only time, Nov. 11, during its processing flow inside the Neil Armstrong Operations and Checkout (O&C) Building high bay at Kennedy.

Technicians with Lockheed Martin, the Orion crew module manufacturer, lowered the adapter onto a test stand for secondary structure outfitting. The CMA will be moved into a temporary clean room at the end of the month for propellant and environmental control and life support system tube installation and welding.

The adapter will connect the Orion crew module to the European Space Agency-provided service module. The Orion spacecraft will launch

on the SLS rocket on EM-1 scheduled for late 2018.

In the meantime, the Orion crew module structural test article (STA), pictured at right, arrived in its shipping container at Kennedy's Shuttle Landing Facility aboard the agency's Super Guppy aircraft Nov. 15 from the agency's Stennis Space Center in Mississippi. The test article was transported to Stennis from the Michoud Assembly Facility in New Orleans.

The container was offloaded and transported to the O&C on Nov. 16 where it was uncrated. Technicians removed the test module's protective covering. Then it was lifted by crane and moved to a test tool called a birdcage where it was secured for further testing. The test article will undergo mechanical assembly for the next several months before being transported to Lockheed Martin in Denver for additional testing.



Lockheed Martin technicians monitor the progress as a crane lowers the Orion crew module structural test article (STA) toward a test tool called the birdcage inside the Neil Armstrong Operations and Checkout Building at Kennedy Space Center. The STA arrived aboard NASA's Super Guppy aircraft at the Shuttle Landing Facility operated by Space Florida. The test article will be secured on the birdcage for further testing. The Orion spacecraft will launch atop NASA's Space Launch System rocket on EM-1, its first deep space mission, in late 2018. Photo credit: NASA/Ben Smegelsky

WE ARE ALL INNOVATORS



KSC innovationExpo

November 1-3 2016

innovationexpo.ksc.nasa.gov



Kennedy Space Center Director Bob Cabana stops by a NASA booth in the Space Station Processing Facility conference center during the 2016 Innovation Expo. Photo credit: NASA



Dr. Dava Newman, NASA's deputy administrator, speaks to employees at the Florida spaceport during the annual KickStart Innovation Expo. The event gives employees an opportunity to present proposals for new ideas and processes. A small amount of funding is awarded to those selected allowing individuals or teams to procure needed items to implement their projects. Photo credit: NASA/Kim Shiflett



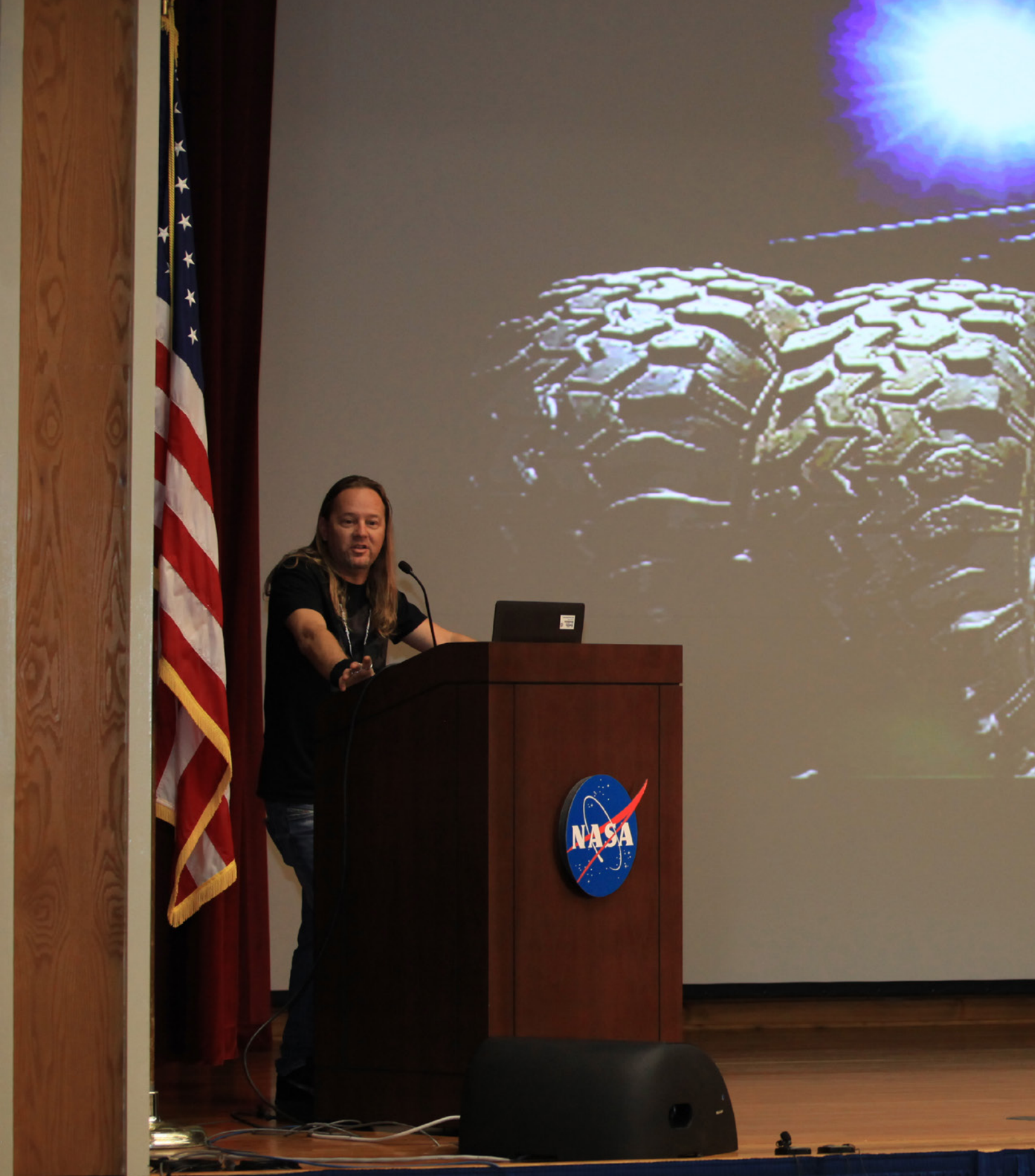
Visitors stop by a NASA booth in the Space Station Processing Facility conference center at NASA's Kennedy Space Center during the 2016 Innovation Expo. Now in its fifth year, the purpose of the Innovation Expo is to help foster innovation and creativity among Kennedy employees who are encouraged to look for ways to do their work better and to propose concepts for tackling future mission needs. Photo credit: NASA



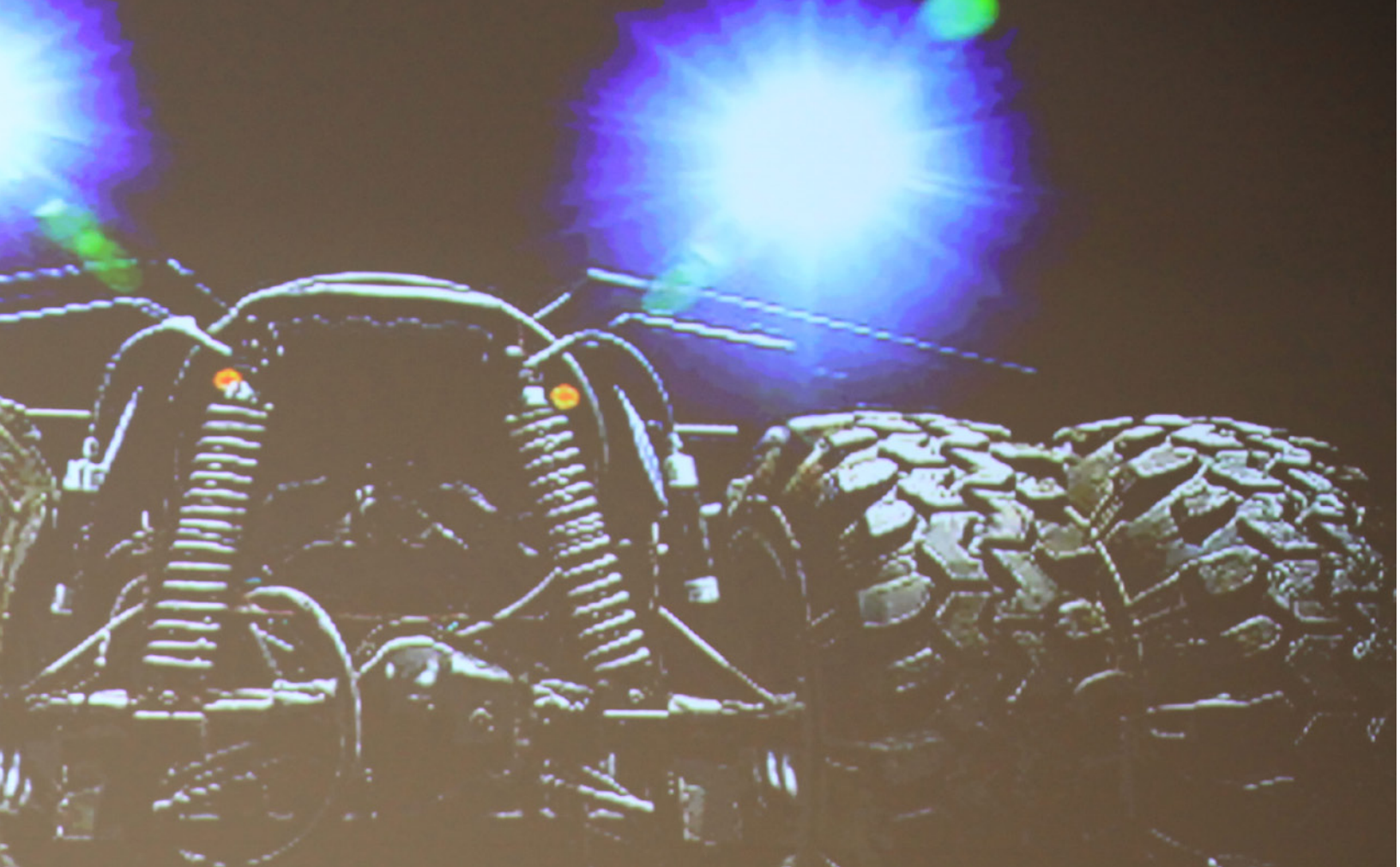
Visitors stop by a NASA booth in the Space Station Processing Facility conference center at Kennedy Space Center during the 2016 Innovation Expo. Photo credit: NASA



A visitor checks out a virtual reality device at a NASA booth in the Space Station Processing Facility conference center during Kennedy Space Center's 2016 Innovation Expo. Photo credit: NASA



Representatives from Parker Brothers, known for designing and building outrageous custom vehicles, spoke to employees at Kennedy Space Center about their creative thinking processes. Photo credit: NASA



Employees also were given an up-close look at their Neutron bike, featured in the movie *Tron*. After the talk, the Parker Brothers gave employees an up-close during the 2016 Innovation Expo at Kennedy Space Center Photo credit: NASA



Scientists with NASA's Cryogenics Test Laboratory (CTL) at Kennedy Space Center provided consultations and access to testing equipment to SeaDek Marine Products of Rockledge, Florida. At SeaDek, from left, are James Fesmire, senior principal investigator, and Adam Swanger, senior research engineer, both from the CTL. At right is James Rebholz, research and development technician with SeaDek. Photo courtesy of SeaDek

TECHNOLOGY DOCKING

Kennedy Space Center shares expertise with local companies

BY LINDA HERRIDGE

SeaDek Marine Products of Rockledge, Florida, prides itself in providing quality non-skid decking products to its customers. When the company needed a solution to an existing material limitation for a type of foam, called closed-cell EVA, used for its padded deck protectors, experts from the Cryogenics Test Laboratory (CTL) at NASA's Kennedy Space Center stepped in to give them a hand.

Cryogenics experts James Fesmire, senior principal investigator, and Adam Swanger, senior research engineer, both from the CTL, suggested some new materials test and evaluation procedures, and access to testing equipment that would not be cost-effective for the company to purchase themselves.

"With our experience in materials and thermal management for real-world environments, we were able to suggest a new approach to the challenge of the marine application," said Fesmire. "It is exciting to see the technical intersection between our two different areas and participate with SeaDek to help find a solution and advance their products."

The meetings and exchange of information were made possible through NASA's Regional Economic Development (RED) Program, an agencywide initiative that began in 2010. Kennedy and the Economic Development Commission (EDC) of Florida's Space Coast formed a strategic alliance in January 2015 for a regional economic development pilot program called Technology Docking to help the center engage with local companies in the region.

After a screening process, the RED Program matches interested small companies with corresponding experts at Kennedy, who offer advice, help solve a problem, provide a new or cost-saving way to solve the problem or suggest an alternative solution.

"As a progressive manufacturing company doing business in the heart of the Space Coast, working with our neighbors at Kennedy Space Center was a natural fit," said Kurt Wilson, SeaDek CEO. "We have spent many years breaking down material boundaries, and the assistance from NASA and the EDC brings fresh insight and resources to our mission as a company."

Robert Ashley, with the Exploration Research and Technology Directorate at Kennedy, is the project lead for the center's RED Program. When the EDC selects companies for the program, Ashley helps to match them with subject-matter experts at the center.

"The RED Program is the means by which NASA can use its tremendous talent and capabilities, purchased by taxpayer investment, to return a dividend to local communities by engaging with area companies to help them overcome technological challenges and bring new or better products to market faster than otherwise possible, leading to job creation and economic growth,"

Ashley said.

Ashley said sometimes companies just need the reassurance that they are going in the right direction. Other times, they need additional consultations and technical assistance.

"We also have had some instances where helping companies ultimately ends up helping us as well," Ashley added.

Another company that received assistance through the RED Program, was GeNO LLC, a biopharmaceutical company in Cocoa, Florida. The company produces nitric oxide drug delivery products for a variety of therapeutic uses. The challenge involved a reaction vessel that worked intermittently and how to correct the problem.

Several NASA mechanical engineers with backgrounds in fluid dynamic analysis, thermal modeling and structures were matched with the company.

Charles Moore, an aerospace engineer with the Launch Services Program, met with GeNO and recommended the development of a material equation of state that would provide far greater insight into the gas evolution process within the reaction vessel.

"The Technology Docking Program was a productive experience for GeNO LLC," said Ryan Denton, an engineer with the company. "The subject-matter experts assisted us in a search for an answer that would have taken us an additional two years to find on our own."

Denton said the face-to-face meetings with NASA engineers were always very stimulating. "Technology Docking not only saved us product development time, but also saved us money," Denton said.

Ashley said there are plans to broaden the program's reach to make it easier for companies to partner with the center, including an umbrella Space Act Agreement with the EDC that will serve as a conduit and make it easier for smaller companies to access Kennedy's expertise.

"This effort is about connecting our regional industry with NASA's technology, capabilities and resources, with the goal of solving technology challenges together and driving economic successes for the region," said Elizabeth Huy, EDC senior manager of business development.

Kennedy is one of six NASA centers participating in the Regional Economic Development Program, part of the agency's Space Technology Mission Directorate, and currently the only one formally partnering with an economic development organization. Over the past two years, 69 companies have participated in initial discussions with NASA experts, and fourteen of those companies have been selected to receive additional NASA assistance through the Technology Docking program.

Liquid Nitrogen

ULTIMATE TEST

Kennedy's Cryo Test Lab
a global resource

BY ANNA HEINEY

WWW.NASA

TK-001 6000 G
250 PSIG M

The test panel is shrouded in mist during the cold vapor test, which was designed to help establish a new test standard. Photo credit: NASA

Mars



When companies around the world want to understand the energy efficiency of a particular system or material, they often call on Kennedy Space Center's Cryogenics Test Laboratory. For the past 20 years, the lab has worked with industry partners to not only test materials, but to help establish international standards for such tests.

Cryogenic materials must perform at very low temperatures — in many applications, only a few degrees above absolute zero (-273°C). This poses unique challenges and hazards which require particular attention to ensure safe and successful operation.

James Fesmire is a senior principal investigator for NASA and co-founder of the "Cryo Test Lab" at Kennedy. His team regularly consults and conducts testing with companies and organizations including for example Japan, South Korea, Germany, and most currently, France. "It's a testament that we are quite popular around the world," Fesmire said.

The cornerstone of the lab's offerings is being one of the best in the world to advance and improve energy efficiency to benefit all mankind. A current customer is Technip, out of Paris, France, which requested help protecting a floating liquefied natural gas

(LNG) vessel, the Shell Prelude — the largest floating object built by humans. A few years ago, after seeing some of NASA's patents on aerogel composites, Technip came to Kennedy's cryo experts for help figuring out how to insulate and protect the vessel's more than a quarter-mile length of carbon steel equipment and decking from cryogenic spills.

Why is NASA, an entity typically known for air and space vehicles, helping with the oil and gas industry? The answer is simple and two-fold. First, ensuring the most efficient coatings and protections can lead to a better world for all. Additionally, because fire, corrosion and cryogenic spills are all hazards that could jeopardize a rocket launch or a vessel such as the Prelude, breakthroughs gained through these partnerships can be applied to the space program and vice versa.

Aside from helping individual companies with their specific needs, NASA and its engineering services contractor, Vencore, through the Contractor 3rd Party Work (C3PW) program, also are establishing industry standards for the cryogenic insulation world. "Our work enabled the writing of the bookson cryogenic insulation standards," Fesmire said, describing two new ASTM International



Members of Kennedy Space Center's Cryo Test Lab team set up the cold vapor test in which a newly developed nozzle created a wall of mist against a test panel loaded with sensors. Photo credit: NASA



The test panel is shrouded in mist during the cold vapor test, which was designed to help establish a new test standard. Photo credit: NASA



Members of Kennedy Space Center Cryo Test Lab team set up the cold vapor test in which a newly developed nozzle created a wall of mist against a test panel loaded with sensors. Photo credit: NASA

publications based on 20 years' worth of testing of hundreds of materials. ASTM International is one of the world's foremost organizations dedicated to developing and establishing voluntary consensus standards.

NASA is helping the industry establish standards — both Fesmire and Vencore's Dr. Barry Meneghelli are official delegates with the International Organization for Standardization, or ISO, committee on LNG installations and equipment. With Technip's unique insulation needs, new standardized tests had to be established to test three different spill states: liquid soak, liquid jet and cold vapor.

This September, Kennedy took on the cold vapor test. Observers from England, France and Japan descended upon the spaceport for a week to observe the testing protocols Fesmire and his team put in place. In October, Dr. Meneghelli took the first results of the cold vapor test and proposed test protocols to an ISO meeting in Dubai. The next ISO committee meeting will be hosted by NASA and Vencore at the Kennedy Space Center in April 2017, through which the new test standard will be drafted.

While designing and planning the cold vapor tests, Kennedy's cryo team had to develop a new nozzle that could create a wall of mist. "The nozzle we used didn't exist when we started a year ago,"

Fesmire said. "We had to invent our own nozzle design."

Another benefit to NASA's work is the spinoff possibility into the public sector. The nozzle technology created for the test is now under review and could be used not only for cryo spill protection, but also by firefighters across the country.

Next up on the docket is a new research project for the Department of Energy, also through the C3PW program, developing cryogenic tanks for automotive applications. "We are innovating a highly-integrated thermal insulation system for hydrogen storage for fuel cells in future vehicles," Fesmire said.

Once again, the work being done by the team for the automotive industry could transfer into the space sector. For the hydrogen powered cars, the tanks need to have a vacuum jacket that can ensure the vehicle's performance for years. When spacecraft fly into the vacuum of space, they need similar insulation materials to ensure the keeping of the cryogenic propellants for extended periods of time.

"Being engaged with the world is central to innovation in NASA," Fesmire said. "Building a technical base of expertise among people in academia, institutions, government labs, and especially manufacturing companies and machine shops is the type of partnering premise that we've built our lab upon."





A new liquid hydrogen (LH2) liquid separator tank has arrived at NASA's Kennedy Space Center in Florida. It will be used to support the agency's Space Launch System rocket and all future launches from Launch Pad 39B. The tank was lifted by crane, rotated, and then lowered on the transporter for the move to the pad.

The existing hydrogen vent system that terminates at a flare stack was designed for gaseous hydrogen. New requirements for Exploration Mission 1 and future launches include the need to address liquid hydrogen in the vent system. The new LH2 separator/storage tank will be added to the existing hydrogen vent system to assure gaseous hydrogen is delivered downstream to the flare stack.

At Pad B, the existing hydrogen vent line and supporting systems will be modified to accommodate the new LH2 liquid separator tank. The Ground Systems Development and Operations Program and the Engineering Directorate at Kennedy are performing the upgrades to Launch Pad 39B to support the agency's premier multi-user spaceport.

The 60,000 gallon tank was built by INOXCVA, in Baytown, Texas, a subcontractor to Precision Mechanical Inc. in Cocoa, Florida. It is about 56 feet long, with a 14-foot diameter. Photo credit: NASA/Kim Shiflett

I Will **LAUNCH AMERICA**

Restoring America's Human Launch Capability

Juan Calero

Integrated Performance Office
Integration Lead,
NASA's Commercial Crew Program



I Will Launch America: Juan Calero

BY DUSTIN W. CAMMACK

Juan Calero had great interest in aerospace from an early age. That interest was initially sparked by his father, who worked in the airline industry, and the many flights his father took him on all over the world.

"I loved the trips, but really didn't care about where we went," said Calero. "I was more interested in the different planes and analyzing them."

It's that level of enthusiasm that drives Calero in his current role as integration lead for NASA's Integrated Performance Office at Kennedy Space Center.

His early passion was to become a pilot, but Calero took on electrical engineering instead. While he remembers visiting Kennedy as a kid, he never envisioned working for the space agency. That all changed when NASA held open interviews at his alma mater, the University of Miami in Coral Gables, in 1990.

"I told them I would love to work for NASA and do something that I could put my hands on," said Calero. "I was hired to work in the Spacelab Program in an area called 'Level IV.'"

With that group, Calero wrote test procedures for flight payload experiments, worked closely with technicians on test equipment, and worked side-by-side with U.S. and International developers of the payloads that flew on Spacelab missions.

Calero's storied career spans 25 years and many NASA programs. In 2011, he was presented an opportunity he could not pass up.

"I remember attending a meeting where the manager of NASA's emerging Commercial Crew Program told us about the new venture," said Calero. "I knew I had to be on the cusp of that program."

It was commercial crew's connection to his love for airplanes that spurred Calero's interest. The program's approach is similar to the start of the commercial aviation industry.

"Commercial Crew is analogous to when the airlines first started putting people on planes while delivering mail. I believe that's where we are now," said Calero. "I can tell my kids that I was one of the first individuals to work in commercial crew before we started having commercial passengers on board spaceships going to low-Earth orbit. That's a big legacy that excites me."

Calero and the CCP Integrated Performance team he supports focus on the analysis and performance of the integrated spacecraft and launch vehicles.

"My group focuses on the performance of the integrated launch vehicles and spacecraft that Boeing and SpaceX are developing,"

said Calero. "Everything from the trajectory of the vehicle, to the integrated loads, to the propulsion system plume effects is analyzed before we fly. When people talk about rocket science, integrated performance is rocket science and these are real rocket scientists doing the analysis."

That analysis starts with computer models that determine the limits the vehicles can withstand. The models then are validated through test flights to ensure the performance matches those simulated models.

"This is what we will do with the next test flights and abort tests, which is important because we are able to compare the flight data to the computer models," said Calero. "This is how we feel comfortable with the design of that integrated rocket."

Both partners will conduct their tests separately, but will work closely with NASA to ensure they satisfy the CCP certification requirements. Once completed, the vehicles will be certified human-rated vehicles and will fly post-certification missions to the space station with crew.

Testing doesn't stop once the initial analysis is complete. The models are verified regularly, incorporating data from tests and missions.

"The previous pad abort test SpaceX conducted provided very useful data," said Calero. "They installed sensors on their spacecraft to measure the forces the crew would experience during an abort. We checked the analyzed results against the actual data and, sure enough, they validated that many of the models utilized were correct."

Calero knows firsthand how simple interactions with young people can ignite their imagination and interest in the aerospace industry.

"On one of the flights I was on with my father, I got to sit next to a pilot. I couldn't stop asking questions about how to become a pilot. I was completely blown away," said Calero. "It sparked something in me to pursue an education in science and math and led me to the career I have today. That pilot probably doesn't remember having that conversation and causing that spark, but I certainly do."

Calero also understands getting the public excited as a whole is key to keeping the agency at the vanguard of space exploration.

"When we have astronauts and industry leaders travel the country meeting kids, who knows when one of them will spark their imaginations," said Calero. "These kids could very well be the next astronauts leading the journey to Mars or the engineers and rocket scientists leading the future space programs here at Kennedy."

2016 HARRY KOLCUM NEWS & COMMUNICATIONS AWARD WINNERS



Mike Curie, Greg Pallone honored for excellence in telling the space story

Longtime NASA spokesman and launch commentator Mike Curie, and Greg Pallone, veteran Brevard County correspondent for News 13, were selected by the National Space Club Florida Committee (NSCFL) for the 2016 Harry Kolcum News & Communications Award.

They were honored Nov. 8 during the NSCFL's monthly luncheon, held in the pavilion at the Radisson at the Port Convention Center in Cape Canaveral, Florida.

"Each year we recognize area representatives of the news media and other communications professionals for excellence in telling the space story along Florida's Space Coast, and throughout the world. Mike and Greg have distinguished careers worthy of this recognition," said Kevin Brown, NSCFL chairman.

The award is named in honor of Harry Kolcum, the former managing editor of *Aviation Week & Space Technology*, who was Cape bureau chief from 1980 to 1993, prior to his death in 1994. Kolcum was a founding member of the NSCFL.

Curie is a NASA Public Affairs Officer at Kennedy Space Center. His is one of the voices frequently heard describing launch

countdowns for NASA missions originating from the Space Coast. His space career began in 1985, with stints at Johnson Space Center and NASA Headquarters before becoming Kennedy's news chief in 2012.

Pallone is Brevard County Bureau Chief for News 13 on Florida's Space Coast and since 2007 has been a fixture covering all launches and the space program in general for Central Florida. Before moving to Florida he worked in Savannah and Albany, Georgia; Huntsville, Alabama; and Atlanta.

Nominees must be a current or past professional member of the news media who regularly cover launch and space operations in Florida; or a communications-related professional representing corporate, government or military entities involved with launch or mission operations in Florida.

Nominees must have excelled at facilitating and/or communicating the space story to the general public in a consistent manner deserving of recognition, and their principal work location was in Florida.



A heavy load transport truck from Tillett Heavy Hauling in Titusville, Florida, arrives at the Vehicle Assembly Building (VAB) at Kennedy Space Center, carrying the first half of the A-level work platforms, A north, for the agency's Space Launch System (SLS) rocket. The A-level platforms are the topmost platforms for High Bay 3 in the Vehicle Assembly Building (VAB). The platform will be delivered to the VAB staging area in the west parking lot. The Ground Systems Development and Operations Program is overseeing upgrades and modifications to High Bay 3 to support processing of the SLS and Orion spacecraft. A total of 10 levels of new platforms, 20 platform halves altogether, will surround the SLS rocket and Orion spacecraft and provide access for testing and processing. Photo credit: NASA/Ben Smegelsky

ON SITE

DART team on target after

By Anna Heiney Hurricane Matthew

While residents of Florida's east coast listened to the wind and rain as Hurricane Matthew churned past on the morning of Friday, Oct. 7, NASA's Bob Holl was on the phone.

The storm had just made its closest approach to Kennedy Space Center and was slowly easing away as Holl, chief of the center's Damage Assessment and Recovery Team (DART), dialed in from home to tie into a 9 a.m. call with about 50 of the center's senior leaders and other team members to talk about how the center was faring.

The job of the DART team is to identify and triage any damage or other safety issues following an emergency, with the goal of returning the center to normal operations.

But "normal" is a relative term following an event such as a hurricane, Holl pointed out.

"Return to normal" means there is a reasonable expectation of safety," he said. "It also means if people encounter any problems or unsafe conditions, everyone knows how to report it."

The team had watched closely as Hurricane Matthew drew closer to Florida. Each morning, forecasters with the U.S. Air Force's 45th Weather Squadron provided a briefing on the predicted conditions for that day and the rest of the week, including storm models and probabilities.

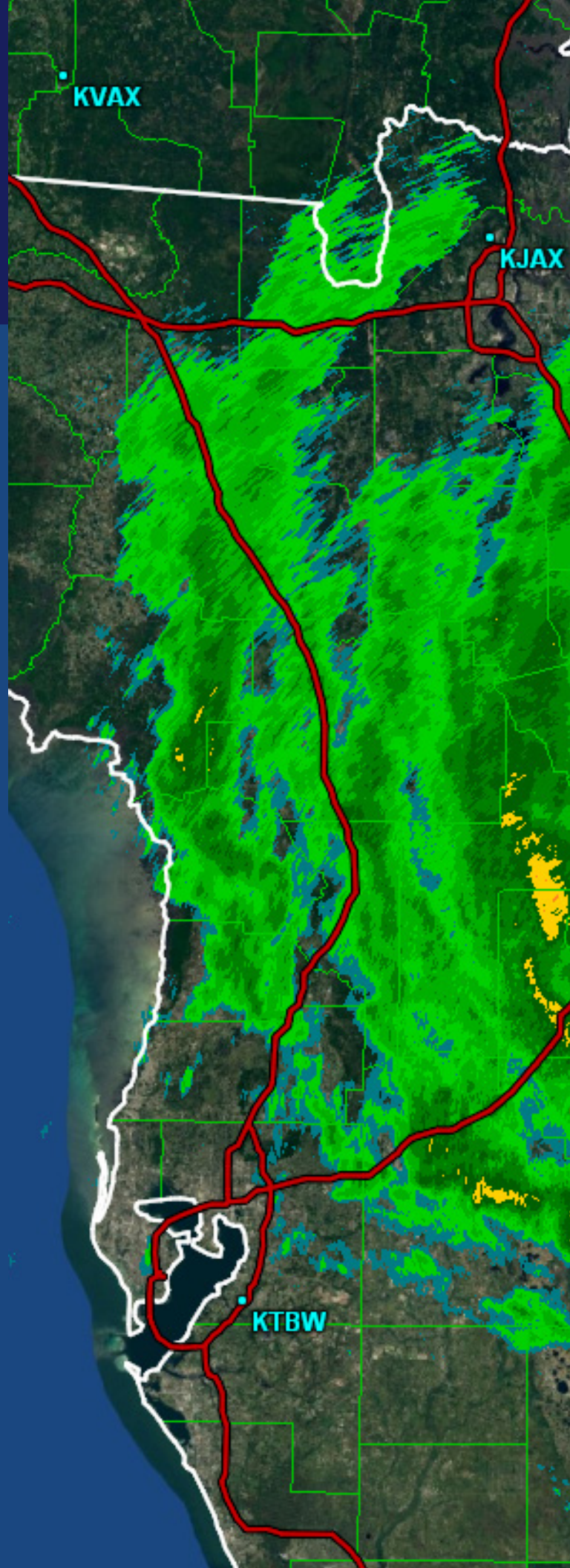
Earlier forecasts predicted Matthew would come close to the Space Coast, but turn north in time to keep most of the storm's effects offshore, passing by on Monday or Tuesday of that week.

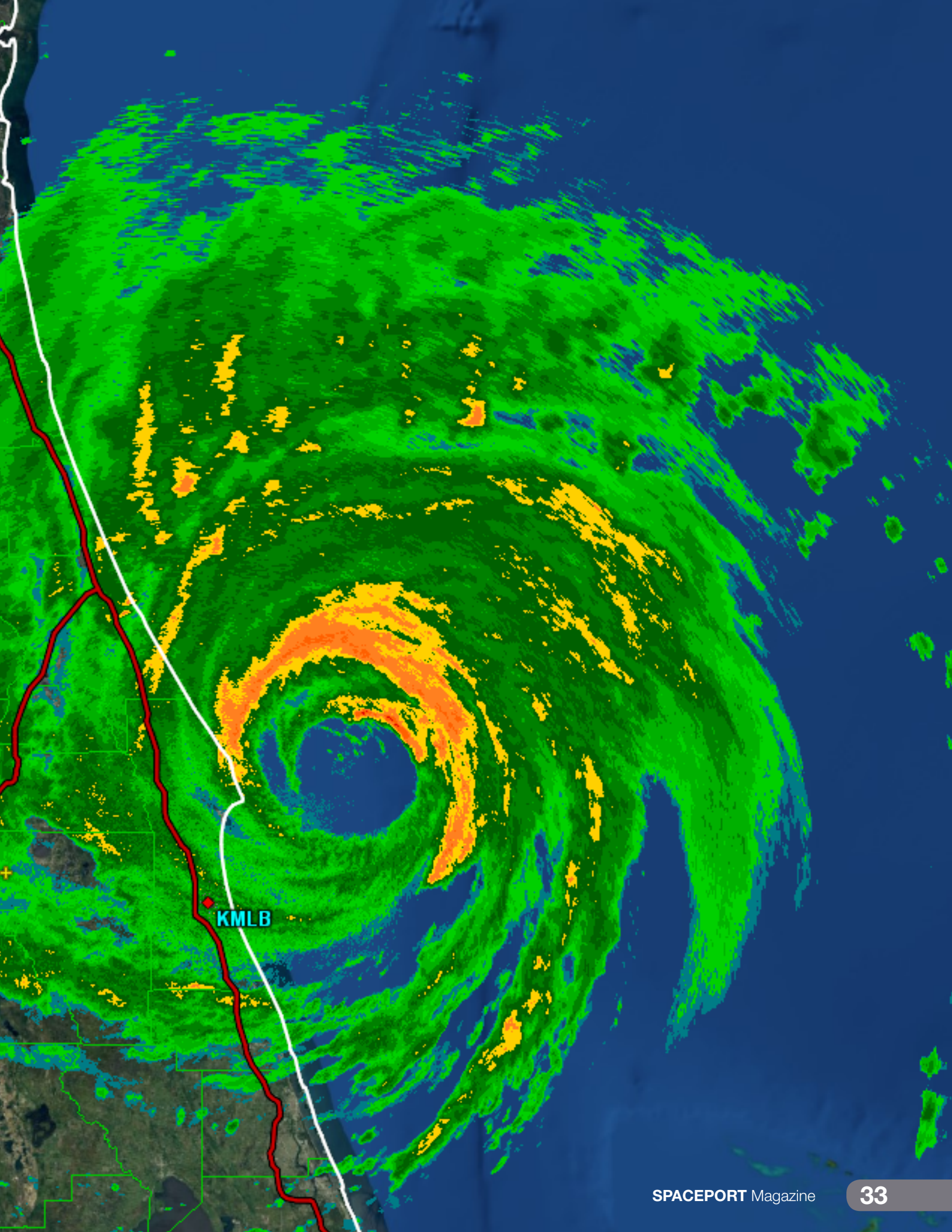
"But every day, it got a little slower," Holl said. "Every day, it didn't make that turn, and it started really looking like it was going to come into and through Florida."

Eventually, county officials closed the causeways leading to the barrier islands of Merritt Island, where Kennedy is located, and the beaches to the east. Kennedy closed Wednesday, Oct. 5, at 1 p.m., and a small team of 139 specialists, known as the Ride-out Team, stayed on center through the storm.

Just as Matthew approached the coast, the storm was downgraded from a Category 4 to a Category 3 storm. The hurricane's eye passed just 20 to 25 miles east of Cape Canaveral Air Force Station, with Kennedy's Launch Pad 39B near the western eyewall experiencing peak gusts of 107 mile-per-hour winds.

The DART comprises several smaller, coordinator-led teams that focus on specialized areas or operations. Participation in the DART





KMLB

is over and above team members' regular day jobs; the team's leadership meets a few times a year to ensure they're familiar with processes and expectations.

Many DART members, including Holl and his team assistant, Greg Gaddis, worked for many years in the Space Shuttle Program, which had its own DART operation that oversaw preparation and recovery efforts for the Launch Complex 39 area at the north end of the space center. In the 2004 storm season alone, the team had to deal with a seeming parade of hurricanes -- including Charley, Frances, Jeanne and Ivan -- that either threatened or impacted the center. Frances removed some panels from the walls of the massive Vehicle Assembly Building, while another facility suffered significant water intrusion.

"I come from a program where you practice," Holl said. "The phrase is, 'You don't rise to the level of your hope — you fall to the level of your training.'"

Although the DART team deals primarily with hurricanes, its scope is wider-ranging.

"During a storm about a year ago, a microburst came through and did a bunch of damage. It blew some of the pea gravel off the roof of the Headquarters building and broke a few windows," Holl recalled.

"So they activated the DART, the repairs were done and after a few hours we determined everything could return to normal."

Other events that have closed the portions of the center in recent years included a water line break that caused a loss of potable water pressure across the north end of the center, and shifting weather that carried heavy smoke from a prescribed burn to facilities in the spaceport's Industrial Area. In both cases, buildings in those areas were temporarily closed and employees sent home or to other locations until conditions were safe for regular operations.

The team's collective experience, training and prep work came together in October during the center's brush with Matthew — which, thankfully, struck with less intensity than some forecasts had predicted.

Many facilities had roof damage, broken windows or lost power. Portable chillers mounted on trailers were brought in to provide cooling and ventilation to buildings that had lost air conditioning, including the Launch Control Center. Almost every spotlight on the center had blown over and broken, Holl said, and water intrusion also was a common problem.

Kennedy Space Center reopened at 6 a.m. Oct. 11. By the end of that week, the DART team had handed over the ongoing repair and recovery work to the managers of affected facilities and organizations.

But they are ready for next time — whenever that may be.

"This was the strongest storm we've seen here in nearly 40 years," Holl said of Matthew.

"We were hopeful that Kennedy would be spared. But we knew we were ready for whatever the storm could throw at us."





Members of the Disaster Assessment and Recovery Team (DART) repair a section of roof atop the Operations Support Building II at Kennedy Space Center. The effort is part of the spaceport's ongoing recovery from Hurricane Matthew, which passed to the east of Kennedy on Oct. 6 and 7, 2016. The center received some isolated roof damage, damaged support buildings, a few downed power lines, and limited water intrusion. Beach erosion also occurred, although the storm surge was less than expected.
Photo credit: NASA/Kim Shiflett

GROWING CHAMBER

Advanced Plant Habitat test unit arrives

BY LINDA HERRIDGE

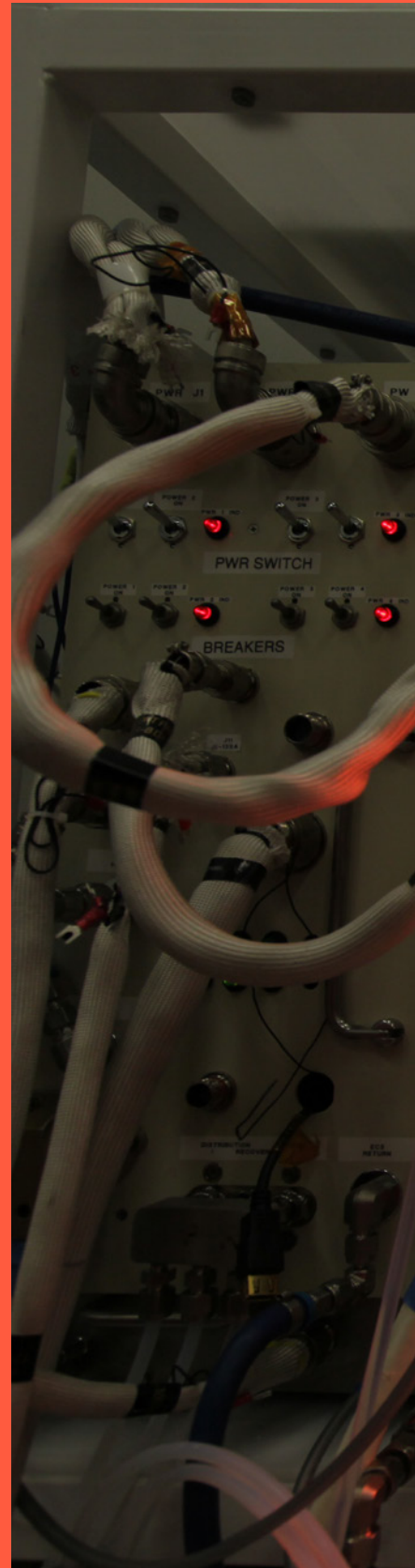
A high fidelity test version of NASA's Advanced Plant Habitat (APH), the largest plant chamber built for the agency, arrived at Kennedy Space Center on Nov. 17. The engineering development unit arrived by truck, was offloaded and transported to a laboratory at the Space Station Processing Facility.

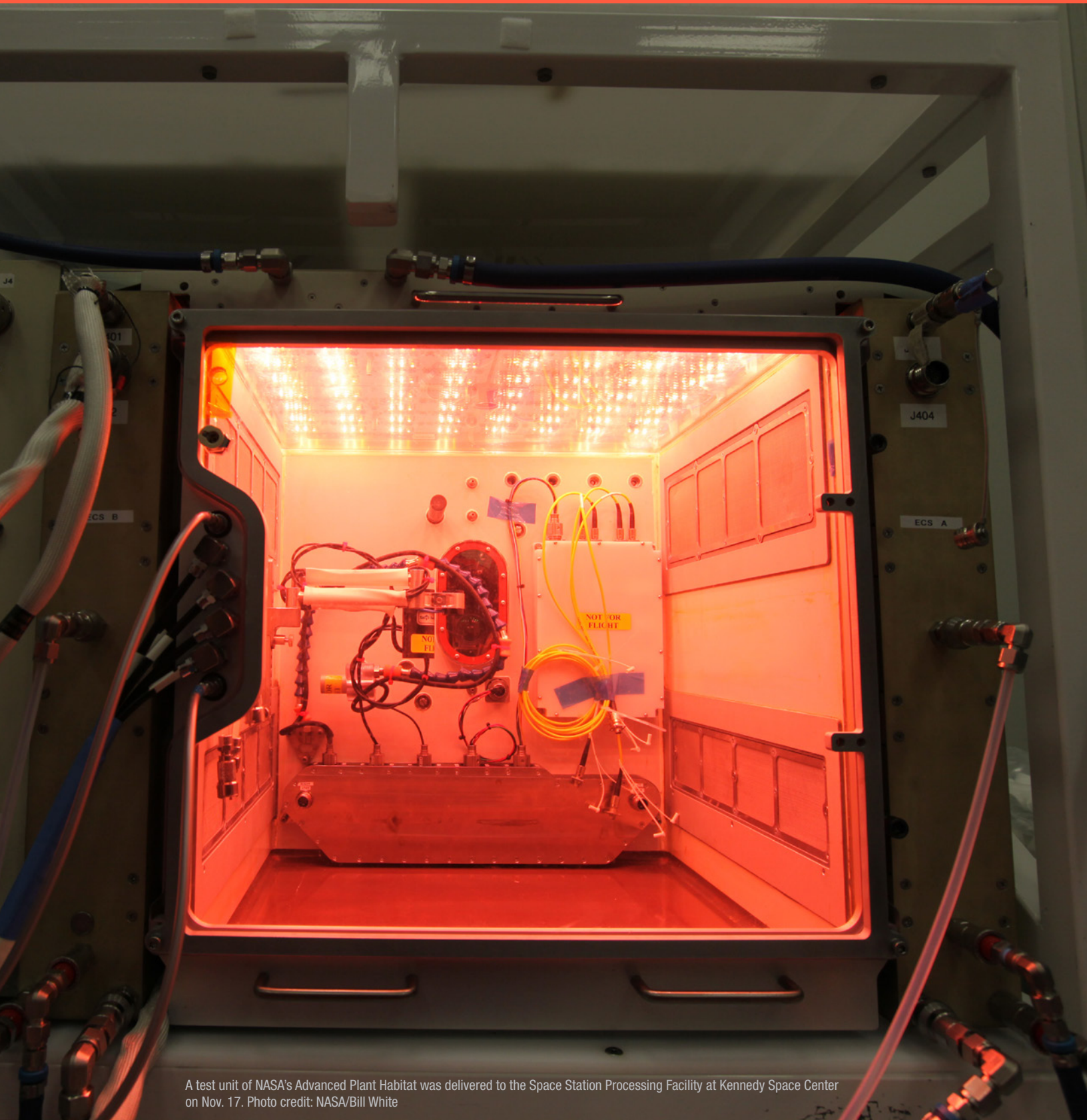
Inside the lab, NASA engineers, and scientists and technicians on the Engineering Services Contract will train with the test unit to learn how to handle and assemble it before the actual APH unit arrives early next year. They also will test how the science integrates with the various systems of the plant habitat.

NASA Kennedy engineers designed parts of the APH, but also fabricated the flight growth chamber, with the remaining subsystems designed and built by ORBITEC in Madison, Wisconsin. The unit is a closed-loop system with a controlled environment than can house large plants. The system will use red, green and blue LED lights, similar to the Veggie growth system that currently is on the International Space Station. The APH also has the capability of using white LEDs and infrared light. The APH will have about 180 sensors and four times the light output of Veggie.

Kennedy scientists developed the science carrier that will be inserted in the APH for plant growth experiments on the space station and the control experiments on the ground. Payload integration engineers with Jacobs, on the Test and Operations Support Contract, will help integrate the science, or seeds, into the APH. Jacobs research scientists also are providing lab space and support for the APH.

The small-scale experiment, called Plant Habitat 1 or PH01, will contain Arabidopsis seeds, small flowering plants related to cabbage and mustard. PH01 and the APH unit will be delivered to the space station in 2017.





A test unit of NASA's Advanced Plant Habitat was delivered to the Space Station Processing Facility at Kennedy Space Center on Nov. 17. Photo credit: NASA/Bill White

EPSCoR

NASA-supported research boosts future spaceflight programs

BY BOB GRANATH

A leak detector soon to be tested aboard the International Space Station was designed by university scientists and could play a crucial role in NASA's Journey to Mars. The device was developed under the auspices of an agency program based at the Kennedy Space Center in Florida.

NASA's Experimental Program to Stimulate Competitive Research, or EPSCoR, is a congressionally-directed effort managed for the agency at Kennedy. Several experiments developed at EPSCoR-funded universities are being built for flights to the space station, as well as experiments on deep space probes.


According to Donald James, associate administrator for NASA's Office of Education, EPSCoR's impact is long-term and far-reaching.

"By helping establish the state-of-art infrastructure needed to conduct the cutting-edge research it funds," he said. "EPSCoR is improving the science and research capabilities at universities while also stimulating partnerships between government, higher education and industry."

The extensive reach of the program goes across the United States and its territories.

"We have established partnerships with colleges in 28 states as well as Puerto Rico, the U.S. Virgin Islands and Guam," said Jeppie Compton, NASA's national project manager for EPSCoR. "We provide seed funding to educational research institutions to develop projects directed toward self-sustaining, nationally competitive capabilities in aerospace and aerospace-related research."

EPSCoR's project coordinator Crystal Bassett, who works for Wichita Tribal Enterprises, explained that there are three primary components for EPSCoR funding.



“EPSCoR is improving the science and research capabilities at universities while also stimulating partnerships between government, higher education and industry.”

Donald James
Associate Administrator for NASA's Office of Education

Orbital ATK's Cygnus cargo spacecraft is captured using the Canadarm 2 robotic arm on the International Space Station on Oct. 23, 2016. The University of Nebraska's Detector for the Analysis of Solar Neutrons, or DANSON, experiment was among more than 5,100 pounds of cargo and research equipment packed aboard the spacecraft. Photo credit: NASA



“Research Infrastructure Development awards of \$125,000 per year are available for a three year base period of performance,” she said. “Research Awards are for up to \$750,000 for three-years with proposals involving high-priority NASA basic research and technology development. The third is EPSCoR International Space Station Flight Opportunity Awards of up to \$100,000 for a three-year performance period are also available.”

Compton and Bassett noted that there are currently about 130 projects in various stages of development and some have already been flown to the ISS. Compton’s office wall is covered with an extensive chart listing the status of these efforts.

The leak detector was developed at the University of Maine’s Orono campus and soon will be at work aboard the space station.

“The system prototype is to be launched to the ISS possibly in early 2017,” Bassett said.

A wireless leak detection system would make future missions safer for astronauts by quickly alerting crew members if there is a leak and pinpointing its location.

Co-science principal investigators are Dr. Ali Abedi, professor of electrical and computer engineering and Dr. Vince Caccese, professor of mechanical engineering. Both work at the University of Maine-Orono. According to a report by the two scientists, leaks causing air and heat loss are a major safety concern aboard any spacecraft.

“The prototype, developed at the Wireless Sensing Laboratory on Maine’s Orono campus, has six flight-ready wireless sensors that can quickly and accurately hone in on a leak,” the report said. “First, it detects the frequency generated by the air as it escapes into space, then triangulates its location with a series of algorithms.”

The leak detector was successfully tested during April 2016 at

NASA’s Johnson Space Center in Houston by University of Maine electrical engineering graduate students Casey Clark and Lonnie Labonte. It is scheduled to launch with other ISS supplies on the SpaceX CRS-10 mission.

Another EPSCoR sensor already is at work aboard the space station. It is designed to detect radiation damage and materials fatigue and has the potential to produce electrical power for deep space missions.

Called the Detector for the Analysis of Solar Neutrons, or DANSON, it was developed at the University of Nebraska.

Solar neutrons are energetic subatomic particles emitted by the sun.

Science principal investigator Dr. Axel Enders, professor of physics and astronomy at the University of Nebraska at Lincoln, developed this experiment. His goal is to test neutron radiation-absorbing materials in space to determine the effects or damage to materials when these particles are absorbed.

The DANSON experiment was launched as part of the Orbital ATK CRS-5 mission to the station. A Cygnus spacecraft lifted off from NASA’s Wallops Flight Facility in Virginia atop an Antares rocket on Oct. 17, 2016.

Spacecraft traveling to deep space are too far from the sun for solar power to be effective. Such probes now are powered by thermo-nuclear reactors fueled by plutonium. This approach tends to be inefficient and requires extensive shielding to protect spacecraft systems.

Enders explained that scientists have investigated designs for new semiconducting materials that can be used to build a neutron voltaic device. This alternative would employ a neutron based photovoltaic device that has the potential to supply the energy needed to power deep space probes.

“Such a device could generate electricity similar to a solar cell, but from neutrons instead of photons, to power NASA’s future deep space probes,” he wrote in a recent report.

Bassett explained that other research will support efforts to explore an asteroid and NASA’s Journey to Mars.

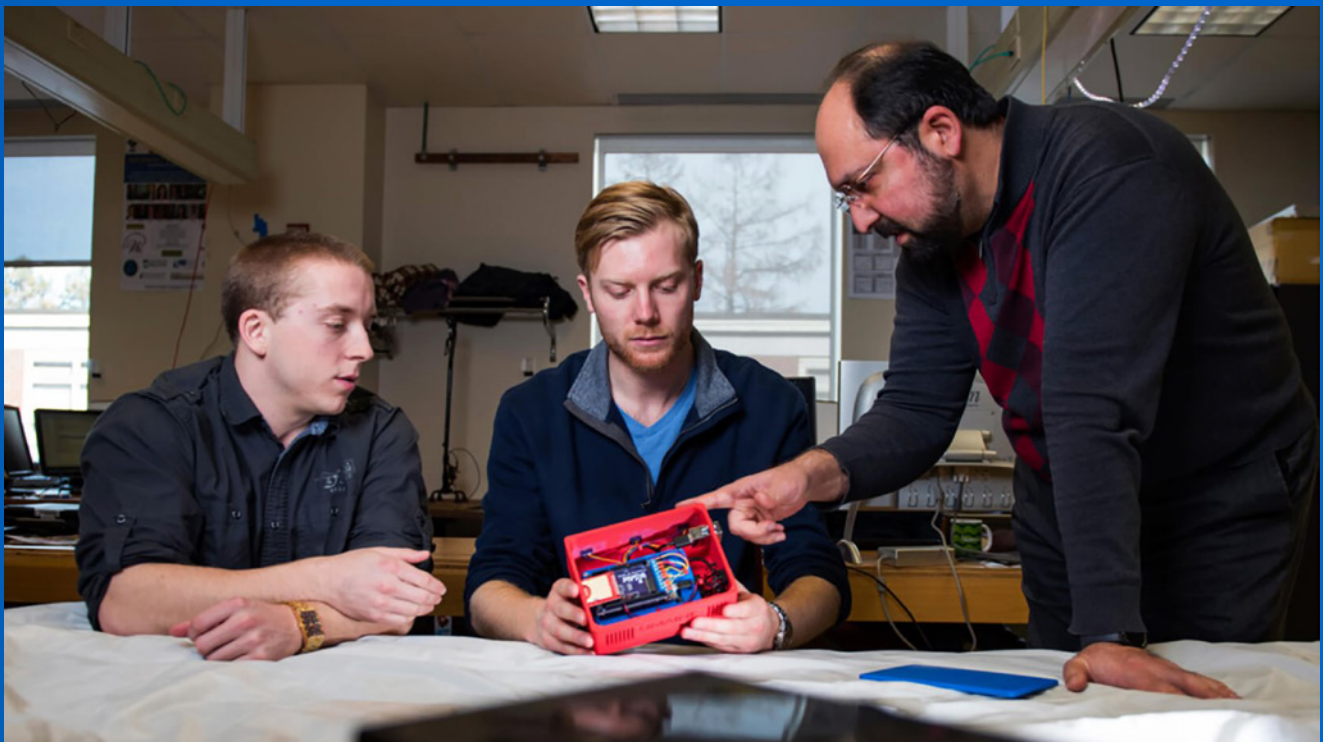
“Scientists at the University of Delaware are studying spacesuit material that would self-heal if struck by a micrometeorite,” she said. “Researchers at the University of North Dakota are developing concepts for a Martian habitat.”

Compton pointed out that the types of studies going on at universities cover many areas of NASA research and planning for future missions.

“The research is aligned with NASA’s mission directorates,” he said. “To receive EPSCoR funding, we have to find that a project adds value and supports the mission directorate goals. The value now is showing up in technology transfer and spinoffs that not only benefit missions in space, but life here on Earth.”



A sensor designed to detect radiation damage and materials fatigue now is at work aboard the International Space Station. The Detector for the Analysis of Solar Neutrons, or DANSON, was developed at the University of Nebraska. It was installed by NASA astronaut Shane Kimbrough shortly after its arrival aboard the Cygnus spacecraft. Such a device could generate electricity similar to a solar cell, but from neutrons instead of photons, to power NASA's future deep space probes. Photo credit: NASA



A leak detector soon to be tested aboard the International Space Station was developed by scientists and students at the University of Maine's Orono campus. From the left are doctoral student Lonnie Labonte, Casey Clark, who is working on a master's degree in electrical engineering, and the experiment's principal investigator Ali Abedi, a professor of electrical and computer engineering. Photo credit: University of Maine



America Recycles Day

Kennedy employees donate to community on America Recycles Day

Employees at Kennedy Space Center brought a wide variety of household items to work Nov. 15 and Nov. 16, in conjunction with America Recycles Day.

America Recycles Day is a nationally recognized initiative dedicated to promoting recycling in the United States. Kennedy partnered with several organizations in order to donate as many of the items as possible to those who could use them the most in the Space Coast community. These included Goodwill Industries, Bridges BTC Inc., Cellphones for Soldiers, the Lions Club and the Ronald McDonald House.

Space center personnel were invited to bring electronic waste, from cell phones to computers; new or gently used household items such as sporting goods, home decor and kitchen items; shoes, clothing and eyeglasses; and many more. Kennedy's Sustainability team sponsored the event.

In total, spaceport employees made about 345 drop-offs. Televisions and cell phones were especially common.

"It turned out to be a great event," said Jeanne Ryba, NASA Sustainability specialist. "Employees appreciated the convenience of dropping off their unwanted items and knowing they would be used again by someone in the community, or disposed of in an Earth-friendly way."

"Employees appreciated the convenience of dropping off their unwanted items and knowing they would be used again by someone in the community, or disposed of in an Earth-friendly way."

Jeanne Ryba
NASA Sustainability Specialist



Computers, monitors, vacuum cleaners and other electronics are donated by employees at Kennedy Space Center in conjunction with America Recycles Day.
Photo Credit: Kim Shiflett



Our Refuge

**NASA'S KENNEDY SPACE CENTER
NATIONAL WILDLIFE REFUGE**

1. How many alligators are on KSC?

Lots. That is as specific an answer as there is. Many of the areas that alligators use are inaccessible, they spend much of their time under the water, and they move from one habitat type to another frequently. All of those factors make them very difficult to count.

2. How big do the alligators get on KSC?

The biggest alligator that has been measured by the KSC Ecological Program is just over 12 feet. Alligators this large are rare.

3. What do alligators eat?

They are generally carnivorous. Crabs, fish, turtles, birds and small mammals are all part of their natural diet. They are known to eat some plants and berries when they are ill. Alligators are also opportunistic and will gladly eat “junk food” when it is offered to them. Alligators actually don't eat much; a 100 pound dog will eat more in one year than an 800 pound alligator!



A Little Egret wades in a waterway in an area called Wilson's Corner in the Merritt Island National Wildlife Refuge (MINWR) near Kennedy Space Center. An alligator swims nearby. Photo credit: NASA/Glen Benson

4. When is alligator nesting season?

The breeding season starts in May when male alligators begin courting females. By June, pairs have mated and females build vegetation nests in the marsh. Eggs hatch in about 65 days. The mother carries her young to the water and protects them from predators, including male alligators.

5. What is the difference between alligators and crocodiles?

Alligators have more rounded snouts and crocodiles' snouts are long, skinny, and pointed. Crocodiles' bottom teeth stick out over their upper lip when the mouth is closed, giving them a “toothy” grin. Alligators' teeth are enclosed in the mouth when it is shut. There are no crocodiles residing on KSC because they only occur in the more tropical climates of south Florida.

6. Are alligators legally protected?

They are protected under the Endangered Species Act as Threatened because of their resemblance to the American crocodile, which is endangered. Alligators are legally hunted in several states, including Florida, within a specific hunting season in designated areas, and hunting requires a permit.



An alligator lies near a waterway at Kennedy Space Center. Photo credit: NASA/Bill White



An alligator hisses in a field at Kennedy Space Center. Photo credit: NASA

7. Why is it illegal to feed alligators?

Alligators are reptiles and work on instinct, not intelligence. When they are fed by a person, they lose their natural fear of humans and start to associate people with food. They may eventually become aggressive, and there is no way to “unteach” this behavior. When this happens and it is reported to wildlife officials, the alligator is labeled a “nuisance animal,” and it is trapped and killed.

8. What should I do if I see an alligator near my home or job site?

If the alligator does not approach people and is minding its own business, just leave it alone and enjoy the experience from a safe distance. If an alligator approaches you or it poses a threat to people, on KSC call 321-861-5050 (Duty Office) or off KSC call 866-392-4286 (866-FWC-GATOR).



A baby alligator instinctively moves toward nearby freshwater. Photo credit: NASA/Amber Watson

9. Are alligators ecologically valuable?

Yes. They are important top predators that help keep populations of smaller animals under control. They also create habitat for other wildlife in the marsh by digging holes that hold water during the dry season. Because alligators are top predators, they can live more than 60 years, and bioaccumulate environmental contaminants. Alligators are used as an indicator species to monitor environmental health.

10. What are the present-day challenges to alligators?

As the human population expands, alligators become increasingly crowded into freshwater habitats, including golf course lakes, roadside ditches and retention ponds. Conflicts with humans become more frequent, and the alligators are exposed to decreased water quality. Also, alligators (and many other reptiles) have temperature-dependent sex determination. This means that the sex of the hatchlings is determined by the incubation temperature of the eggs. Warmer temperatures associated with climate change could potentially have a dramatic impact on sex ratios and, ultimately, alligator populations.

HEROES AND LEGENDS

Attraction honors pioneers of spaceflight

BY BOB GRANATH

“Liftoff of Discovery with a crew of six astronaut heroes and one American legend,” said launch commentator Lisa Malone of NASA Public Affairs as the space shuttle mission STS-95 flew into orbit on Oct. 29, 1998. While it was a flight in the late 1990s, it was reminiscent of NASA’s storied past. An international crew lifted off with John Glenn, a member of the Mercury program’s Original Seven astronauts.

In ceremonies on Nov. 11, 2016, Kennedy Space Center Visitor Complex in Florida opened its doors to the Heroes and Legends attraction that includes the new home of the U.S. Astronaut Hall of Fame. In addition to displays honoring the 93 Americans currently enshrined in the hall, the facility looks back to the pioneering efforts of Mercury, Gemini and Apollo. It provides the background and context for space exploration and the legendary men and women who pioneered the nation’s journey into space.

Kennedy Space Center Director Bob Cabana, a former space shuttle astronaut and member of the Astronaut Hall of Fame, noted that the new attraction will encourage a future generation of space explorers.

“I hope that all of you, when you get to see Heroes and Legends, you’re inspired,” he said. “The children today can see that there is so much more they can reach for if they apply themselves and do well.”

The visitor complex is operated by Delaware North Companies Parks and Resorts. According to Therrin Protze, the company’s chief operating officer of the Kennedy Space Center Visitor Complex, the Heroes and Legends attraction is just inside the entrance to set the stage as guests arrive.

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ASTRON
Presented



The Heroes and Legends exhibit at Kennedy Space Center Visitor Complex opened on Nov. 11. The attraction is just inside the entrance to set the stage as guests arrive. Photo credit: NASA/Glenn Benson

UNITED STATES ASTRONAUT HALL OF FAME



THE FIRSTMAN JARVIS

The Firstman Jarvis is a composite sculpture representing the first American astronaut dedicated to the space program, but which was not until the late 1950s that the United States had a dedicated astronaut. The Firstman Jarvis is the first American astronaut to be dedicated to the space program. The Firstman Jarvis is the first American astronaut to be dedicated to the space program. The Firstman Jarvis is the first American astronaut to be dedicated to the space program.

The Spirit of Space Alan B. Shepard Jr. First American in Space

ALAN B. SHEPARD JR.

On May 14, 1961, Alan B. Shepard Jr. became the first American to travel into space. He was launched on a 15-minute flight aboard the Freedom 7 spacecraft. Shepard's flight was a significant milestone in the history of the United States space program. Shepard's flight was a significant milestone in the history of the United States space program. Shepard's flight was a significant milestone in the history of the United States space program.

A statue of astronaut Alan Shepard is housed in a rotunda and connects visitors to each of the astronaut inductees through state-of-the-art interactive technology. Photo credit: NASA/Glenn Benson



A statue of astronaut Alan Shepard, America's first person in space, stands just inside the doors to the U.S. Astronaut Hall of Fame. Photo credit: NASA/Glenn Benson

“We’re focusing on a story to create what we consider a ‘launch pad’ for our visitors,” he said. “This is an opportunity to learn about the amazing attributes of our heroes behind the historical events that have shaped the way we look at space, the world and the future.

“We are grateful to NASA for allowing us to tell the NASA story to millions of guests from all over the world,” Protze said.

Cabana offered appreciation to those who made possible the new attraction, Heroes and Legends presented by Boeing.

“I want to personally thank Therrin Protze and Delaware North, as well as The Boeing Company,” Cabana said. “Both of these companies made this possible.”

Falcon’s Treehouse, an Orlando-based design firm, began construction on the 37,000-square-foot Heroes and Legends facility in the fall of 2015.

A sweeping ramp entrance is designed to simulate the journey to space. Once inside, a seven-minute presentation on the historic beginning of the space race acknowledges that the Cold War rivalry between the United States and the Soviet Union was the impetus for America’s push to the stars in NASA’s early years.

Since Alan Shepard became the first American in space in 1961, astronauts have been to the moon, deployed the Hubble Space Telescope, built the International Space Station and now are preparing for the Journey to Mars.

The Astronaut Hall of Fame exhibit is housed in a rotunda. It intimately connects visitors to each of the astronaut inductees through state-of-the-art interactive technology. A 365-degree video cylinder with five interactive kiosk stations provide access to stories about each of the Hall of Fame astronauts.

One element of the experience will provide guests an opportunity to capture a memento of their visit: a photo opportunity to pose with some of the featured heroes and legends.

The concept for a U.S. Astronaut Hall of Fame began in the 1980s with the six surviving Original Seven Mercury astronauts. Along with Gus Grissom’s widow, Betty Grissom, they envisioned a place where space travelers could be remembered — much like sports figures or rock ‘n roll stars. The hall of fame opened with induction of Mercury astronauts in May 1990. At the time, the facility was located in



Former space shuttle astronaut Dan Brandenstein, (speaking), chairman of the Astronaut Scholarship Foundation board of directors, said that those who developed the original hall of fame ideas would be proud. Seated, from the left, are Rick Abramson, executive vice president and chief operating officer of Delaware North, Kennedy Space Center Director Bob Cabana and John Elbon, vice president and general manager of Boeing. Photo credit: NASA/Kevin O'Connell

Titusville, Florida, just outside the Kennedy Space Center.

During a news conference at the opening of the original facility, Mercury astronaut Deke Slayton looked to the future.

"I like the fact that it will be a growing Hall of Fame," he said.

"It won't be stagnant, confined just to the Original Seven astronauts. We want to have other astronauts honored and other names will be added."

Grow it did. Gemini astronauts were added in March 1993 and Apollo era crews, including Skylab and Apollo-Soyuz, were inducted in October 1997. In the years to follow, astronauts have been welcomed from the space shuttle and space station eras.

Former space shuttle astronaut Dan Brandenstein, who is chairman of the Astronaut Scholarship Foundation board of directors, stated that those who developed the original hall of fame idea would be proud.

"I'm certain the new Heroes and Legends featuring the U.S. Astronaut Hall of Fame far surpasses anything they would have imagined," he said.

When the original Astronaut Hall of Fame opened, Shepard noted that it included personal items from those who flew in space.

"We hope it will encourage youngsters to follow in our footsteps," he said.



Kennedy Space Center Director Bob Cabana, a former space shuttle astronaut and member of the Astronaut Hall of Fame, said the new attraction will encourage a future generation of space explorers. Photo credit: NASA/Kevin O'Connell

The new displays include even more memorabilia. The exhibit floor taps into holograms and interactive media to change the way visitors interact with astronaut memorabilia and space program artifacts.

Interactive features also include the original consoles of the Mercury Mission Control room with the world map that was used to follow the path of capsules between tracking stations. Also on display are the Sigma 7 Mercury spacecraft piloted by Wally Schirra during his six-orbit mission in October 1962 and the Gemini IX capsule flown by Tom Stafford and Gene Cernan for three days in June 1966.

“I don’t consider myself a hero like say, Charles Lindbergh. I just did what was proper and exciting — something for my country and my family. I guess I’m just a lucky guy.”

Jim Lovell
Gemini VII, Gemini XII, Apollo 8 and
Apollo 13 astronaut, and member of
the U.S. Astronaut Hall of Fame

A theater featuring a “four-dimensional,” multisensory experience allows guests to vicariously join four space-age NASA heroes on the most perilous stages of their adventures. Artistically choreographed with lighting and special effects, sound and surrounding images will create the sensation of being “in the moment” as guests overlook planet Earth.

A collection of nine exhibit modules describe the attributes of a hero – inspired, passionate, curious, tenacious, disciplined, courageous, principled and confident. These also help guests discover more about NASA’s astronauts as told through their own experiences.

For many astronauts, humility could be added to the list. Master of ceremonies and a former CNN space correspondent John Zarrella asked Gemini and Apollo astronaut Jim Lovell how it feels to be considered one of America’s heroes.

“I don’t consider myself a hero like say, Charles Lindbergh,” said Lovell, a member of the Astronaut Hall of Fame. “I just did what was proper and exciting -- something for my country and my family. I guess I’m just a lucky guy.”

Protze stated that he hopes visitors to the Kennedy Visitor Complex and the new attraction will leave excited about NASA’s efforts to explore.

“This new attraction will be a phenomenal introduction,” Protze said. “We are here to inspire minds through a memorable space experience.”



When asked by former CNN space correspondent John Zarrella how it feels to be considered one of America’s heroes, Gemini and Apollo astronaut Jim Lovell said he doesn’t consider himself a hero “I just did what was proper and exciting — something for my country and my family.” Photo credit: NASA/Kevin O'Connell



The six Expedition 50 crew members celebrate Thanksgiving in space Nov. 24, with rehydrated turkey, stuffing, potatoes and vegetables. Photo credit: NASA

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