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National Aeronautics and
Space Administration

Kennedy Space Center's

SPACEPORT MAGAZINE

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FRONT COVER: The CST-100 mock-up is displayed inside Orbiter Processing Facility 3 at Kennedy Space Center on June 9. The Boeing Company plans to use the facility as a manufacturing hub for the spacecraft. Photo credit: Kim Shiflett

BACK COVER: This artist rendering shows a wide-angle view of the liftoff of the 70-metric-ton (77-ton) crew vehicle configuration Space Launch System from the launch pad. The first flight test of NASA's new rocket is scheduled for 2017.

NASA'S LAUNCH SCHEDULE

Date: July 2 -- 2:56 a.m. PDT
Mission: Orbiting Carbon Observatory-2 (OCO-2)
Description: OCO-2 is an Earth satellite mission to study carbon dioxide in the atmosphere and provide scientists with a better idea of the chemical compound's impacts on climate change. It will launch on a Delta II 7320 rocket from Complex 2 at Vandenberg Air Force Base, California.

Date: No Earlier Than July 10 -- 2:02 p.m. EDT
Mission: Orbital 2 Commercial Resupply Services Mission to International Space Station
Description: Launching from the Mid-Atlantic Regional Spaceport at NASA's Wallops Flight Facility, Orbital 2 will deliver cargo and crew supplies to the International Space Station.

Date: July 23, 2014
Mission: Progress 56
Description: Launching on a Russian Soyuz from Baikonur Cosmodrome, Kazakhstan, Progress 56 will deliver cargo and crew supplies to the International Space Station.

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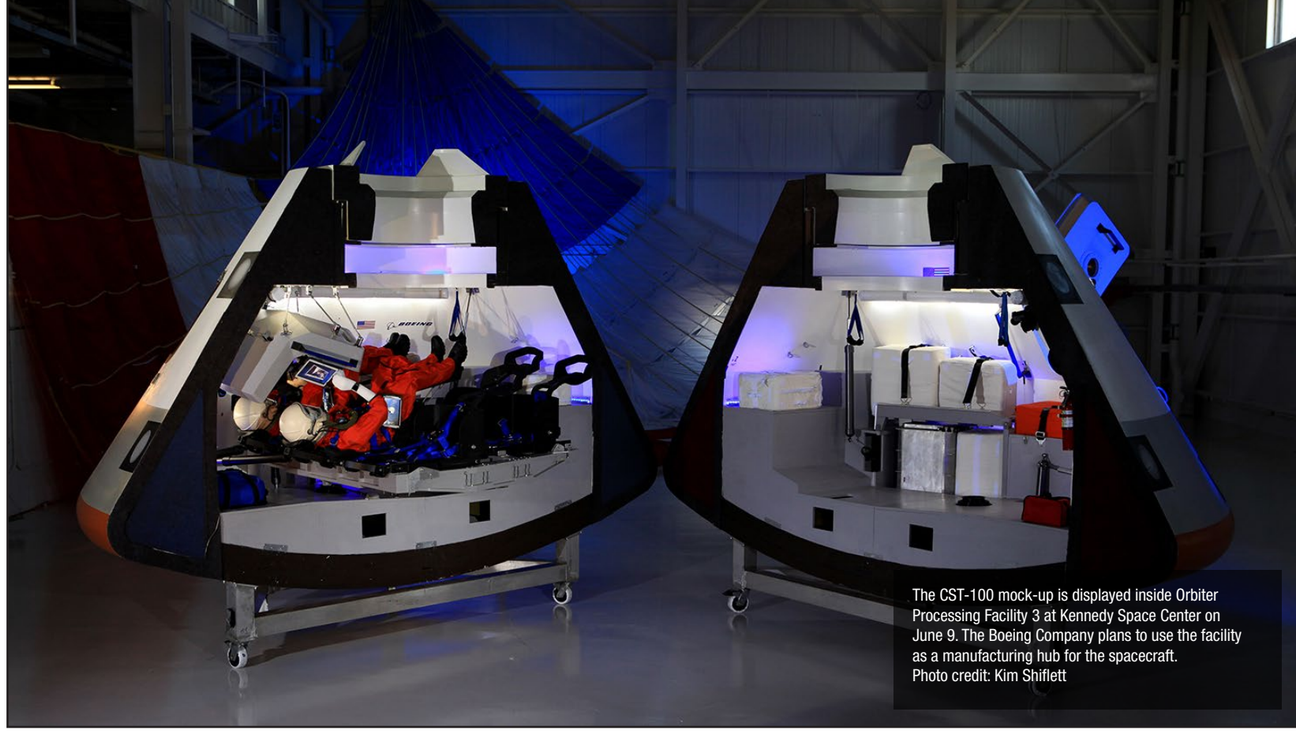


The CST-100 mock-up is displayed inside Orbiter Processing Facility 3 at Kennedy Space Center on June 9. The Boeing Company plans to use the facility as a manufacturing hub for the spacecraft. Photo credit: Kim Shiflett

NASA partner Boeing unveils CST-100 processing plans

BY STEVEN SICELOFF

Kennedy Space Center took another step along the path of transformation June 9 when The Boeing Company unveiled detailed plans to convert a shuttle processing facility into an assembly hub for the company's next generation of crewed spacecraft.

Speaking inside Orbiter Processing Facility 3 at Kennedy, U.S. Sen. Bill Nelson of Florida said Boeing's plans demonstrate that the only place in the nation to have launched people into orbit remains well-positioned to serve the future of space exploration, too.

"This is a celebration of a great public-private partnership," Nelson said. "The public sphere in local, state and federal with the private sector. And what you see is the result, which was one of the goals we set in (the) NASA bill in 2010."

Boeing anticipates building its CST-100 up from a pressurized crew compartment into a fully operational spacecraft inside the OPF. The company is developing its spacecraft in partnership with NASA's Commercial Crew Program under its Commercial Crew Integrated Capability agreement.

"We're transitioning this facility into a world-class manufacturing facility," said John Mulholland, Boeing's program manager for the CST-100. "With (a) 50,000-square-feet processing facility, it's going to allow us to process up to six CST-100s at once."

The facility was leased by Kennedy to Space Florida in October 2011.

Since then, the ramps, platforms and specialized equipment for the shuttles has been moved out to make room for the machinery needed to ready the CST-100 spacecraft for flight. The main hangar has room to process several spacecraft at once, with adjoining sections of the building well-suited to process other systems such as engines and thrusters before they are integrated into the main spacecraft. SPM

COUNTDOWN BEGINS

NASA administrator Charlie Bolden marks the T-6 months and counting to launch of Orion on Exploration Flight Test-1 during a visit June 18 to the Operations and Checkout building high bay at Kennedy Space Center. Photo credit: NASA/Kim Shiflett

Orion allows exploration beyond our home planet

BY LINDA HERRIDGE

NASA Administrator Charlie Bolden helped mark T-6 months and counting to the launch of Orion on Exploration Flight Test-1 (EFT-1) during a visit June 18 to the Operations and Checkout (O&C) Building high bay at Kennedy Space Center.

"This is a big deal for us. Behind me is a tangible piece to Mars," Bolden said. "The Orion spacecraft is going to travel farther into space than humans have done in 40 years."

EFT-1 is a critical part of NASA's strategy and a big step forward on the path to Mars. Bolden said the test demonstrates how the Kennedy team continues to transform the center into a multi-user facility capable of many different kinds of launches.

"It's possibly the most significant human spaceflight milestone this year, pointing toward our return with humans into deep space," Bolden said. "Right now, NASA is building on knowledge gained through the International Space Station and more than 50 years of human spaceflight experience, solving difficult challenges that will enable humans to safely explore deep space."

NASA Orion Program Manager Mark Geyer said the launch of Orion in six months is going to be visible evidence that the U.S. is still exploring.

"Work on this design sets us up for following missions," Geyer said. "Orion will look remarkably similar for Exploration Missions 1 and 2. All of the systems that are flying on EFT-1 were designed from the beginning to be human-rated, to be able to fly people onboard."

According to Lockheed Martin Orion Program Manager Cleon Lacefield, the first flight test is scheduled for Dec. 4. During the first high-orbital flight test, which will last a little more than four hours, Orion will travel 15 times farther out into space than the space station currently is today.

Orion's computers, software, guidance and control systems, separation events and heat shield will be tested during the flight.

"For the first time, since we went to the moon, we're stacking a vehicle in this high bay that will allow us to explore beyond our home planet and one day put boots on Mars," said Kennedy Director Bob Cabana. "That's very exciting. This is a world-class manufacturing facility with a world-class team operating it."

The Orion crew module is stacked on the service module in the Final Assembly and System Testing cell inside the Operations and Checkout Building high bay at Kennedy Space Center. Photo credit: NASA/Kim Shiflett
For more information, visit **http://www.nasa.gov/orion**.

On June 10, the Orion crew module was moved to the Final Assembly and System Testing (FAST) cell and stacked on the service module. In the FAST cell, the integrated crew and service modules will be put through their final system tests prior to rolling out of the O&C for integration with the rocket.

"We are well on our way to establishing a human presence in our solar system. And when we leave planet Earth to do it, we're going to be leaving from right here at Kennedy Space Center. Go Orion!" Cabana said.

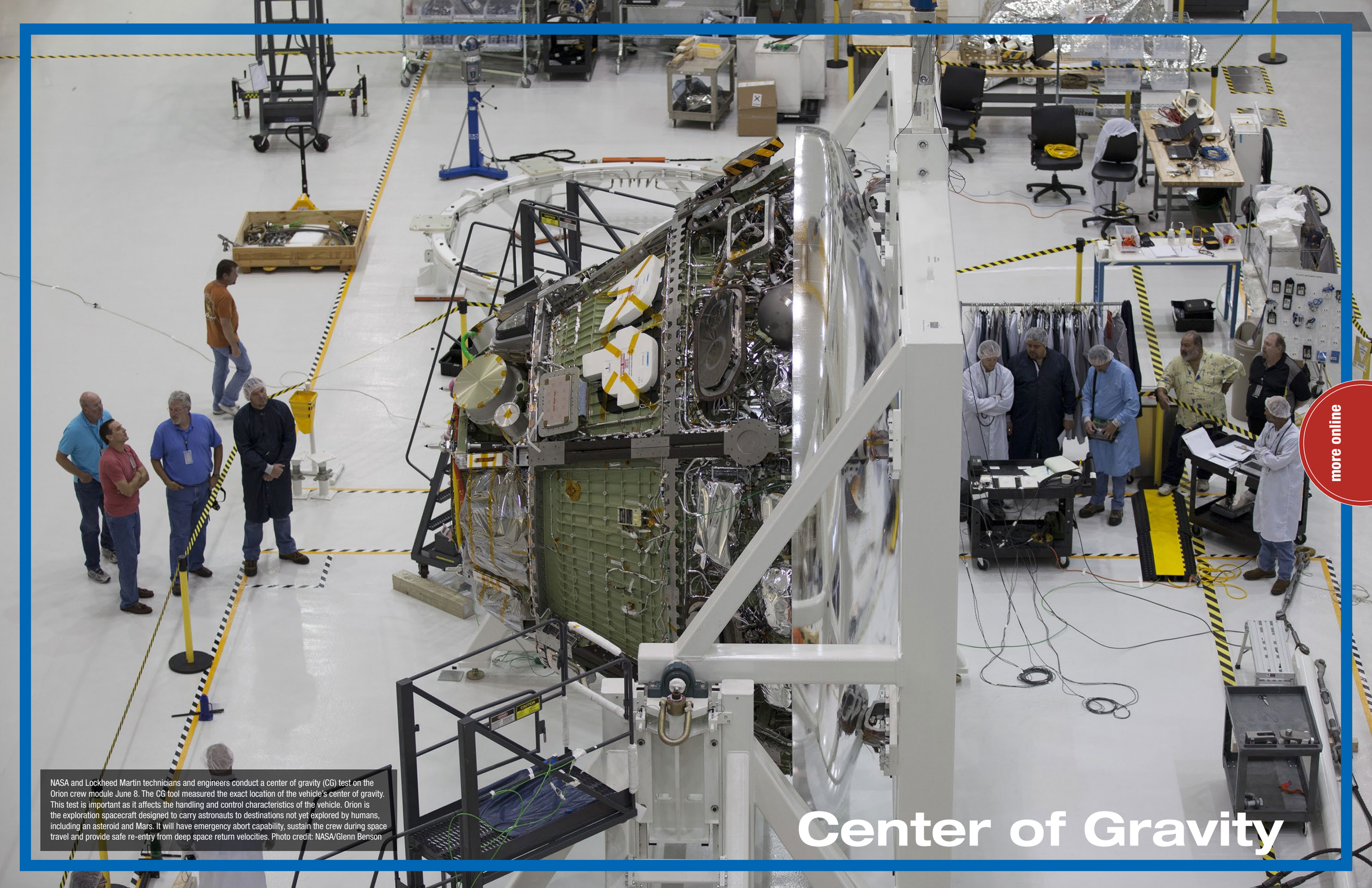
Orion will launch atop a United Launch Alliance Delta IV Heavy rocket from Launch Complex 37 on Cape Canaveral Air Force Station in Florida. The two-orbit, four-hour flight test will help engineers evaluate the systems critical to crew safety, including the heat shield, parachute system and launch abort system.

After two orbits, Orion will re-enter Earth's atmosphere at nearly 20,000 mph and a temperature of 4,000 degrees F. Its parachute system will deploy to slow the spacecraft for a splashdown in the Pacific Ocean. NASA's Ground Systems Development and Operations Program and the U.S. Navy will retrieve Orion from the ocean, bring the spacecraft back to shore and prepare it for transport back to Kennedy.

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

For more information on Orion,
visit http://www.nasa.gov/orion

For more information on EFT-1,
visit http://go.nasa.gov/1qJWiqV



Center of Gravity

NASA and Lockheed Martin technicians and engineers conduct a center of gravity (CG) test on the Orion crew module June 8. The CG tool measured the exact location of the vehicle's center of gravity. This test is important as it affects the handling and control characteristics of the vehicle. Orion is the exploration spacecraft designed to carry astronauts to destinations not yet explored by humans, including an asteroid and Mars. It will have emergency abort capability, sustain the crew during space travel and provide safe re-entry from deep space return velocities. Photo credit: NASA/Glenn Benson

more online

Dark Skies Essential

It's sea turtle nesting season along Space Coast shoreline

BY LINDA HERRIDGE

They generally only come out at night. And if the timing is right, you may catch a glimpse of a sea turtle lumbering onto the shoreline along Florida's space coast in search of a place to lay its precious cargo of eggs.

There currently are only seven different species of sea turtles in the world, varying in size from the small Kemp's Ridley to the very large Leatherback that can weigh more than 1,000 pounds and reach eight feet in length. Along with these, the most prevalent sea turtles that appear in Florida include the Loggerhead and Green. The Hawksbill and Olive Ridley are rarely seen nesting in Florida. The Flatback lives in Australia and the south Pacific. All are on the endangered species list except for the Loggerhead, which is listed as threatened.

Sea turtle nesting and hatching season in Florida generally runs from May to November. These gentle creatures need dark skies and that means lights out in the evening, not just at Kennedy Space Center but all along the eastern seaboard of Florida.

According to Jane Provancha, a wildlife ecologist with Innovative Health Applications (IHA), more than 5,000 turtles nest on Kennedy's protected beach, as well as on a portion of the Canaveral National Seashore next to the center.

"For sea turtles, the beach is the most important reproductive phase of their life history. They need near-shore access and sand that's in good shape for constructing their nests." Provancha said. "And they have to have darkness."

To help employees become more aware of sea turtle nesting habits and Kennedy's efforts to achieve lights out at night, the Environmental Management Branch of the Center Operations Directorate held a Dark Skies workshop May 30.

"The mission of the International Dark Sky Association (IDA) is to preserve and protect the nighttime environment and our heritage of dark skies through environmentally responsible outdoor lighting," said Taylor Pitcock, a NASA environmental specialist. "The purpose of the Dark Skies workshop is to improve awareness and make positive changes in Kennedy's lighting."

Dark skies are a natural resource. The IDA, based in Tucson, Arizona, estimated that one-third of all lighting in the U.S. is wasted, at an annual cost of about 30 million barrels of oil, or 9.1 million tons of coal, at a total cost of about $1.75 billion dollars per year.

Several presenters covered topics including U.S. Fish and Wildlife Services regulations, exterior lighting compliance and Kennedy's light management plan as it relates to sea turtle nesting season and energy savings.

"Kennedy strives to minimize light pollution in any way possible," said Nancy Bray, director of Center Operations. "We incorporate appropriate turtle-friendly lighting into the planning and execution of all our construction projects, and we strive to identify opportunities to update existing lights to meet the federal and state mandates."

Tonya Long, with the Florida Fish and Wildlife Conservation Commission, said sea turtles are one of the oldest four-legged species on Earth. They actually are ancient reptiles, with some species even pre-dating dinosaurs.

"Today's sea turtles may be smaller, but they are no less remarkable," Long said. "They are quite literally living fossils. They have remained largely unchanged for roughly 100 million years."

Sea turtles have a very

A female Loggerhead sea turtle slowly makes her way back to the ocean in the early morning at Kennedy Space Center. Photo credit: NASA/Karen Holloway-Adkins

A female Loggerhead sea turtle lays her eggs in a nest she created on the beach at Kennedy Space Center.
Photo credit: NASA/Karen Holloway-Adkins

complex life cycle. They can take 20 to 30 years to mature and be able to reproduce. The beach is a really critical part of that cycle because that's where sea turtles lay their eggs to incubate. It would be very detrimental to the population if the beach habitat were not intact.

Long detailed the effects of bright, artificial lighting on nesting females and hatchlings.

During the night, a female sea turtle will scope out the area before coming onshore to nest. Visible bright light or glow is a major deterrent.

"We found that areas that are heavily lit will prevent turtles from even coming out of the water. If lights can be modified and made more wildlife-friendly, then there's a good chance sea turtles will start nesting on your beach," Long said.

Lighting also can interfere with females finding their way back to the water. During surveys, Long said she's seen turtle crawls that went half a mile down the beach before they've got back to the water. Think about a 250- to 300-pound sea turtle pulling itself along to near exhaustion. Disoriented female turtles have ended up in homeowners' pools, on back porches, and in the road.

Bright lights also can have a negative effect on turtle hatchlings. They rely on multiple visual cues to make their way from the nest to the water. They search for the brightest open horizon, which usually is the water illuminated by the moon.

"In an area where there is a lot of light, the disoriented hatchlings will go in the wrong direction. Sometimes they'll circle around. They may wander north and south and become confused," Long said.

The hatchlings have limited energy to make it offshore. They make a beeline to the water in a "v" formation. Any delay on the beach can result in increased dehydration, exhaustion, predators and death.

Long said many counties in Florida have lighting ordinances in place. They have developed turtle lighting guidelines.

Kennedy's external lighting guidelines are not new, according to Lynne Phillips, in the center's Environmental Branch. In fact, they've been around since 1995 in various forms. The center's updated lighting plan focuses on light trespass (interior lighting that can be seen from the exterior).

"Since that time, we've had a lot of success with the use of low pressure sodium (LPS), but we've also adopted the use of light emitting diodes (LED) more recently," Phillips said. "Center Operations has done very well incorporating this guidance into our new construction of facilities and retrofitting older facilities, parking lots and outdoor lighting."

Remember these three Golden Rules for lighting, Long said. First, keep the light source's height low to minimize light trespass, and use only the lumens output needed. Lighting sources that are lower to the ground make it easier to direct the light to where it is most needed.

Second, the light source should be shielded. Long recommends the use of full cutoff or fully recessed fixtures. The key is to shield the light so it is not visible from the beach.

Third, the light source should produce light with a long wavelength, because sea turtles are attracted to short wavelength lights. In other words, use "wildlife-friendly" bulbs with wavelengths greater than 560 nanometers. Amber, orange and red LED lights produce shine in these wavelength regions.

"Whether you live on the beach or not, it's really important to follow all of these rules, because the way that you set up the lights at your own home really can affect wildlife in areas that you wouldn't even think about," Long said.

The types of fixtures not recommended are lights categorized as decorative, water feature, pond, private balcony, dune cross-over, fountain and tree strap-down if they can be seen from the beach. Some ways to correct or retrofit existing problems include disconnecting and turning off lights; changing lamps to red, orange or amber LEDs; installing 180-degree shields to block light visible from the beach; and installing a fixture that directs light down and away from the beach.

Balancing safety, security and sea turtles is a challenge. Long said there is some misconception that if the light is bigger and brighter, then you're secure, and that's not necessarily the case.

"You can apply these same principles and have very good security on your property," Long said. "We're not trying to advocate that everybody turn off all of their lights and live in total darkness. We're trying to advocate that the light is focused and used appropriately."

More resources are listed on their website at **http://www.myfwc.com** under Wildlife & Habitats.

Shannon Gann, a wildlife ecologist with IHA, talked about how workers at the center can improve lighting and make a lasting impact and difference in the life history of all wildlife, including sea turtles.

Kennedy and the Merritt Island National Wildlife Refuge have a high biodiversity and more federally protected species than any other preserve in the continental United States. Merritt Island is in the transition zone between the Carolinian and Caribbean zoogeographic provinces.

"Because of our unique location, we are recognized as one of the most biologically diverse estuaries in North America," Gann said. "We have about 2,100 species of plants and about 2,200

Photo at right: Leatherback sea turtle hatchlings head for the ocean during the early morning at Kennedy Space Center. Photo credit: NASA

An endangered green sea turtle is released into the Mosquito Lagoon, which is part of Florida's Indian River, on Jan. 5, 2011. Workers with Kennedy Space Center, Innovative Health Applications and the Fish and Wildlife Conservation Commission rescued more than 300 turtles during the winter's frigid temperatures.
Photo credit: NASA/Kim Shiflett

different species of animals."

The IHA staff conducts surveys of night lighting and early morning sea turtle nesting. The team provides Kennedy's Environmental Management Branch with state-required and federally-required adult and hatchling disorientation rates. They also perform nighttime light surveys, which helps to identify potential noncompliance issues with specific buildings and the center's light management plan.

Lights from nearby facilities can illuminate the beach. Gann said they also found that naturally dark areas can be affected by urban lights and the resulting sky glow. To block as much light as possible, many facilities turn out their lights.

"One hatchling in a thousand will make it to the reproductive stage," Gann said. "The Kennedy beaches must be preserved to help the sea turtle species to survive. Before you leave the office in the afternoon, flip off the lights or draw the shades. This actually will make a difference in the amount of light that shines out to the beach." SPM

For information on the Dark Sky Association, visit http://www.darksky.com.

Dark Sky resources include:

Dark Sky Meter for your smartphone (free apps)

Dark Sky Meter (iOS)

Loss of the Night (Android)

Uses phone camera to measure light pollution and collects user measurements

Dark Sky viewing

Kennedy Space Center Astronomical Association

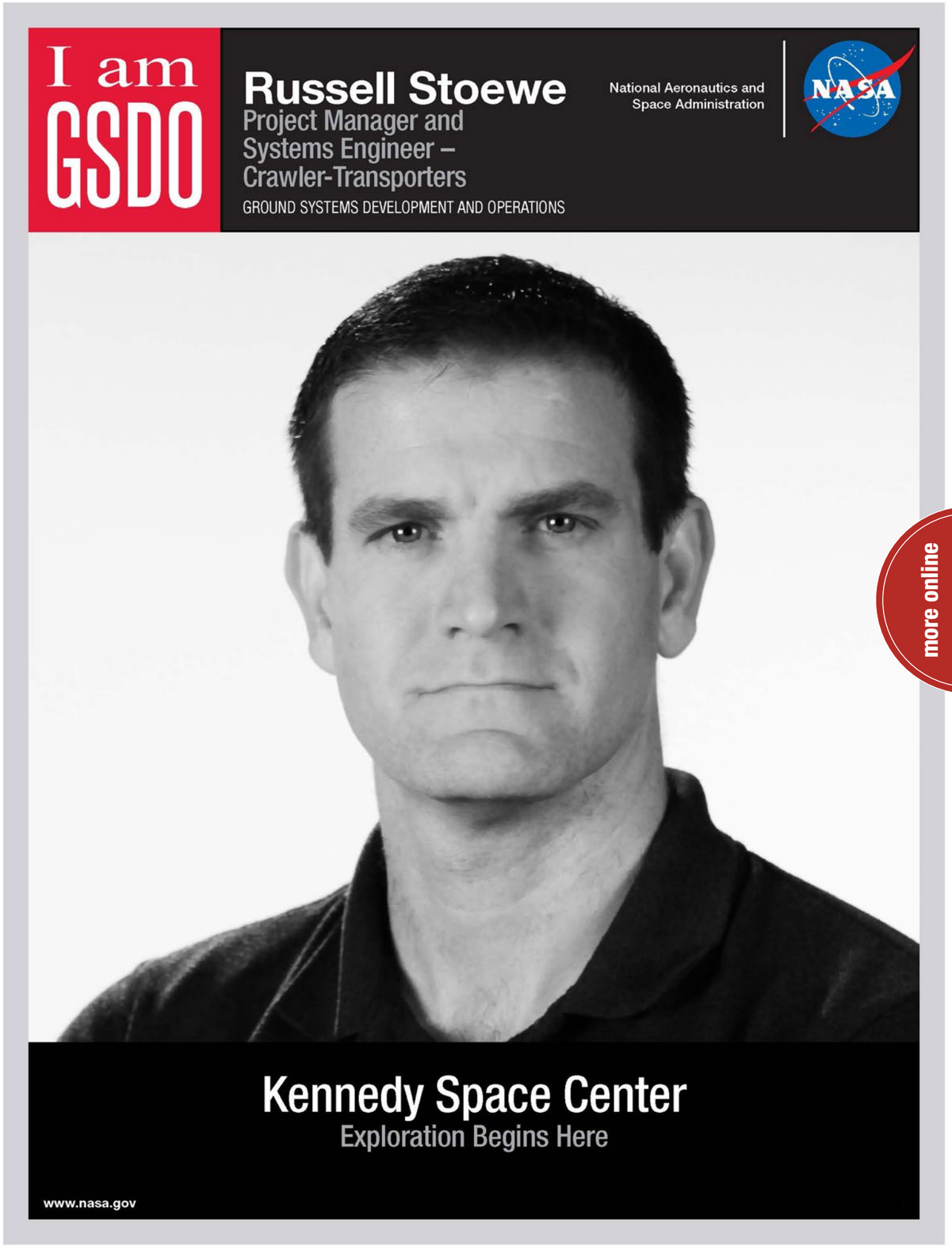
Officially sanctioned club at Kennedy with monthly Star Parties.

Usually scheduled around the new moon at the Shiloh viewing location in the middle of the Merritt Island National Wildlife Refuge.

Enjoy the night sky and share its wonders.

Open to everyone at Kennedy.

Public website: http://www.4saleusa.net/kscaa.



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REVOLUTIONARY RESEARCH

NASA Chemical Engineer Annie Caraccio reviews data from experiments with the trash-to-gas reactor in Kennedy Space Center's Material Science Laboratory.
Photo credit: NASA/Dan Casper

opposite page:
Annie Caraccio poses with her father, Thomas Caraccio, a pharmacist, left, and her brother U.S. Army Capt. Robert Caraccio, who served in Afghanistan after she graduated from Manhattan College with a master's degree in chemical engineering in December 2010.
Photo credit: Family of Anne Caraccio

Love of chemistry inspires research for deep-space explorers of future

BY BOB GRANATH

Annie Caraccio has been a chemical engineer in the Materials Science Division at Kennedy Space Center for the past three years. During that time, she has become involved in revolutionary research that will be of value on Earth and other planets.

"My start date as a full-time employee was Feb. 14, 2011," she said. "It's appropriate that it was Valentine's Day because I love my work."

Caraccio is part of a team developing a technology that could turn ordinary debris and other garbage accumulated by a crew of astronauts into valuable resources such as methane gas, oxygen and even water using processes that currently are used on Earth.

She is performing human factor assessments of the waste processing technology in a simulated planetary habitat in Hawaii for four months. The goal is to learn how astronauts would operate in a base on Mars.

Caraccio's career path began in Bellmore, New York, a suburb of New York City on the south shore of Long Island. She is the younger of two children. Her father, Thomas Caraccio, is a pharmacist and her mother, Joan Caraccio, who died in 2007, was a nurse.

Caraccio's first exposure to the Florida spaceport came during a family vacation when she was about five years old.

"I don't remember much, but I recall being in awe of NASA," she said. "I knew some really smart people worked here."

She explains that her path to a career in engineering started because of her older brother.

"He was a really great role model when I was growing up," she said. "He received an appointment to the U.S. Military Academy at West Point and he planned to study engineering. That started me thinking about doing the same.

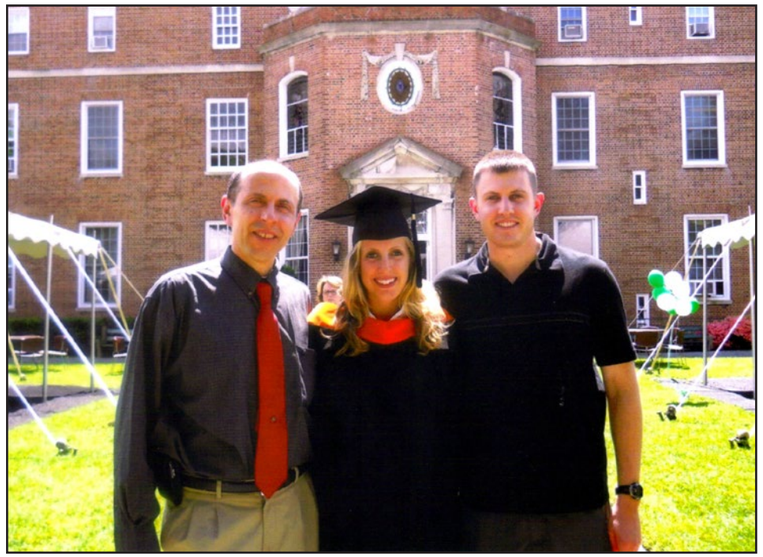
"I had a great high school chemistry teacher whose name was Mr. O'Kane," she said. "I'll never forget that great class. What my brother was studying seemed challenging and since I liked chemistry and wanted a challenge, I decided to major in chemical engineering."

After high school graduation, Caraccio entered Manhattan College in the Bronx, New York.

"It was a hard four years, but it really paid off," she said.

Looking for work experience, Caraccio took a job near Union Square at the Consolidated Edison Company of New York., commonly known to locals as Con Ed, following her sophomore year.

The following year she worked for D&B Engineers and Architects, a leader in environmental engineering and science. The



Annie Caraccio is a chemical engineer with the Materials Science Division in the Engineering and Technology Directorate. Photo credit: NASA/Dan Casper

company's work includes planning, designing and implementing environmental projects.

"The summer I worked there, I was supporting the hazardous waste department with various groundwater and soil cleanup processing projects for 'Superfund'-type sites," she said.

Superfund is the federal government's program to clean up uncontrolled hazardous waste sites.

"Just before graduating with my bachelor's degree in 2009, I had a chance to go to the Society of Women Engineers National Conference in Baltimore," Caraccio said. "I talked to the people at a NASA booth and applied for an internship, and I was persistent in following up."

Her determination paid off. She participated in three semesters of the NASA co-op program, working in Kennedy's Polymer Science and Technology Laboratory developing polymers that could repair themselves.

"We were developing self-healing insulation systems for electrical wiring to support the space shuttle orbiters," she said. "It was important to ensure the miles of wiring would work properly even if damaged. It was exciting work because it was a technology that could also aid the commercial sector, including the aviation industry."

Soon after beginning work at Kennedy, two events convinced Caraccio the Kennedy Space Center is where she wanted to work long term.

"During June of 2010 I had an opportunity to sit in the pilot's seat of the shuttle Endeavour," she said. "Then I watched my first shuttle launch from the steps outside Launch Control Center. The power of that rocket with the vibration reverberating off my chest was awe-inspiring. I realized I had tears streaming down my face. It was an incredible experience."

Later that year, Caraccio graduated from Manhattan College with her master's degree in chemical engineering. Soon after, she drove her 1995 Mercury Cougar 1,100 miles from the Bronx to Cape Canaveral.

As a chemical engineer, Caraccio focuses on developing a reactor to recycle trash during deep-space missions. Materials such as scraps, wrappers, packaging and other garbage could be converted into methane gas, oxygen and water.

"I love doing research involving technologies that support human spaceflight, especially when many have potential applications here on Earth."

While the term "reactor" often is associated with nuclear energy, in this case it is an apparatus controlling a chemical reaction. The reactor being tested at Kennedy contains more than three quarts of material and burns at about 1,000 degrees Fahrenheit.

"Not only will this effort help space missions, but it will also be valuable on Earth. We have enough problems recycling and disposing of our own trash," Caraccio said.

Caraccio's experiences also have included participating in center director Bob Cabana's Reverse Mentoring Program. The effort's objective is to improve communications at Kennedy. Participants have an opportunity to talk with Cabana individually about center issues and show him their work.

"I had an opportunity to demonstrate how we were developing ways to convert trash to useful gas," Caraccio said. "The work is very hands on and technical. When I showed him how we did something, he understood and picked it up quickly and knew how to use our specialized tools. He was very interested in our work."

Caraccio is now part of a six-person crew participating in a long-term human space simulation called "HI-SEAS" for Hawaii Space Exploration Analog and Simulation. The HI-SEAS Habitat is about 8,000 feet in elevation on the northern slope of Mauna Loa, a volcano on the largest island in the Hawaii Island chain.

"The simulation will run for 120 days," Caraccio said. "It's designed to be a Mars-equivalent habitat, with the main focus being human factor studies to understand and engineer a flight-like waste processing technology for long duration missions."

While busy with her career at Kennedy, Caraccio still finds time to volunteer with a local troop of Girl Scouts.

"I work primarily with high school girls," she said. "I encourage them to consider STEM (science, technology, engineering and mathematics) careers. But, the main thing I tell them is to find a career doing something that they feel passionate about."

Caraccio is enthusiastic about being a part of NASA's long-term goal for exploration beyond Earth.

"I love doing research involving technologies that support human spaceflight, especially when many have potential applications here on Earth," she said. "Given the opportunity to add value and apply the research during a deep-space mission to Mars, I'd definitely like to be a part of it." SPM

RESEARCH GOOOAL!

2014 World Cup soccer ball provides lesson in aerodynamics

Fans across the globe have been cheering on their team during the Fédération Internationale de Football Association (FIFA) 2014 World Cup tournament. These fans include NASA engineers, who used the lead-up to the tournament to test the aerodynamics of this year's new ball design, developed by Adidas and dubbed the Brazuca ball.

Although NASA is not in the business of designing or testing balls, the tournament provides an opportunity to explain the concepts of aerodynamics to students and individuals less familiar with the fundamentals of aerodynamics.

"Sports provide a great opportunity to introduce the next generation of researchers to our field of aerodynamics by showing them something they can relate to," said Rabi Mehta, chief of the Experimental Aero-Physics Branch at NASA's Ames Research Center in Moffett Field, California.

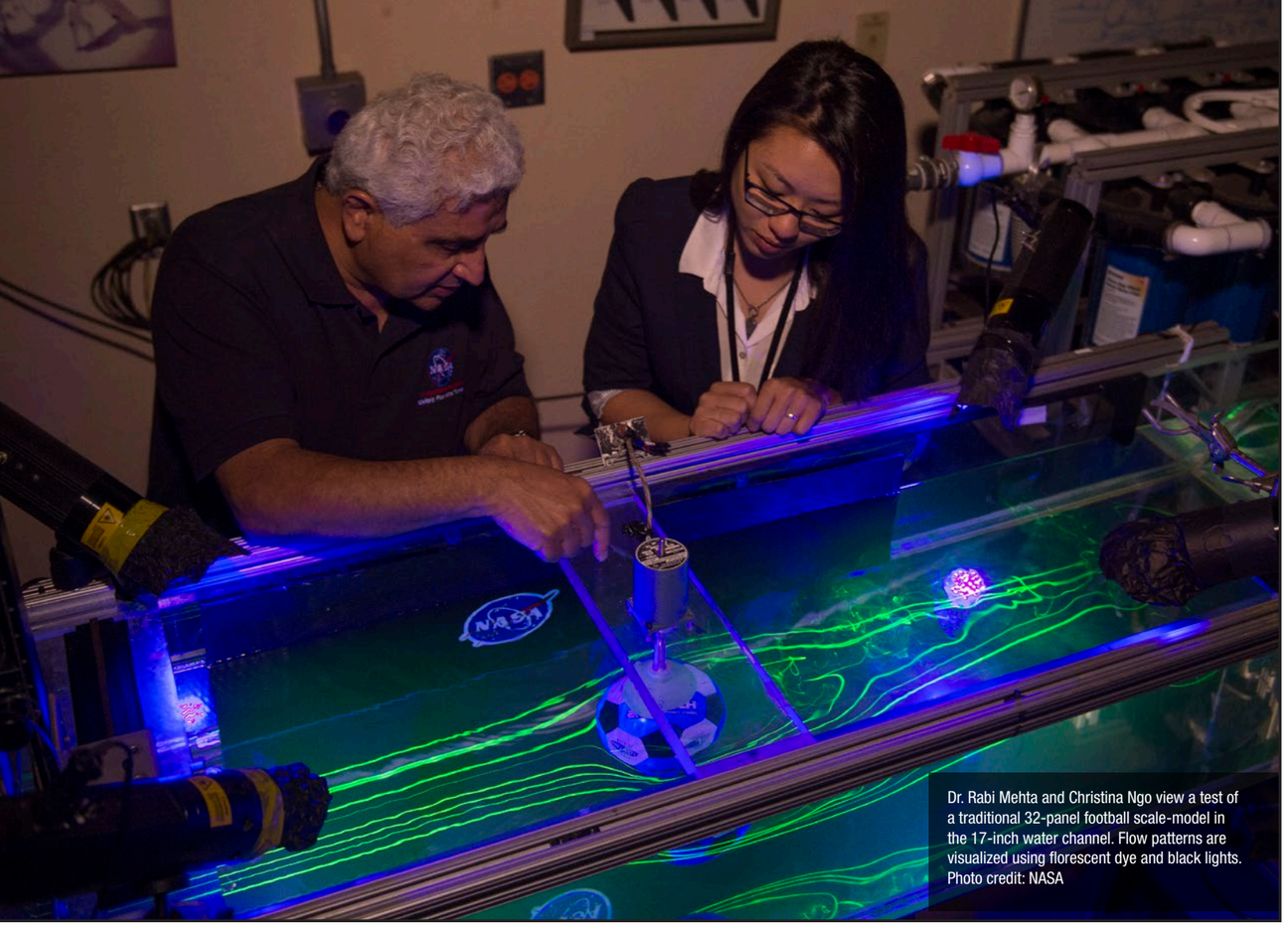
Aerodynamics is the study of how air and liquids, referred to collectively as "fluids" in aerodynamics research, flow around objects. Engineers at Ames, a world leader in fundamental aerodynamics research, possess an in-depth understanding of how fluids flow around simple three-dimensional shapes such as cylinders and spheres. With this knowledge, engineers can predict how even the minor alterations in these basic shapes change flow patterns.

A close up of the Brazuca ball in Ames' Fluid Mechanics Laboratory's two-foot by two-foot wind tunnel. Smoke highlighted by lasers visualizes air flow around the ball. Photo credit: NASA

Dr. Rabi Mehta uses smoke and lasers to inspect the flow pattern around an Adidas Brazuca football. Photo credit: NASA

The previous World Cup ball, the Jabulani, was described as sometimes demonstrating "supernatural" movements. It was beloved by strikers but hated by goalkeepers because, when kicked with little or no spin, the ball "knuckled," giving strikers a greater chance of scoring. Knuckling occurs when, at zero or near-zero spin, the seams of the ball channel airflow in an unusual and erratic manner, making its trajectory unpredictable.

Taking full advantage of a ball's flight characteristics to gain an advantage is nothing new in sports. In baseball, the only difference between a curveball, a fastball, a slider or a knuckle ball is how a pitcher manipulates the spin of the baseball with respect to its stitches. On a football, there are no external stitches piecing the outer covering of the ball together but it does have seams, many of them.



Dr. Rabi Mehta and Christina Ngo view a test of a traditional 32-panel football scale-model in the 17-inch water channel. Flow patterns are visualized using florescent dye and black lights. Photo credit: NASA

To address the unpredictability of the Jabulani ball, Adidas worked with hundreds of players to develop the Brazuca football. A traditional football has 32 panels, the Jabulani has eight panels and the Brazuca has only six.

Despite having fewer panels, the finger-like panels on the Brazuca increase the seam length, compared to previous World Cup balls. The seams are also deeper than those of the Jabulani and the panels are covered with tiny bumps; all of these factors influence the ball's aerodynamics.

What seems like common sense about air moving around a simple sphere does not, in fact, bear true. The airflow around a sphere is not smooth; a great amount of drag is created behind the object. An example of this can be seen on a golf course, where a smooth golf ball travels much shorter distances than a regular, dimpled golf ball. The dimples on the ball's surface agitate the air creating a smaller low-pressure wake behind the ball and decreasing drag, therefore increasing its distance.

"There is a thin layer of air that forms near the ball's surface called the boundary layer and it is the state and behavior of that layer that is critical to the performance of the ball," said Mehta. "The materials used, the ball's surface roughness and its distribution determines its aerodynamics."

The overall increased roughness of the Brazuca football will help to decrease the ball's knuckling tendencies at kicking speeds typically encountered in the World Cup.

In the 2- by 2-foot wind tunnel in the Fluid Mechanics Laboratory at Ames, Mehta demonstrates the airflow around the Brazuca football releasing controlled smoke flow over the surface of the ball highlighted with laser light to increase flow visibility. At different speeds, there are noticeable differences in airflow around the ball.

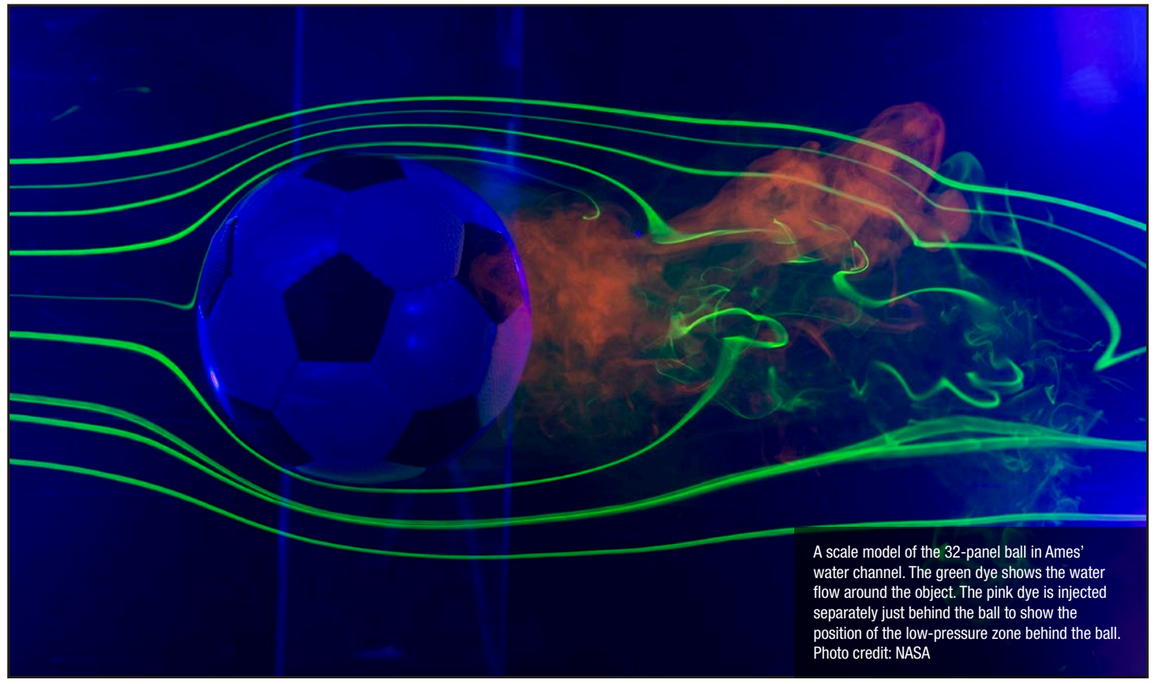
"What we are looking for in the smoke patterns is at what speed the smoke patterns suddenly change," remarked Mehta. This is when the knuckling effect is greatest."

Tests in the wind tunnel and a 17-inch water channel, which uses florescent dye dispensed into the fluid flow under black lights, shows that the speed of greatest knuckling for a traditional ball is around 30 miles per hour (mph). This is well below the typical kicking speed of a World Cup-caliber player, which is about 50 to 55 mph. Interestingly, the Jabulani, a much smoother ball, produced its greatest knuckling effect in that same speed range (about 50 mph), which is why the players in the 2010 World Cup noticed the effect more frequently.

The smoother a ball is, the higher the speed at which the knuckling effect occurs. However, with the increased roughness of the Brazuca, this critical speed for maximum knuckling is reduced to about 30 mph. So it is expected that the 2014 World Cup ball will have a more predictable flight path at typical striking speeds.

"The players should be happier with the new ball," predicted Mehta. "It is more stable in flight and will handle more like a traditional 32-panel ball."

Will this make the game less exciting? The answer is -- no. With a new understanding of the aerodynamics of the Brazuca football, the audience, especially kids, can better appreciate the feats of skill on the field. Elite athletes will continue to manipulate the ball in amazing ways. They don't have terms such as "Bend it like Beckham" for nothing. SPM



A scale model of the 32-panel ball in Ames' water channel. The green dye shows the water flow around the object. The pink dye is injected separately just behind the ball to show the position of the low-pressure zone behind the ball. Photo credit: NASA

Ground support technicians use a special work stand to guide a roller bearing shaft for insertion on the C truck of crawler-transporter 2, or CT-2, at Kennedy recently.
A section of the treads on the C truck were removed to allow access to the bearings. Work continues in high bay 2 to upgrade CT-2. The modifications are designed to ensure CT-2's ability to transport launch vehicles currently in development, such as the agency's Space Launch System, to the launch pad. The Ground Systems Development and Operations Program office at Kennedy is overseeing the upgrades. For more than 45 years the crawler-transporters were used to transport the mobile launcher platform and the Apollo-Saturn V rockets and, later, space shuttles to launch pads 39A and 39B. Photo credit: NASA/Dimitri Gerondidakis

Bearing the ice

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SPACE HARVEST

Researchers mirror space station's Veg-01 harvest

BY LINDA HERRIDGE

Red romaine lettuce and other fresh vegetables could be on the menu for astronauts in the future. NASA astronaut and Expedition 40 Commander Steve Swanson harvested the first fresh vegetable crop, Veg-01, on June 10 from the Veggie plant growth system on the International Space Station (ISS).

"I was all smiles watching Swanson harvest his space lettuce, and I noted a great deal of excitement among the other crew members," said Trent Smith, a project manager in the ISS Ground Processing and Research Project Office at Kennedy Space Center.

The following day, researchers harvested a control version of Veg-01 inside the Payload Development Laboratory at Kennedy's Space Station Processing Facility (SSPF). The 'Outredgeous' red romaine lettuce was grown on the space station and in the control laboratory for 33 days.

The ground team was able to monitor Veggie on the space station through a downlink in the SSPF. Veggie experiment procedures on the space station -- including activation of the plant pillows containing the red romaine lettuce seeds, delivering water and monitoring plant growth -- were precisely mirrored on Earth in the control lab.

One of the goals of Veg-01 was a hardware test of the growth system, according to Gioia Massa, NASA project scientist for Veggie, also in the ISS Ground Processing and Research Project Office. Another goal was to get some baseline data for food safety of the plants.

"We want to know if there is anything on the station that might grow in the plant environment that could be harmful for the crew," Massa said. "We'll be doing microbial analysis of the plants, some of the plant pillows and the bellows from the Veggie growth system."

On the space station and in the control lab at Kennedy, the tops of the lettuce were cut away from the plant pillows and swabbed for microbial samples. The pillows and bellows also were swabbed. The plants, sample swabs and a couple of the plant pillows were packaged and placed in a minus 80-degree freezer for storage.

"Our samples will be frozen until the flight samples return on the SpaceX's fourth commercial resupply mission," Massa said. "Then we'll be able to do analysis on both of them."

Researchers will measure the antioxidant, anthocyanin and mineral levels in the lettuce. According to Massa, red romaine lettuce tends to have higher levels of antioxidants than other leafy greens; higher antioxidants help counteract the effects of radiation in space. The data will be shared with NASA flight surgeons, the astronaut crew office and microbiologists at Johnson Space Center in Houston, with the hope of approval for the crew to grow and eat a red romaine lettuce crop in orbit.

"Our end goal is for food production, and Veggie is our first step for NASA to be able to achieve food production systems for space," Massa said. "We're looking at developing what we call a pick-and-eat capability for space station within the next few years."

NASA astronaut Steve Swanson, Expedition 40 commander, harvests a crop of red romaine lettuce plants June 10 in the International Space Station's Harmony node that were grown from seed inside the Veggie facility, a low-cost plant growth chamber that uses a flat-panel light bank for plant growth and crew observation. Photo credit: NASA/Alex Gerst

Besides having the ability to grow and eat fresh food in space, there also may be a psychological benefit. The crew does get some fresh fruits or vegetables, such as carrots or apples, when a supply ship arrives at the space station. But the quantity is limited and must be consumed quickly.

"We think that having that additional component of fresh food grown on the station would make the crew generally happier, and hopefully healthier," Massa said. "It's something to look at. It's something that changes with the passage of time."

Massa said a dedicated team at Kennedy, including engineers, scientists and project managers, worked on Veggie for several years. Engineers and scientists at Orbital Technologies Corp. (ORBITEC) in Madison, Wisconsin, built the Veggie hardware and worked with NASA to prepare it for flight.

"Veggie has lit a spark in everyone that's been involved with it," Massa said. "It's been exciting for the crew. It's been exciting for the team in the Payload Operations Center."

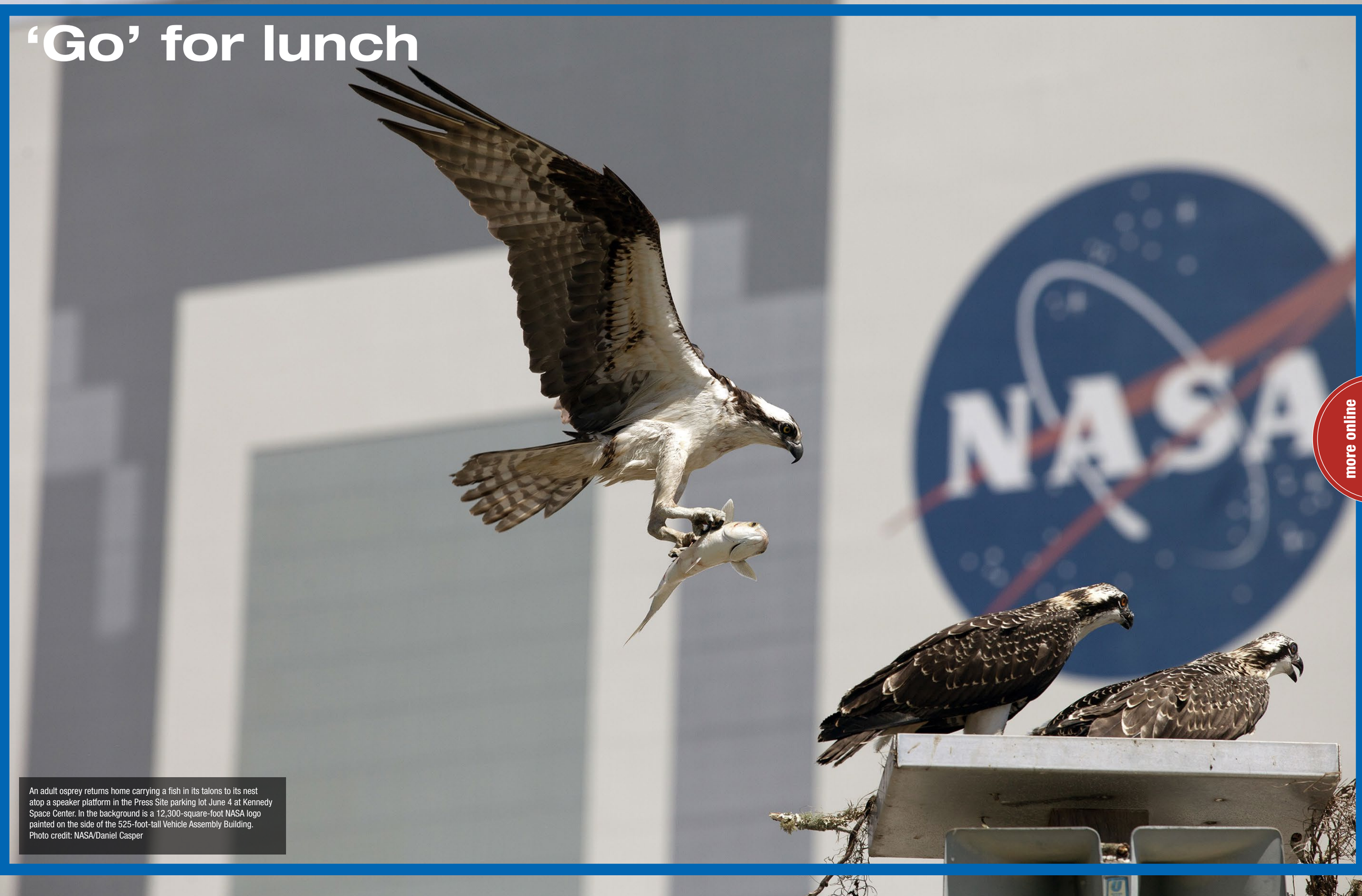
What's on the horizon for Veggie? The plant growth system now is available for other scientists to propose experiments, and a number of them are being reviewed for the future. "We do have a list of other crops that we think could grow well in Veggie. Different crops could be grown in different sizes of plant pillows," Massa said. "We're even doing some research on dwarf plum trees to see if those might be able to grow in Veggie."

An experiment going up to the space station on SpaceX's fifth commercial resupply mission will use Veggie as a platform to grow Arabidopsis, a small flowering plant related to mustard or cabbage. Arabidopsis is of particular interest to plant biologists because its entire genome sequence has been modeled, and changes to one of those model organisms are easily observed.

One experiment is from the University of Florida in Gainesville, and the other from the Nobel Foundation in Oklahoma. Both will grow Arabidopsis in petri dishes using Veggie's LED lights, not pillows.

According to Massa, these dishes will be harvested in orbit and fixed or preserved to allow investigators to look at different gene expressions related to developmental cellular biology. SPM

‘Go’ for lunch



An adult osprey returns home carrying a fish in its talons to its nest atop a speaker platform in the Press Site parking lot June 4 at Kennedy Space Center. In the background is a 12,300-square-foot NASA logo painted on the side of the 525-foot-tall Vehicle Assembly Building. Photo credit: NASA/Daniel Casper

more online

PERFECT FIT

Florida high school senior soaks in career-shadowing experience at Kennedy

High school senior Angelique Noles enjoyed a week-long visit behind the scenes at several of Kennedy Space Center's laboratory facilities.
Photo credit: Dan Casper

In April, Port Charlotte High School senior Angelique Noles placed first in the senior-level physics and astronomy category at the 59th Annual State Science and Engineering Fair of Florida. Then she was selected for a career-shadowing experience at Kennedy Space Center.

"I knew after speaking with her for five minutes that she was the one," said Amanda Griffin, who helped interview three other contenders and coordinated the visit on behalf of Kennedy's Education and External Relations directorate.

"Not only did she have an unbridled passion for science, I could see a direct correlation between her work and what our Veggie scientists have been working on," Griffin added, referring to NASA's Veggie project, which is studying ways to grow food in space.

The weeklong visit took her behind the scenes at several of the center's laboratory facilities and introduced her to many scientists and engineers working in her areas of interest.

"Every new person I met left a positive impression," Noles said of her weeklong visit. "I am leaving Kennedy with more ideas and aspirations than what I walked in with."

Noles' itinerary at Kennedy was specially tailored to give her more time with people and facilities dedicated to the types of science she loves most: physics and astrobiology. As a result, she spent hours in the Veggie, astrobiology and microbiology labs, the cryo lab, and Kennedy's SwampWorks technology lab. Additionally, Noles had opportunities to see Kennedy's work in materials failure, ultrasound, microgravity, Earth Systems modeling and more.

"The goal was to give Angelique the chance to see real-life applications of the research she's done, as well as possible career choices," Griffin said.

Noles' parents always encouraged her interest in science, and she's found additional inspiration in famed astrophysicists Carl Sagan and Neil deGrasse Tyson, as well as Sally Ride, the first American woman to fly in space.

She plans to attend Florida Institute of Technology in Melbourne with the ultimate career goal of studying at Europe's Center for Nuclear Research (CERN) in Geneva, Switzerland.

"The shadowing opportunity this week really pushed me to see my passions into reality," she said. "Dreams are born and realized here, and to be in the presence of that process is amazing."

While Kennedy made a strong impression on Noles, she left her hosts equally impressed.

"I was amazed at her ability to grasp the concepts the Ph.D. scientists were throwing at her," Griffin said. "She is extremely bright and will do well in whatever she sets her mind to." SPM

Angelique Noles met many scientists and engineers working in her areas of interest during a visit to Kennedy Space Center. Photo credit: Dan Casper

Inventors receive recognition for patented innovative technologies

BY LINDA HERRIDGE

Smart coatings, aerogel composites and hydrogen-sensing tape are just three of the 20 innovative technologies developed at Kennedy Space Center that received U.S. patents within the last four years. The 35 engineers, scientists and researchers who developed them were honored by the center's Technology Transfer Office on June 9 during a Patent Recognition Ceremony at the Kennedy Learning Institute. The last recognition event was held in 2010.

Mike Lester, from the Technology Transfer Office, said it is time to recognize the researchers who have achieved patents in the last several years and acknowledge the tremendous innovations going on in research and technology at the center.

"The technologies you have developed represent years of hard work," said Janet Petro, Kennedy's deputy director. "NASA is moving forward and the new technologies being developed help the agency and stimulate the economy."

Luz Calle, a NASA research materials engineer in the Engineering and Technology Directorate, and Wenyan "Wendy" Li, a research scientist with QinetiQ North America on the Engineering Services Contract, received their patent recognition for developing "Coatings and Methods for Corrosion Detection and/or Reduction," or smart coatings.

Calle said receiving the patent for this technology was a long and difficult process.

"I jokingly say that the invention is the easy part," Calle said. "For example, the patent for which Wendy and I received recognition was based on work that started in 2004. The patent application was filed in 2005 and the patent was awarded in 2010."

The need to find a more environmentally friendly and efficient method to detect and control corrosion is what prompted Calle and Li to develop the smart coating technology. Currently, it has been the subject of several technology development partnerships and is advancing toward commercialization.

"Methods and Systems for Advanced Spaceport Information Management" was invented by Phillip Meade and Judith "Charlie" Blackwell-Thompson, both engineers in the Ground Processing Directorate, in conjunction with NASA and The Boeing Company. The patent is for methods and systems that reduce the time, cost and rework associated with the test and checkout of a payload over its lifecycle through the use of a distributed command and control architecture, according to Meade.

"This management system allows users to relocate test operations that are traditionally performed at the launch site to the payload developer location," Meade said. "It reduces the processing time required at the launch site and the costs for payload test and verification."

Blackwell-Thompson said one of the takeaways from this patent is that it allows flight and ground software to be tested together and early in the life cycle so that any issues are not repeated.

"Color Changing Materials for Hydrogen Detection" was invented by Luke Roberson, Janine Captain, Martha Williams, Trent Smith and LaNetra Tate, and is just one example of many Kennedy-developed technologies crossing over to the commercial world.

The project was led by principle investigator Dr. Luke Roberson, a research scientist in the Materials Sciences Division. Applications of the chemochromic color changing sensor were developed for leak detection on the launch pad to visually notify technicians of hydrogen leaks. Tape versions of the detector were applied to the space shuttle orbiter midbody umbilical unit during fueling operations for the STS-117, STS-118, STS-120, STS-122 and STS-123 missions.

Williams, the lead polymer scientist and founder of the Polymer Science and Technology Laboratory in the Materials Science Division of the Engineering and Technology Directorate, said the overarching theme of technology development is to bring technical solutions to real problems and technology gaps identified by NASA.

The hydrogen detection tape was licensed to the University of Central Florida (UCF) in January 2014. The university in turn spun off a company, HySense Technology LLC, to bring the technology to consumers.

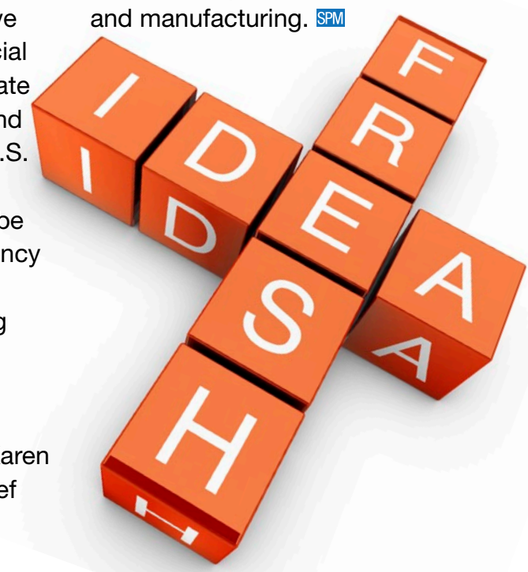
David Makufka, manager of Kennedy's Technology Transfer Office said the research and technology work performed at the center is critical for meeting NASA's missions, including the technology transfer mission.

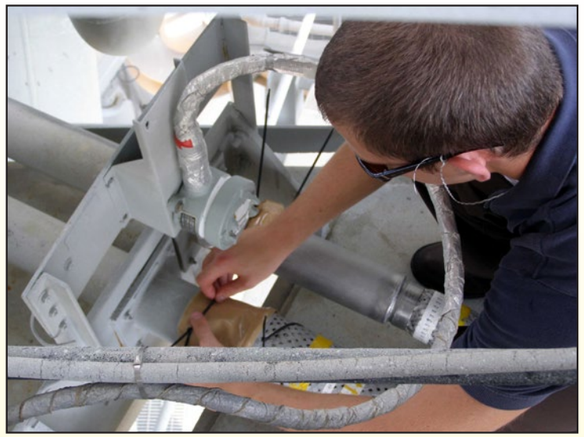
"Many of the inventions that were recognized at today's ceremony also have been licensed to commercial companies, helping to create new products, new jobs and a positive impact on the U.S. economy," Makufka said.

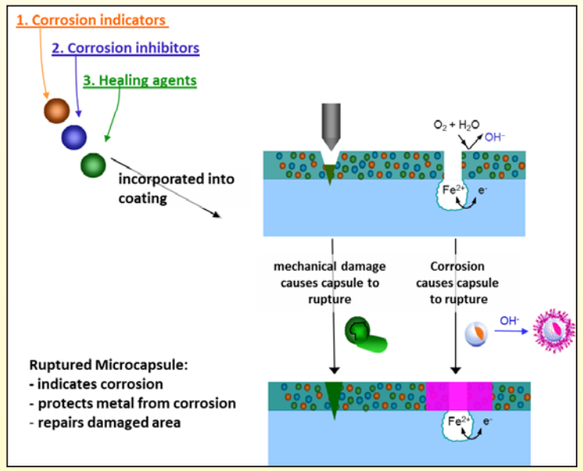
"Kennedy continues to be recognized across the agency for great innovation and collaboration in developing technologies that meet important NASA mission needs while also enabling other applications," said Karen Thompson, Kennedy's chief technologist.

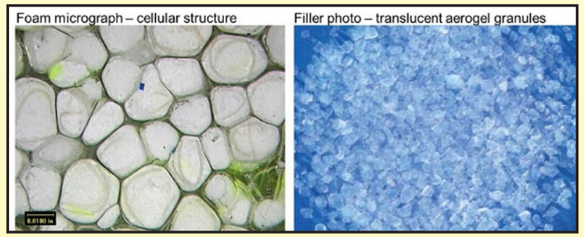
"Today, we recognized Kennedy employees who have received patents over the last few years."

NASA's Technology Transfer Program ensures that technologies developed for missions in exploration and discovery are broadly available to the public, maximizing the benefit to the nation. Kennedy's Technology Transfer Office secures NASA's intellectual property from new technology reports submitted by researchers. In cooperation with the center's Patent Counsel, the office files for patent protection based on commercial potential and the level of innovation of the technologies. The intellectual property is then transferred to industry through patent and copyright licenses to be used in commercial products, services and manufacturing. SPM









1) Dr. David Smith, a microbiologist in NASA's Surface Systems Office at Kennedy Space Center, applies color changing tape for hydrogen detection on a hydrogen cryogenic line at Launch Pad 39A on Oct. 15, 2007, during preparations for the STS-120 mission. The technology recently was licensed to the University of Central Florida in Orlando, Florida. It was invented by Martha Williams, Trent Smith, Luke Roberson, LaNetra Tate and Janine Captain. Photo credit: NASA/Luke Roberson

2) Coatings and Methods for Corrosion Detection and/or Reduction, also called Smart Coatings, was invented by Luz Calle and Wenyan "Wendy" Li. The Smart Coatings have been the subject of several technology development partnerships to date. Photo credit: NASA/Luz Calle

3) Microscopic images of Foam/Aerogel Composite Materials (Aerofoam) invented by Martha Williams, Trent Smith, James Fesmire, Jared Sass and Eric Weiser. Aerofoam has improved thermal performance properties with the added benefits of being inherently flame retardant and exceptionally thermally stable. Photo credit: NASA

4) A technician prepares an emulsified version of the Activated Metal Treatment System for Removal of PCBs and other Halogenated Contaminants Found in Ex Situ Structures. The technology was invented by Jacqueline Quinn in conjunction with inventors from the University of Central Florida in Orlando, Florida. This technology has been licensed by several environmental remediation companies. Photo credit: NASA

Patents and Inventors

Anti-Corrosive Powder Particles
Donald Parker and Louis MacDowell

Activated Metal Treatment System for Removal and Remediation of Polychlorinated Biphenyls (PCBs)
Jacqueline Quinn and Kathleen Loftin in conjunction with inventors from Scientific Specialists

Removal of PCBs and Other Halogenated Organic Contaminants Found in Ex Situ Structures
Jacqueline Quinn in conjunction with inventors from the University of Central Florida (UCF)

Mechanical Alloying of a Hydrogenation Catalyst Used for the Remediation of Contaminated Compounds
Jacqueline Quinn in conjunction with inventors from UCF and Scientific Specialists
(Two patents have been issued for this particular technology.)

Shape Memory Thermal Conduction Switch
William Notardonato in conjunction with inventors from UCF

Method of Fault Detection and Rerouting
Tracy Gibson, Mark Lewis and Pedro Medelius

Coatings and Methods for Corrosion Detection and/or Reduction (Smart Coatings)
Luz Calle and Wenyan "Wendy" Li

Self-Validating Thermocouple
Jose Perotti, Josephine Santiago-Bond, Bradley Burns, Carlos Zavala and Carlos Mata

Integral Battery Power Limiting Circuit
Bradley Burns and Norman "Mike" Blalock

Methods and Systems for Advanced Spaceport Information Management
Phillip Meade and Judith "Charlie" Blackwell-Thompson

Electrodynamic Arrays having Nanomaterial Electrodes (Dust Shield)
Carlos Calle and Steve Trigwell

Method and Apparatus for Accurately Calibrating a Spectrometer
Robert Youngquist and Stephen Simmons

Insulation Test Cryostat with Lifting Mechanism
James Fesmire and Adam Dokos

Approach for Achieving Fire Retardancy in a Compatible Polymer Matrix
Martha Williams and Trent Smith

Color-Changing Tape for Hydrogen Detection
Martha Williams, Trent Smith, Luke Roberson, LaNetra Tate and Janine Captain

Aerogel/Polymer Composite Materials (Aeroplastic)
Martha Williams, Trent Smith, James Fesmire, Luke Roberson and LaNetra Tate

Foam/Aerogel Composite Materials (Aerofoam)
Martha Williams, Trent Smith, James Fesmire, Jared Sass and Eric Weiser (Langley)

Polyimide Wire Repair System
Martha Williams, Tracy Gibson, Scott Jolley, Steven Parks and Clyde Parrish

Image Processing for Binarization Enhancement via Fuzzy Reasoning
Jesus Dominguez

JUST IN CASE

New craft will be America's first space lifeboat in 40 years

BY STEVEN SICELOFF

The next generation of American spacecraft designed to carry people into low-Earth orbit will be required to function as a lifeboat for the International Space Station for up to seven months. This service has not been provided by an American spacecraft since an Apollo command module remained docked to Skylab for about three months from 1973 to '74.

Like a lifeboat on a cruise ship, the spacecraft is not expected to be called into service to quickly evacuate people, but it has to be ready for that job just in case.

Right now, the lifeboat function on the space station is served by requiring a pair of Russian Soyuz spacecraft to be docked at all times. Each Soyuz holds three people. So with two docked, there can be six people working on the station at any one time. The crew grows occasionally during the overlap periods when a new Soyuz and crew arrive but the old crew has yet to leave.

There are fundamentally two capabilities a spacecraft must perform to be called a lifeboat, said NASA engineers who are working with companies developing spacecraft in the agency's Commercial Crew Program (CCP).

First, the spacecraft needs to provide a shelter for astronauts in case of a problem on the station. Second, the ship has to be able to quickly get all its systems operating and detach from the station for a potential return to Earth.

"You've got to make sure it provides the same capability on day 210 as it does on day one," said Justin Kerr, manager of CCP's Spacecraft Office.

Two things make it tough for spacecraft designers when it comes to the lifeboat feature: power, and protection from things outside the spacecraft, such as micrometeoroids. The vast amount of electricity generated by the space station's acre of solar arrays is reserved for the station's systems and science experiments.

The amount of power dedicated for a docked crew spacecraft is similar to the amount of electricity a refrigerator uses.

"There's very little power available for these spacecraft so what we're really driving the partners to do is develop this quiescent mode that draws very little power," Kerr said.

Ideally, designers want to have the spacecraft powered off when it is attached to the station. That might not be possible, though, because air doesn't automatically circulate in microgravity the way it does on Earth. So a spacecraft, even with its hatch open inside of the station, can develop dead spots, or sections of the cabin without air for breathing, unless there is something to move the air around.

"You don't want someone to go into the spacecraft and immediately pass out because there's no breathable air in that one area," said Scott Thurston, deputy manager of CCP's Spacecraft Office.

Designers also have the unique challenge to build a spacecraft that's strong enough to withstand impact from micrometeoroids, without being too heavy to launch. Although numerous impacts are not expected, designers are still expected to show their craft can survive an occasional hit.

"It's something you have to design for, the magic BB scenario," Thurston said.

The situations when the craft will be needed are not only hypothetical, there also have been occasions on the International Space Station when crew members have taken refuge in the Soyuz because space debris was passing nearby. CCP gave aerospace companies a list of requirements their spacecraft need to meet during NASA's certification process for use as in-orbit lifeboats, Thurston said.

Boeing, Sierra Nevada Corporation and SpaceX are working in partnership with NASA on spacecraft designs that meet these criteria under their Commercial Crew Integrated Capability agreements.

Thurston said each company is coming up with its own novel solutions for the best way to meet the needs of a spacecraft that docks with the station and then stays in orbit for seven months. "There's no rock left unturned," Thurston said. "Some have started out with very extravagant environmental control and life support systems, and as they're doing their studies, they're slowly figuring out exactly what they need and what they don't need."

With a new American spacecraft also offering another four to seven seats, the station can host more astronauts than its current complement of six. That means more science on the station since more people would be available for research duties.

"You never kept more on station than you could get off the station and back home," Thurston said. "It's why we staff that station the way we do. Now, you expand the crew capacity and then the crew and that really expands the amount of science you can do." SPM

Proving his mettle

27-year NASA veteran remains inspired by destiny that 'lies above us'

BY FRANK OCHOA-GONZALES

Commercial Crew's Jon Cowart, is awarded the Silver Snoopy from NASA astronaut Mike Fincke during a ceremony June 20. Photo credit: NASA.

Jon Cowart's email signature, which comes from the movie "Intersteller," reads "Perhaps we have forgotten that we are still pioneers . . . That we've barely begun. And that our greatest accomplishments cannot be behind us . . . That our destiny lies above us."

But ask just about anyone who knows the 27-year NASA veteran and they'll tell you all about his many accomplishments and pioneering spirit.

The outspoken engineer told Spaceport Magazine he had gotten over the fact that he had never received NASA's highest honor . . . even though he really wanted one. That is, until June 20, when astronaut Mike Fincke honored Cowart at the Kennedy Space Center Visitor Complex with his very own Space Flight Awareness Silver Snoopy award.

Jon Cowart describes a model of a vehicle stabilization system for Ares I-X in 2009. Photo credit: NASA/Kim Shiflett

"I thought I was too far along in my career and it was just one of those things I was just going to have to get over, because I always wanted one," Cowart said. "I don't remember who was the first person I ever saw receive the award, but it did make an impression upon me that it was very cool and prestigious, and therefore I wanted to earn one."

As a Commercial Crew Program (CCP) deputy partner manager, Cowart is working alongside SpaceX as the company develops its Dragon V2 spacecraft for crew transportation to low-Earth orbit. His Silver Snoopy award recognizes his leadership in the development and implementation of the multi-center Partner Integration Team, or PIT, which is responsible for executing the multi-million dollar Commercial Crew Integrated Capability (CCiCap) Space Act Agreement with SpaceX.

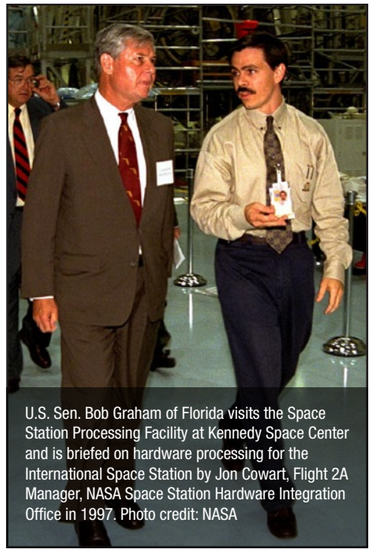
CCiCap supports the agency's commitment to foster the development of a certified end-to-end crew transportation system for use in low-Earth orbit and its commitment to the strategic goals and objectives related to human spaceflight.

Prior to joining CCP, Cowart led the team that was responsible for all of the modifications to Kennedy Space Center's Launch Pad 39B, Vehicle Assembly Building and mobile launcher for the Constellation Program's Ares I-X flight test. That was the first program to develop, build and fly a brand new rocket for the space agency in 28 years -- certainly a feat to be proud of as he helped manage the entire mission from the ground up, through launch and well after splashdown.

Before joining NASA, Cowart was a lieutenant assigned to the 6595th Shuttle Test Group at Vandenberg Air Force Base in California, where he worked as a solid rocket booster mechanical systems and handling engineer.

Cowart was in charge of the first stack of boosters at Vandenberg and then was promoted to an orbiter mechanical systems engineer. He received the Air Force Distinguished Service Medal for his work in the shuttle program. He resigned his commission as a captain to join NASA.

"I will always remember the (Henry David) Thoreau semi-quote 'Go confidently in the direction of your dreams. Live the life you've imagined.'" Cowart said. "Very few people ever realize their dream . . . I am proud that I have been able to do something I set out to do as a child."


U.S. Sen. Bob Graham of Florida visits the Space Station Processing Facility at Kennedy Space Center and is briefed on hardware processing for the International Space Station by Jon Cowart, Flight 2A Manager, NASA Space Station Hardware Integration Office in 1997. Photo credit: NASA

.S... Photo Credit: NASANASA's Jon Cowart, commercial space manager at Kennedy, addresses the participants in NASA's STS-132 Tweetup at Kennedy Space Center in 2010. Photo Credit: NASA

He's been a part of NASA's human spaceflight initiatives since 1987, with roles and responsibilities that range from a Space Shuttle Program project engineer to a member of the International Space Station redesign team.

What he seems most excited about, though, is not his past accomplishments -- it's the future.

"Working in the Commercial Crew Program, I feel I am helping to make that future where you go to a spaceport the way you go to an airport now," Cowart said. "You get in a spaceship and travel the way we travel around the United States in airplanes now. Commercial Crew is helping usher in that future." SPM

SILVER SNOOPY

The Silver Snoopy Award is part of the Space Flight Awareness Program and is the astronauts' personal award. The award is given personally by NASA astronauts as it represents the astronauts' own recognition of excellence. The award consists of a sterling silver "Silver Snoopy" lapel pin flown during a NASA mission, a commendation letter (stating the mission the Silver Snoopy pin was flown on) and a signed, framed Silver Snoopy certificate. To qualify for this award, eligible candidates will have made contributions toward enhancing the probability of mission success, or made improvements in design, administrative/technical production techniques, business systems, flight and/or systems safety or identification, and correction or preventive action for errors.

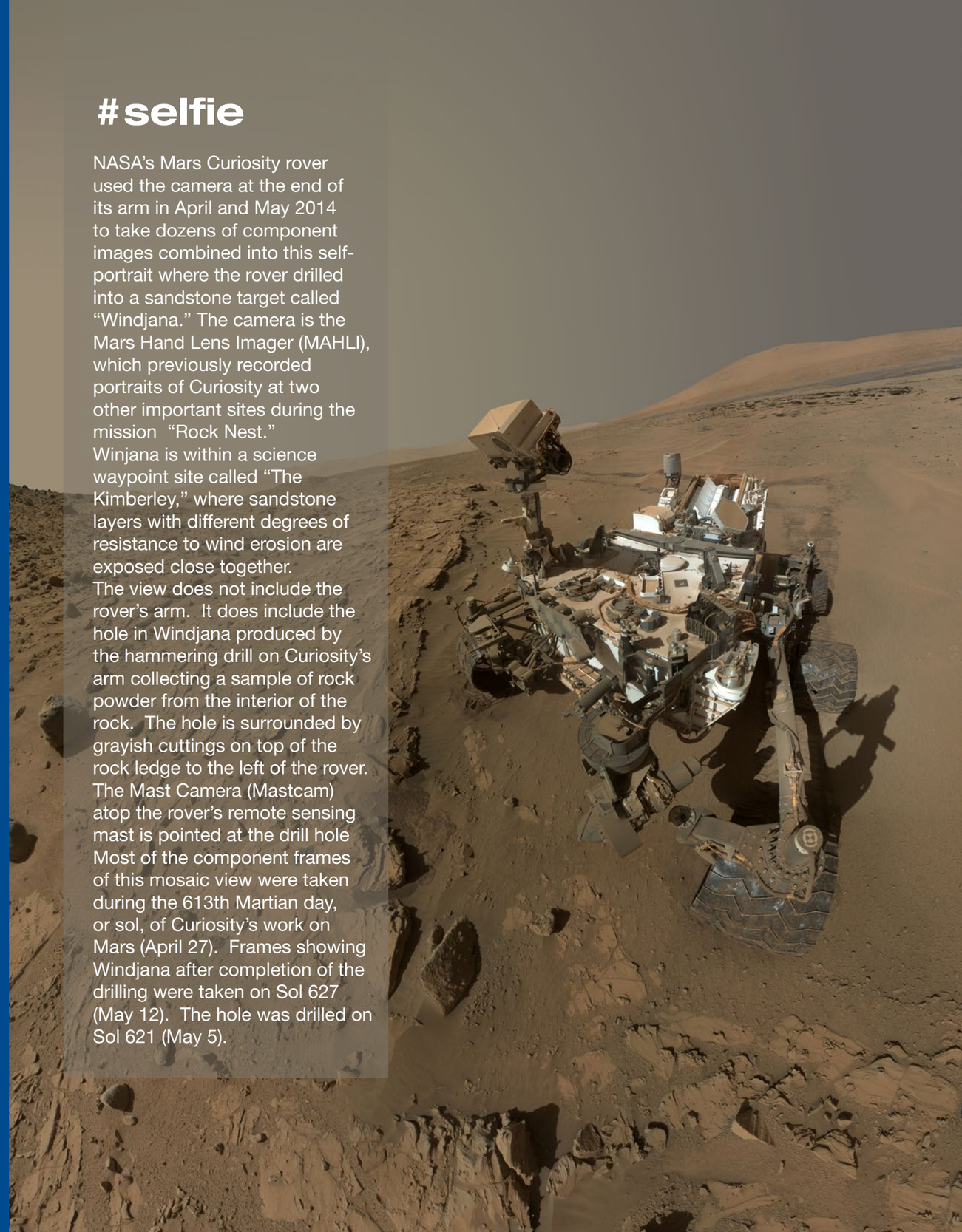
NASA searched for a symbol for spaceflight that would be well known and accepted by the public, similar to the recognition received by the United States Forest Service's Smokey Bear.

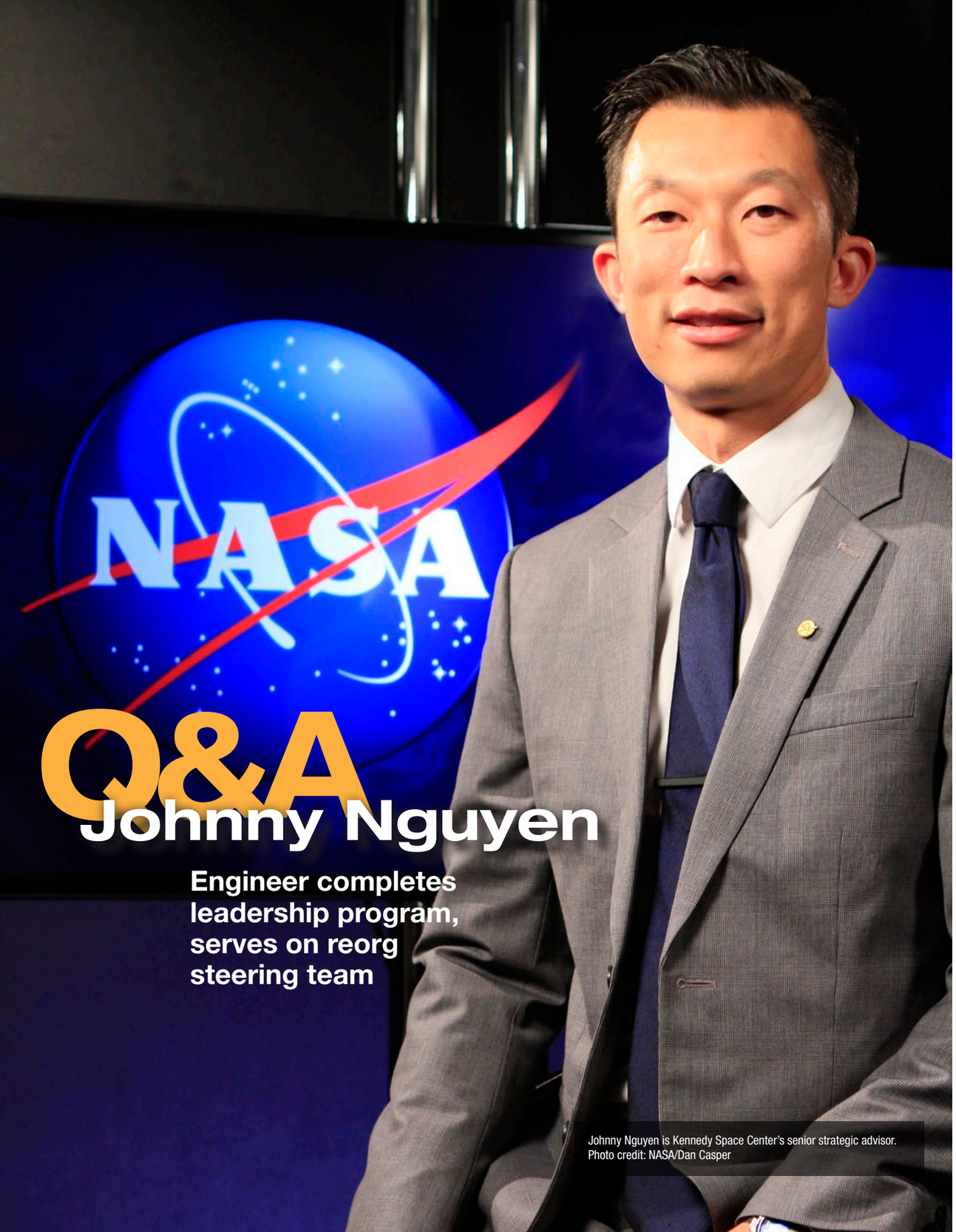
The idea for the Silver Snoopy award came from Al Chop, who was director of the public affairs office for the Manned Spacecraft Center (now called Lyndon B. Johnson Space Center). He wanted to create an award featuring Snoopy as an astronaut to be given by astronauts in recognition of outstanding contributions by employees.

Charles M. Schulz, who was an avid supporter of the U.S. space program, welcomed the idea of using Snoopy for the award. Schulz and United Feature Syndicate (the distributor of the Peanuts comic strip) agreed to let NASA use "Snoopy the Astronaut" for free. Schulz himself drew the image the award pin was based on. He also drew promotional art for posters to promote the award program.

#selfie

NASA's Mars Curiosity rover used the camera at the end of its arm in April and May 2014 to take dozens of component images combined into this self-portrait where the rover drilled into a sandstone target called "Windjana." The camera is the Mars Hand Lens Imager (MAHLI), which previously recorded portraits of Curiosity at two other important sites during the mission "Rock Nest."
Winjana is within a science waypoint site called "The Kimberley," where sandstone layers with different degrees of resistance to wind erosion are exposed close together.
The view does not include the rover's arm. It does include the hole in Windjana produced by the hammering drill on Curiosity's arm collecting a sample of rock powder from the interior of the rock. The hole is surrounded by grayish cuttings on top of the rock ledge to the left of the rover. The Mast Camera (Mastcam) atop the rover's remote sensing mast is pointed at the drill hole Most of the component frames of this mosaic view were taken during the 613th Martian day, or sol, of Curiosity's work on Mars (April 27). Frames showing Windjana after completion of the drilling were taken on Sol 627 (May 12). The hole was drilled on Sol 621 (May 5).





Q&A Johnny Nguyen

Engineer completes leadership program, serves on reorg steering team

Johnny Nguyen is Kennedy Space Center's senior strategic advisor.
Photo credit: NASA/Dan Casper

INTERVIEWED BY LINDA HERRIDGE

Johnny Nguyen was one of two engineers from Kennedy Space Center's Engineering and Technology Directorate who recently completed the Asian-American Government Executives Network (AAGEN) leadership program. He began the program in April 2013.

Nguyen began his career with NASA in 1998 as a co-op student from the University of Central Florida. He worked for the space shuttle and engineering directorates, and was most recently chief of the Fluids Test and Technology Development Branch.

He serves as the center's senior strategic advisor. He currently leads the communications sub team and is on the steering team for the center's reorganization effort. This gives him opportunity to help design the center's future identity as a multi-user spaceport.

One of his responsibilities is to communicate weekly progress updates to the NASA and contractor workforce at the center. He also is a member of the steering team and will have the opportunity to help craft the design of the center's future organization, which will further enable Kennedy's goals of becoming a multi-user spaceport and address the challenges the center currently faces.

SpM: What did you learn from your participation in the AAGEN?

Nguyen: The development program covered a wide array of topics, all meant to better prepare us for eventually entering the Senior Executive Service (SES) corps. We did case studies on different types of leadership and the proper application of them depending on the situation. Other topics included negotiation skills, ethics, mock interviews, dealing with with media relations.

SpM: When did you graduate from the AAGEN leadership program?

Nguyen: Khoa Vo and I graduated from the program April 7, just as a new class was initiated into the program, which includes Tom Engler and Denise Pham.

SpM: Why did you want to work at Kennedy Space Center?

Nguyen: I've always had a huge interest in space and astronomy. NASA should be working on things that are truly for the betterment of mankind. I love knowing that where I work is for the benefit of the human race, that we are doing things never done before, and learning things that will inspire others. And Kennedy Space Center is where you get to see the hardware and rockets take off into space.

SpM: What is one achievement you are most proud of in your work at Kennedy?

Nguyen: I would have to say working and leading, for a time, the Shuttle Transition team where we planned for the safe and efficient shutdown of the space shuttle hardware and assets. That team was truly phenomenal. It was a highly emotional topic and it was something that hand't been done for 30 years. Looking back, I feel privileged to have been a part of that team and doing something that enabled the next space program.

SpM: What are some of your hobbies or interests?

Nguyen: I love to draw and travel. In my spare time, I'm usually working on some new comic strip or planning the next big adventure. I also spend time working out in the gym, trying to be like my role model Yves Lamothe, who works in the Ground Systems Development and Operations Program at Kennedy. SPM

SpM: What advice would you give a student who is interested in pursuing a career in a field similar to yours?

Nguyen: Stay curious. Always ask questions and be hungry for more information. There are simply so many unique things we work on and there is always something of interest. Plus, we draw so much innovation from cross-pollinating ideas that by staying curious, you're bound to unlock new ideas. Don't be satisfied with just the first answer.

SpM: Do you have a mentor at Kennedy?

Nguyen: I have several mentors, some formal, and some don't even know they are mentors! Kennedy's Associate Director Kelvin Manning is one of my formal mentors. At his level, working the day-to-day operations of an entire center, he stays remarkably approachable. I admire his ability to deal with the constant stress and unpleasant duties of his job, yet remain friendly to people at all levels. That's the kind of leader I want to be—someone who gets the job done, but with a smile at the end of the day.

SpM: What are your hopes for the future at Kennedy and for NASA's exploration program?

Nguyen: Like Kennedy's Center Director Bob Cabana says, "Kennedy has a very bright future." I think the people are the pre-eminent experts when it comes to launch, landing and processing, not only on Earth, but from any surface. Our country soon will execute the Asteroid Recovery Mission, and the planetary robotic missions and Kennedy will be integral to every one of them. Not just from a launch role, but also from the technology and science role. Combine that with multi-use and our space partners also processing and launching from here, and Kennedy will be a very exciting place to be.

Johnny Nguyen, at right, receives his certificate for completing the Asian-American Government Executives Network leadership program from Acting Under Secretary for Food Safety Brian Ronholm during a ceremony April 7 at the U.S.D.A. Whitten Building in Washington, D.C.

Hex-Chrome Alternatives

Hex-Chrome Alternatives

a look online

more online

GSDO, Corrosion Lab tests new coatings for aluminum ground support equipment

The Technology Evaluation for Environmental Risk Mitigation (TEERM) Principal Center in NASA's Environmental Management Division has partnered with the Ground Systems Development and Operations (GSDO) Program to investigate alternative coatings that could serve as an option to replace the current hexavalent chromium coatings, also called hex-chrome, on aluminum structures, including large enclosures that house electronics throughout the center.

Results of the alternative coating tests will be shared with other NASA centers, the U.S. Air Force and other government agencies, and the European Space Agency.

For the complete story, go to http://go.nasa.gov/1jLVxYZ

GETTING IT WRIGHT

Clara Wright is a materials engineer in the failure analysis laboratory at Kennedy Space Center.
Photo credit: NASA/Dimitri Gerondidakis

Problem-solving interest led to engineering career

BY BOB GRANATH

From an early age, Clara Wright has been fascinated with solving problems. Along with an interest in math and science, that appeal led her to pursue a career in engineering. Today, she is a materials engineer in the failure analysis laboratory at Kennedy Space Center where she works to determine why something breaks down and how to ensure mission success in the future.

Born in Colombia, Wright and her family moved to the United States in 1988 when she was eight years old.

"My parents decided to leave because it was getting pretty dangerous in Colombia without an end in sight," Wright said.

During the 1980s, drug trafficking cartels were responsible for widespread crime in Colombia and other South American countries.

For Wright and her family, adjusting to their new home in Palm Beach Gardens, Florida, took some time.

"When we left Colombia, my dad was a college professor," she said. "He didn't know much English, so he had to start out in the U.S. being a busboy at a hotel restaurant to provide for our family. My mother had been a 'stay-at-home' mom, and she had to start working full time."

Wright expressed admiration for the effort and sacrifices her parents made.

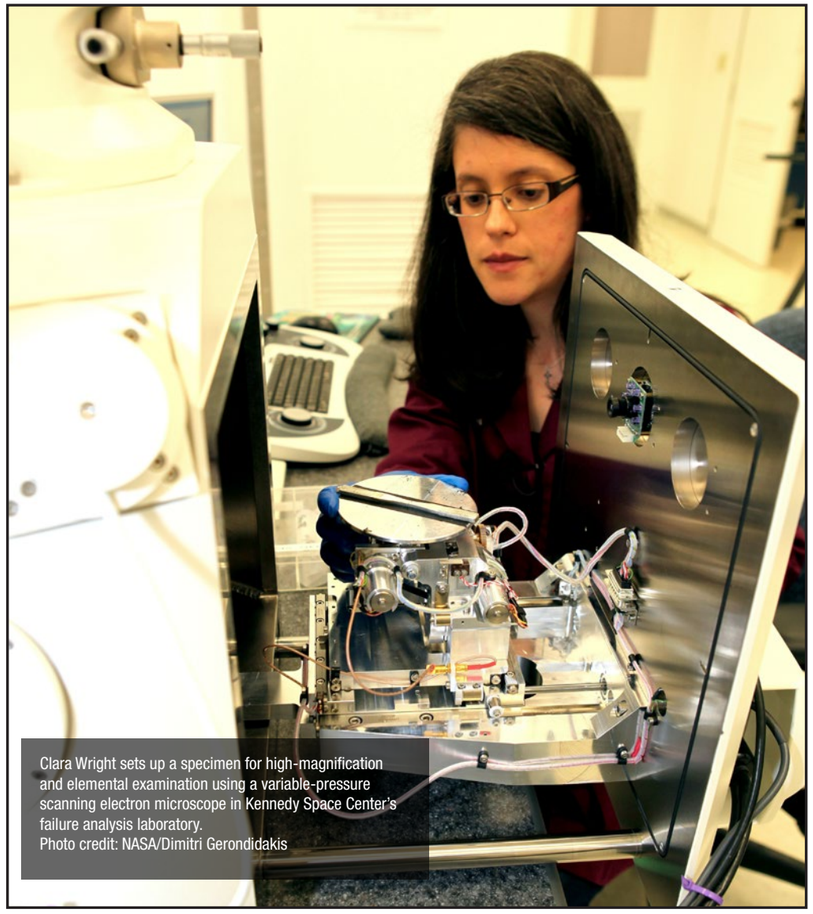
"It wasn't until I was older that I truly appreciated what they did for us," she said. "They gave up everything to give our family a better life and worked hard to overcome the initial hardships. They were an inspiration for their work ethic, and my siblings and I wanted to do the most we could with that opportunity."

It also was a difficult transition for an elementary-age girl who knew only Spanish.

"I remember coming to a new school where I didn't speak the language," Wright said. "My first day, I think I understood only two words."

As Wright learned English and continued her education, she developed an interest in problem-solving.

"From an early age, I used to really like making jigsaw puzzles -- 1,000-piece to 2,000-piece puzzles -- and I liked to see how things fit together or came apart," she said. "I was always very good at math and science, particularly math because I was not hindered by the language barrier, and one of my teachers in middle school recommended that I look into a career in engineering."



Clara Wright sets up a specimen for high-magnification and elemental examination using a variable-pressure scanning electron microscope in Kennedy Space Center's failure analysis laboratory.
Photo credit: NASA/Dimitri Gerondidakis

As she entered her teen years, Wright decided to go into her high school's math, science and engineering program so she could learn more.

"In high school I was introduced to biomedical engineering, which I really liked because it uses engineering principles to help people who need artificial limbs or prosthetics," she said. "I attended the University of Florida (UF) where I learned more about materials engineering and designing materials for biocompatibility. In taking materials engineering classes and through various summer internships, I saw that you could use materials engineering to help people across different industries and multiple applications."

Wright went on to earn a master's degree in materials engineering at Pennsylvania State University, performing research on electrodeposited nickel films for microelectromechanical systems (MEMS) and serving as a graduate teaching assistant. She received her degree in 2005, and, as was the case at UF, she graduated "summa cum laude" -- with highest distinction.

Following her work at Penn State, Wright was offered an opportunity with NASA as a materials engineer at Kennedy.

"I always had a fascination with space and when I got the job offer with NASA," she said, "I was ecstatic that I would be able to contribute and play even a small role in our nation's space program."

In eight years with the agency, Wright is

In this photo from 1985, five-year-old Clara Wright is ready for her first day of kindergarten at El Colegio de La Salle in Bogota, Colombia. Photo credit: Family of Clara Wright

considered an expert in materials engineering, metallurgy, microscopy and failure analysis. She has supported several research investigations at Kennedy, including testing and microscopy of advanced composites systems, and examining electrostatic properties of simulated Martian regolith -- the residual material that covers solid rock of the Earth, moon or planet.

"I'm very passionate about being a materials engineer," Wright said. "It's a very fulfilling career particularly at Kennedy because every investigation is unique. It is greatly gratifying to say that I am one of a handful of people in the world who get to work on hardware that is going to the International Space Station, has been in the vacuum of space or is part of the launch structures."

She points out that each day at Kennedy is different.

"We're always connecting with different groups across the agency," Wright said. "One of the more interesting opportunities that has come

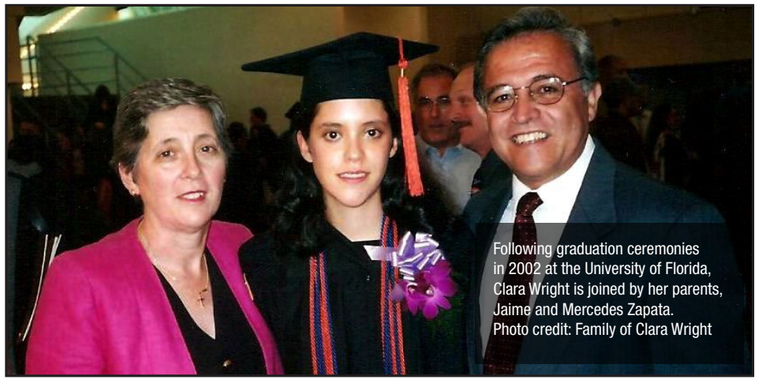
Clara Wright while working on her master's degree at Penn State. Photo credit: Family of Clara Wright

across is performing materials investigations with several astronauts. Years later when one was on his mission, he sent me an email from space reflecting on the magnificence of our planet. It was quite a treat for a young engineer."

Wright now wants to inspire young people to consider careers in science, technology, engineering and mathematics.

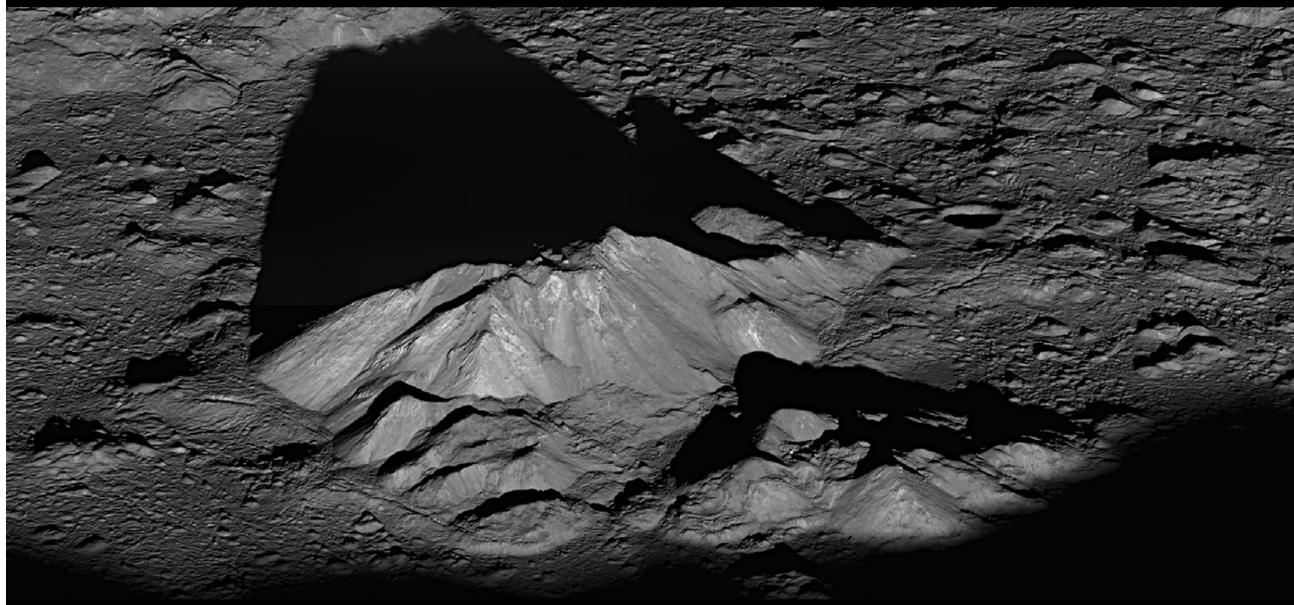
"I encourage students to think about their hobbies and see how a career in engineering would fit into that," she said. "Think about how engineers impact your everyday life -- from smartphones to computers to cars to buildings.

"There are so many things that engineers are a part of that most people, particularly children, would not necessarily think about," she said. "Engineering really teaches you to problem-solve, to think outside the box. That's going to help in any part of your life." SPM



Following graduation ceremonies in 2002 at the University of Florida, Clara Wright is joined by her parents, Jaime and Mercedes Zapata. Photo credit: Family of Clara Wright

the moon as art



And the winner is . . .

Tycho Central Peak Spectacular! Last month you voted for your favorite The Moon As Art photo. NASA's Lunar Reconnaissance Orbiter took this dramatic sunrise view of Tycho crater. Its features are steep and sharp because the crater is young by lunar standards, only about 110 million years old. Over time, micrometeorites, and not-so-micro-meteorites, will grind and erode these steep slopes into smooth mountains. For more, go to **http://lunar.gsfc.nasa.gov/moonartgallery.html**
Photo credit: NASA

Up next

Workers rotate a section of the fairing for NASA's Soil Moisture Active Passive mission (SMAP) in a lifting device in the Building 836 high bay at Space Launch Complex 2 on Vandenberg Air Force Base in California on June 3. The fairing will protect the SMAP spacecraft from the heat and aerodynamic pressure generated during its ascent to orbit aboard a United Launch Alliance Delta II rocket. SMAP will provide global measurements of soil moisture and its freeze/thaw state. These measurements will be used to enhance understanding of processes that link the water, energy and carbon cycles, and to extend the capabilities of weather and climate prediction models. SMAP data also will be used to quantify net carbon flux in boreal landscapes and to develop improved flood prediction and drought monitoring capabilities. Launch is scheduled for November.
Photo credit: NASA/Randy Beaudoin

To learn more about SMAP, visit
http://smap.jpl.nasa.gov

National Aeronautics and Space Administration

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www.nasa.gov

SP-2014-06-166-KSC

This artist rendering shows a wide-angle view of the liftoff of the 70-metric-ton (77-ton) crew vehicle configuration Space Launch System from the launch pad. The first flight test of NASA's new rocket is scheduled for 2017.