



# KENNEDY SPACE CENTER



# 20 14 | Annual Sustainability Report

**“HERE IS YOUR COUNTRY.  
CHERISH THESE NATURAL  
WONDERS, CHERISH THE  
NATURAL RESOURCES,  
CHERISH THE HISTORY  
AND ROMANCE AS A  
SACRED HERITAGE, FOR  
YOUR CHILDREN AND YOUR  
CHILDREN’S CHILDREN.”**

– Theodore Roosevelt

# CONTENTS



- 4** Sustainability & Energy Scorecard
- 8** Shoreline Restoration
- 12** Carlton Hall KSC Scientist of the Year
- 18** Dark Skies
- 26** Corrosion Lab Tests
- 32** E-Motorcycle Conversion

# SUSTAINABILITY AND ENERGY SCORECARD

The Sustainability and Energy Scorecard provides a quick snapshot of Kennedy Space Center's performance in meeting the sustainability goals outlined in the KSC Sustainability Plan. It provides a status for the functional areas spanning greenhouse gas (GHG) emissions, energy intensity, renewable energy, potable water intensity, reduction in fleet petroleum use, green buildings, pollution prevention and waste management and sustainable acquisition. The KSC Environmental Management Branch monitors the performance in each of these categories to achieve a "Go for Green" status and to identify continuous improvements.

# SUSTAINABILITY

## Scope 1 & 2 GHG Emission Reduction

**GOAL:** Greenhouse gases (GHG) are gases produced directly by human activity that trap heat from the sun and warm the planet's surface. The goal is to reduce these gases that are produced by work related to NASA's mission by at least 9.2 percent in comparison to what was produced in 2008 and will reduce this amount by 18.3 percent by the year 2020.

### ● Red

Did not reduce GHG Scopes 1 & 2 by 7.6 percent and is not on track to achieve its FY 2020 target

### ● Yellow

Reduce GHG Scopes 1 & 2 by at least 7.6 percent and is on track to meet the FY 2020 target of 18.3 percent

### ● Green

Reduce GHG Scopes 1 & 2 by at least 9.2 percent compared to the FY 2008 baseline and is on track to achieve its FY 2020 target goal of 18.3 percent

SCORE: ● *Goal Met* – 9.2%

## Scope 3 GHG Emission Reduction

**GOAL:** Scope 3 greenhouse gas (GHG) is produced from sources not owned or controlled by NASA, but are produced by activities, such as employee business travel and commuting. The goal is to reduce GHG Scope 3 by at least 6.2 percent compared to the FY 2008 baseline and is on track to achieve its FY 2020 target of 12.3 percent.

### ● Red

Did not reduce GHG Scope 3 by at least 5.1 percent and is not on track to achieve its FY 2020 target

### ● Yellow

Reduce GHG Scope 3 by at least 5.1 percent and is on track to achieve its FY 2020 target of 12.3 percent

### ● Green

Reduce GHG Scope 3 by at least 6.2 percent compared to the FY 2008 baseline and is on track to achieve its FY 2020 target of 12.3 percent

SCORE: ● *Goal Met* – 6.2%

# & ENERGY



## Reduction in Energy Intensity

**GOAL:** The two-part goal is to: a) reduce the amount of energy used per square foot in predetermined facilities (ex. Headquarters, O&C, OSB, etc.) by at least 27 percent in comparison to what was used in 2003, and b) reduce that energy by 30 percent by the Oct. 1, 2015.

### ● Red

Did not reduce energy intensity (Btu/GSF) in Energy Independence and Security Act (EISA) goal-subject facilities by at least 24 percent compared with FY 2003

### ● Yellow

Reduce energy intensity (Btu/GSF) in EISA goal-subject facilities by at least 24 percent compared with FY 2003

### ● Green

Reduce energy intensity (Btu/GSF) in EISA goal-subject facilities by at least 27 percent compared with FY 2003 and is on track for 30 percent reduction by FY 2015

SCORE: ● Goal Met – Reduced by 49%

## Use of Renewable Energy

**GOAL:** Of the energy used in facilities, 7.5 percent should be renewable energy such as solar panels above the propellants north facility. Fifty percent of that renewable energy needs to be a resource that has been created since 1999, such as a Thermal Energy Storage unit.

### ● Red

Did not use at least 7.5 percent electricity from renewable sources as a percentage of facility electricity use

### ● Yellow

Use at least 7.5 percent electricity from renewable sources as a percentage of facility electricity use but less than half (3.75 percent) was obtained from new sources (post-FY 1999)

### ● Green

Use at least 7.5 percent electricity from renewable sources as a percentage of facility electricity use. Of this 7.5 percent at least half (3.75 percent) of facility electricity use comes from new sources (post-FY 1999)

SCORE: ● Goal Met – Used 22% renewable energy – 16% was from new

## Reduction in Potable Water Intensity

**GOAL:** Reduce the gallons of water used per square foot by 14 percent as compared to 2007's, which is equal to 5.4 gal/sf and is working towards reducing that amount by 26 percent which is equal to 10 gal/sf in the year 2020.

Significant construction upgrades to Kennedy's water distribution system continued in FY 2014. To maintain water quality as new lines are installed for service, considerable flushing and testing occurred that resulted in a score of red. Although the annual goal was not met, the long-term water conservation goal is on track, particularly as the Center begins reaping the efficiency benefits of the upgrades being performed now. Current readings verify the long-term water conservation goal is on track.

### ● Red

Did not reduce water intensity by at least 12 percent from FY 2007 baseline

### ● Yellow

Reduce water intensity by at least 12 percent from FY 2007 baseline

### ● Green

Reduce water intensity by at least 14 percent from FY 2007 baseline and is on track for 26 percent reduction by FY 2020

SCORE: ● Goal Not Met – 3.1%

## Increase in Alternative Fuel Usage to Overall Usage

**GOAL:** In 2014, 34 percent of the fuel used in vehicles on the center must be alternate fuel (ex. electric, natural gas, ethanol, etc.). The Center is working towards the goal of 40 percent alternative fuel usage by the year 2020.

### ● Red

Did not increase the ratio of Alternative Fuel Usage to Overall Fuel Usage by at least 0.05 percent in FY 2014 and is not on track to achieve its 40 percent target by FY 2020

### ● Yellow

Increase the ratio of Alternative Fuel Usage to Overall Fuel Usage by at least 0.5 percent compared to FY 2005 to achieve an overall 33.5 percent target in FY 2014 and is on track to achieve its 40 percent target by FY 2020

### ● Green

Increase the ratio of Alternative Fuel Usage to Overall Fuel Usage by at least 1 percent compared to FY 2005 to achieve an overall 34 percent target in FY 2014 and is on track to achieve its 40 percent target by FY 2020

SCORE: ● Goal Met – 45%

## Green Buildings

**GOAL:** The Guiding Principles are a set of government-established criteria for federal agencies to use in building and maintaining sustainable buildings. The goal is to have 13.1 percent of applicable buildings meet the Guiding Principles by 2014 and to be working toward the goal of 15 percent by the year 2015. The use of these Guiding Principles make buildings more energy-efficient and less dependent on natural resources for heating, cooling and other operations.

### ● Red

Did not demonstrate that at least 13.1 percent of goal subject facilities, measured in either gross area or number of facilities, met the GP and is not on track to meet the comprehensive goal of 15 percent by FY 2015

### ● Yellow

At least 13.1 percent of goal subject facilities, measured in either gross area or number of facilities (but not both), meet the GP and is on track to meet the comprehensive goal of 15 percent by FY 2015

### ● Green

At least 13.1 percent of goal subject facilities, measured both in terms of gross area and number of facilities, meet Guiding Principles (GP) for Federal Leadership in High Performance and Sustainable Buildings and is on track to meet the comprehensive goal of 15 percent by FY 2015

SCORE: ● *Goal Met* – 21% of gross area and 16% of number of facilities

## Pollution Prevention and Waste Management

**GOAL:** Keep 50 percent of everyday, non-hazardous garbage and 50 percent of construction and demolition (C&D) garbage out of the landfill.

The center has two contractors who handle non-C&D solid waste disposal, one for inside the gate and one for the Visitor Complex (VC). The center (inside the gate) diverted 52% and the VC diverted 15%. The VC is a service industry with more than one million visitors annually and unique sustainability challenges not experienced inside the gate. Opportunities for improvement have been discussed and a Corrective and Preventive Plan has been generated in the Sustainable Environment Management System to document and monitor corrective and preventive activities for this goal.

### ● Red

Divert less than 43 percent of non-hazardous solid waste (excluding C&D waste) and divert less than 43 percent of C&D waste and is not on track to meet 50 percent goal by FY 2015

### ● Yellow

Divert at least 43 percent of non-hazardous solid waste (excluding C&D waste) and divert at least 43 percent of C&D waste and is on track to meet 50 percent goal by FY 2015

### ● Green

Divert at least 50 percent of non-hazardous solid waste (excluding C&D waste) and divert at least 50 percent of C&D waste

SCORE: ● *Goal Not Met* – 44% non-C&D, 80% C&D

## Sustainable Acquisition

**GOAL:** Ninety-five percent of new contract actions require the use of sustainable products and services. Some examples are the light bulbs used in your office, toilet paper and less-toxic chemicals used in cleaning your bathrooms.

### ● Red

Less than 50 percent of new applicable contract actions contain requirements for sustainable products and services

### ● Yellow

At least 50 percent of new applicable contract actions contain requirements for sustainable products and services

### ● Green

At least 95 percent of new applicable contract actions contain requirements for sustainable products and services

SCORE: ● *Goal Met* – 100%

SCORE  
CARD



# DID YOU KNOW?

**It takes about three liters of water to produce each “one liter” of bottled water, largely because of the water required in the production of the plastic bottles.**



# Restoration of Protective Shoreline COMPLETED NEAR KEY LAUNCH PADS

Majestic sand dunes along a pristine shoreline can make for a picturesque landscape. They also serve a crucial role in the natural environment.

A six-month project to repair protective sand dunes along the shoreline of Kennedy Space Center recently was completed. The effort was celebrated with a ceremony at the site of the restoration effort.



Frequent pounding from storms, especially Hurricane Sandy in October 2012, along with other weather systems, such as higher than usual tides, destroyed the sand dunes protecting important infrastructure at the spaceport.

With the additional effects of climate change showing up from Miami to Alaska, two University of Florida (UF) geologists are focusing their attention on the shores of the center.

Nancy Bray, center operations director for Kennedy, said NASA is taking the situation seriously and has plans for dealing with it. A similar plan has been prepared for NASA's Wallops Island Flight Facility in Virginia, though Wallops has not yet seen the effects that have shown up at Kennedy. "We do consider sea-level rise and climate change to be urgent," she said. "Without that secondary dune line, we could have saltwater intrusion at the launch pad."

According to Don Dankert, a biological scientist in the NASA

Environmental Management Branch of Center Operations, the work completed a reconstruction effort that began in October 2013.

"We built a 1.2 mile dune," he said. "It's all donated sand from our (U.S. Air Force) friends over on Cape Canaveral Air Force Station. They provided us with 90,000 cubic yards of beach quality sand."

Glenn Semmel, chief within the Environmental Management Branch of Center Operations, pointed out that vegetation was planted along the new dune to prevent erosion.

"All totaled, 180,000 plants were placed along the restored stretch of beach," he said. "As they take root and grow, the vines and shrubs should hold the sand in place."

The May 2 ceremony included Burton Summerfield, a senior advisor for Institutional Management in the office of the Kennedy associate director, and Becky Bolt, a wildlife ecologist with InoMedic Health Applications Inc. (IHA), joining Dankert in planting the final palmetto palm at the base of the mound.

Assistant professor Peter Adams of the UF Geological Sciences department and associate professor of geology John Jaeger, along with Kennedy officials, began developing a strategy for restoration of the space center shoreline in 2009.

"It started about five years ago with the formation of the Dune Vulnerability Team to assess the condition of our shoreline and develop a strategy to provide long-term protection," Dankert said. "Our partners with IHA, the University of Florida, the U.S. Army Corps of Engineers and the U.S. Geological Survey, helped us develop a plan for preserving our diminishing shoreline."

He added that this is just one small part of an overall project to reconstruct the dunes along the Kennedy shoreline. Over the years, tropical weather has continually battered the shoreline. Some systems pass by, but there have been a few direct hits. Even though it did not make landfall, one of the most destructive storms ever to hit the United States was



Hurricane Sandy, which pounded the beaches of Brevard County in Florida, including those at Kennedy. The storm continued up the coastline damaging the Southeastern and Mid-Atlantic states before delivering a devastating blow to the Northeast.

pads ~ a costly and complex possibility. In addition to rebuilding the dunes, the team's efforts included planting native vegetation on newly created dunes to provide soil stabilization and to benefit native wildlife. "We planted grasses, sunflowers, vines, sea grapes and



"It's a constant battle to restore the dunes that hold off the weather-induced erosion," Dankert said. "The new dune is going to provide protection for our launch infrastructure along our most critically eroded stretch of shoreline."

The new stretch of reconstructed sand dunes is near two key spaceport facilities -- Launch Pads 39A and 39B. NASA officials recently announced a 20-year property agreement with SpaceX for operation of Pad 39A for the Falcon Heavy rocket. At nearby Pad 39B, work is underway to support the agency's heavy-lift Space Launch System rocket and Orion spacecraft.

Looking further into the future, the agency is taking an approach it calls "managed retreat." That means if sea-level rise becomes insurmountable, Bray said, NASA eventually may have to move roads, utilities and perhaps even launch

palmettos," Dankert said.

The space center's shoreline also is an important habitat for wildlife, including several endangered species such as the Southeastern beach mouse, indigo snakes and gopher tortoises.

"We've done some great things working with our friends over at the (Merritt Island National Wildlife) Refuge to enhance the beach habitat, especially for our nestling and hatchling sea turtles," he said.

Dankert expressed pride in how well the sand dune project had progressed.

"Our beaches had been slowly eroding for years," he said. "We got it all done pretty quickly, starting in October and we finished a little ahead of schedule."

# ELECTRIC VEHICLES AND CHARGERS

Five new electric cars joined Kennedy Space Center's fleet vehicles through a General Services Administration Electric Vehicle Pilot Program.

One of the new vehicles is a Chevy Volt. Another, the Ford C-MAX, is a plug-in hybrid electric vehicle, or PHEV. The remaining three are Ford Focus battery electric vehicles, or BEVs. The vehicles are in use throughout the center, supporting a variety of programs and facilities.

EV chargers have been installed in order to support the program and ensure power is available to these specialized cars. Electric vehicles boast economic and environmental considerations compared to conventional gasoline-powered vehicles.



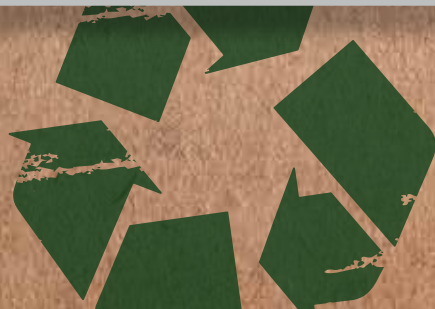


# RECYCLE

## HOW MUCH POWER IS SAVED BY RECYCLING ?

Commodity	Amount Recycled	Appliance Powered	Hours of Use
Aluminum can	10	Air Conditioner	1.7 hours
Aluminum can	10	Hair Dryer	1.7 hours
Aluminum can	10	Laptop Computer	51.9 hours
Aluminum can	10	60 W CFL Bulb	199.5 hours
Glass Bottle	10	Air Conditioner	.07 hours
Glass Bottle	10	Hair Dryer	.07 hours
Glass Bottle	10	Laptop Computer	20.9 hours
Glass Bottle	10	60 W CFL Bulb	80.2 hours
Plastic Bottle	10	Air Conditioner	.8 hours
Plastic Bottle	10	Hair Dryer	.8 hours
Plastic Bottle	10	Laptop Computer	25.4
Plastic Bottle	10	60 W CFL Bulb	97.8

Source EPA



# REC

# CARLTON HALL

## KENNEDY SPACE CENTER SCIENTIST OF THE YEAR

Ecologist Carlton Hall is on a different kind of mission at Kennedy Space Center – a mission to take care of and protect the center's land and resources for current and future generations of spaceport workers. To recognize his efforts in climate change research related to Kennedy's future launch capabilities, Hall, with InoMedic Health Applications Inc., received the KSC Scientist of the Year Award during the 2014 NASA Kennedy Space Center Honor Awards ceremony. "I was shocked and speechless," Hall said. "Everything we do here is a team effort."

Hall has worked at Kennedy for 31 years. He is the Ecological Program manager and a scientist under the Medical and Environmental Support Contract. He also was one of the founding scientists on the space shuttle and center operations ecological monitoring and research project in the early 1980s.

At that time, extensive testing was conducted to assess and document environmental impacts of space shuttle launches, and the results were summarized in a recently-published NASA technical publication, "Ecological Impacts of the Space Shuttle Program at John F. Kennedy Space Center."

Hall and his team work closely with the U.S. Fish and Wildlife Service at the Merritt Island National Wildlife Refuge. The refuge recently was selected by the U.S. Department of the Interior as one of three test sites nationwide to conduct research on how to enhance scrub jay habitats. Florida scrub jays have been on the threatened species list since 1987.

"Carlton always strives to put Kennedy at the forefront of ecological research and find ways to showcase what an incredible place the center is," said John Shaffer, environmental planning lead in the Center Operations Directorate. "He and his group of scientists and researchers have showcased Kennedy's unique environment and ensured NASA continues to succeed with its mission."

Working together they have made significant progress in determining how controlled burns are conducted for land management, proposing smaller patches of burns rather than burning huge swathes at the same time.

They also work closely with the U.S. Air Force, the

National Park Service and university partners to collect information and develop knowledge for environmental compliance and natural resource management needs in east central Florida.


"Our goal is to ensure that NASA operates the center in a sustainable and environmentally-friendly way," Hall said. "We are situated in an ideal place to study climate change. KSC is in the transition region between the subtropical and temperate climatic zones. As temperatures rise, we expect to see a shift in the species of plants and animals present in our ecosystem."

Hall and his group are working on a Climate Adaptation Science Investigators program to assess the risks associated with multiple climate change scenarios at Kennedy. Areas of concern include infrastructure, workforce health and safety, critical assets and natural resources. The investigation looks at how climate change and sea-level rise could affect the center's current facilities, assets and workforce, and what it could mean for the construction of new facilities in the future.

"Long-term tide gauge, weather station and satellite data indicate temperatures and sea level have been rising for the last century, and the rates appear to be accelerating. Though for the last three years, this area has been in a water deficit," Hall said. "But that could change, and it's important to identify Kennedy roads or facilities that could be flooded if water levels rise due to more intense storms."

Another concern with rise of water level is underground contaminants from past activities. Hall said a rising water table has the potential to carry undesirable chemicals to the surface, possibly impacting human and ecosystem health. "There is still so much to learn about how our ecosystem responds to hydrologic conditions, fire and man-made change, and Kennedy represents a unique and amazing 'outdoor living laboratory' where this type of research can be conducted," Hall said.

Hall analyzed sea-level rise projections in various areas around the center and compared them to projected facility life cycles. The data he and his group produced recently was



incorporated into the Kennedy Master Plan and the KSC Future Development Concept document. Hall said beach erosion already is a real problem along Kennedy's coastline. A sand dune restoration project was completed in 2014 along a mile of the Atlantic Ocean shoreline between Launch Pads 39A and 39B in an attempt to protect those facilities from storm surges and rising tides. Construction workers removed a section of the railroad west of the dunes, along with the gravel beneath, to recycle the materials and ensure sea turtles can continue to nest successfully in the area after the dune is restored.

Hall has a bachelor's and master's of science degree in wildlife and fishery science from Texas A&M University in College Station, and holds a doctorate in environmental science from the College of Engineering at Florida Tech in Melbourne.

***“Our goal is to ensure that NASA operates the center in a sustainable and environmentally-friendly way.”***



# ARTIFACTS PROGRAM



By donating priceless space artifacts, NASA does more than share its past successes with the world -- it also prevents these items from landing in landfills.

In keeping with NASA's policy of educating and informing the public through exhibits, the agency encourages the donation of appropriate artifacts to eligible museums, schools, universities, libraries and planetariums. Sharing these artifacts helps to preserve evidence of NASA's activities, successes and discoveries, and makes this space history tangible -- which in turn advances initiatives promoting science, technology, engineering and math.

The artifacts program has spared many donated items that otherwise would be sent to landfills due to their sensitive nature, export control or demilitarization requirements. The center's property disposal officer coordinates with the NASA Headquarters Logistics Management Division and the NASA Artifact Working Group to ensure artifacts are properly screened. When an item loses its technical ability or is no longer needed, it's a team effort to ensure these items are identified.

A Web-based Artifact Screening Module, hosted and maintained by the General Services Administration, makes it possible for eligible organizations to screen, request and receive NASA artifacts.

This effort began in 2009 and remains active today.

# DID YOU KNOW?

Every ton of paper recycled can  
save the energy equivalent to  
165 gallons of gasoline



# OUTREACH ACTIVITIES

Kennedy employees participated in special events designed to give them more opportunities to take an active role in living sustainably, both at work and at home.

The Environmental Management Branch held an Earth Day Sustainability Fair beside the Pathfinder Fitness Trail on April 22. More than 500 employees attended the fair, which showcased home, garden, transportation, nature and recycling products and services from 18 local and state vendors.

Workers had the chance to clear space in their homes and divert usable materials from the landfill at the 2014 KSC America Recycles Day events on Nov. 13-14. More than 200 people donated 12 bins of personal electronics, 11 pallets of televisions, 2,000 pounds of clothing and 27 bicycles.

The clothing and bicycles were given to the North Brevard Charities Sharing Center in Titusville, Florida. The bicycles were to be refurbished by inmates at the Brevard County Sheriff's Farm, then given to low-income children, homeless adults and veterans.





# DID YOU KNOW?

**According to the United States Environmental Protection Agency, the air inside of a home is two to five times more polluted than the air outside, mainly because of household cleaners and pesticides.**



# KENNEDY SPACE CENTER KEEPS DARK SKIES For sea turtle nesting



They 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. 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.

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 factor in the reproductive phase of their life history. They need near-shore access and sand that's in good shape for constructing their nests," said Jane Provancha, a wildlife ecologist with InoMedic Health Applications (IHA). "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.

"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."

"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."

Lighting can interfere with females finding their way back to the water. Disoriented female turtles have ended up in homeowners' pools, on back porches, and unfortunately, sometimes they end up 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. Any delay on the beach can result in increased dehydration, exhaustion, predators and death.

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).

Remember these three Golden Rules for lighting.

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. Full cutoff or fully recessed fixtures are recommended. 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.

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.

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.

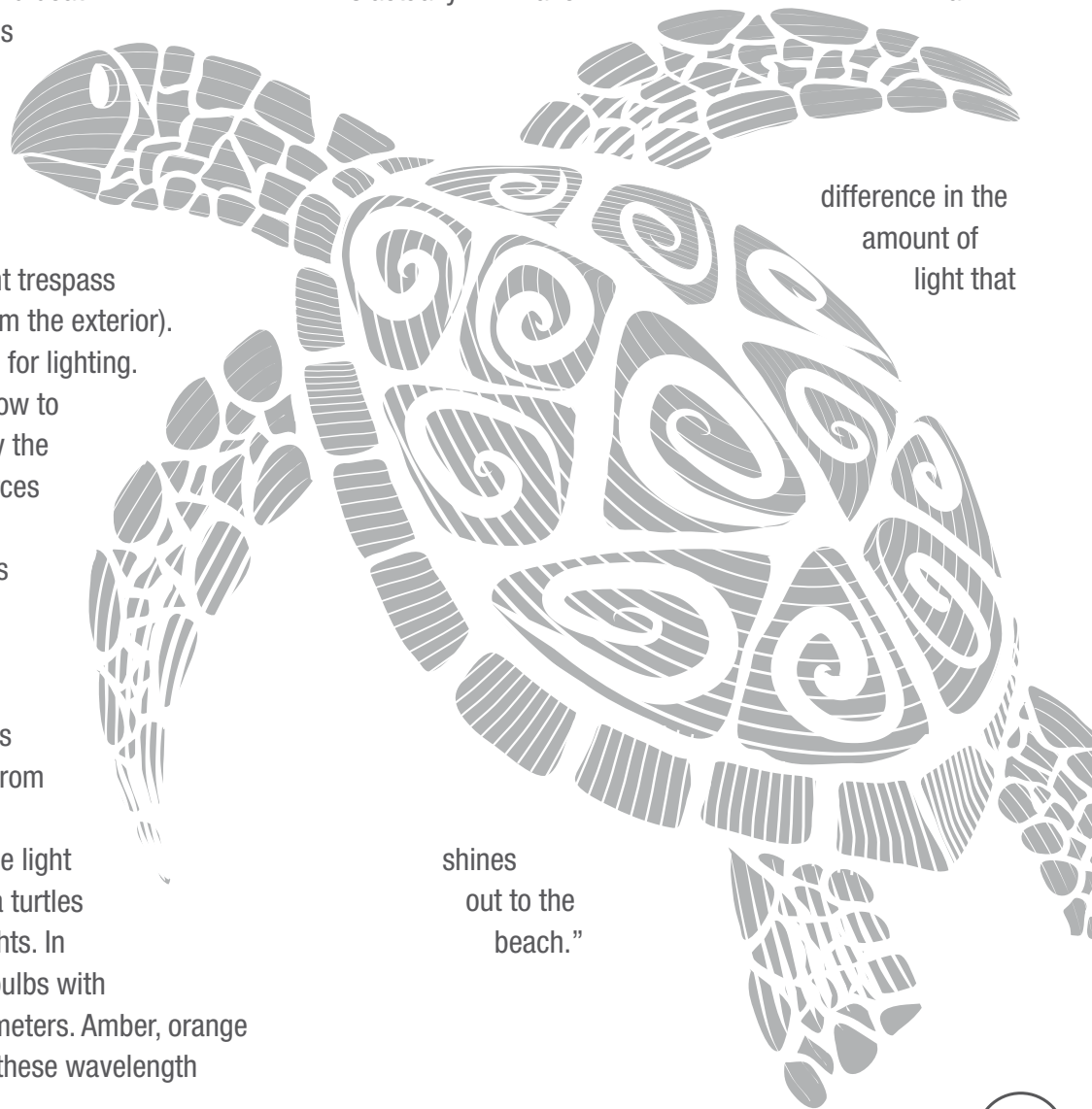
"One hatchling in a thousand will make it to the reproductive stage," Gann said. "The Kennedy beaches must be preserved to help the sea turtle species to survive. Before you leave the office in the afternoon, flip off the lights or draw the shades.

This actually will make

a

difference in the amount of light that

shines out to the beach."



# NEIL ARMSTRONG OPERATIONS & CHECKOUT BUILDING LEED SILVER CERTIFICATION

One of the spaceport's most iconic facilities earned a prestigious certification following a major upgrade that provided sustainability improvements from the inside out.

On June 6, the U.S. Green Building Council officially awarded its Leadership in Energy and Environmental Design (LEED) Silver Certification to the Neil Armstrong Operations and Checkout (O&C) Revitalization project.

The approximately 255,000-square-foot O&C north building is used by several NASA programs at Kennedy. The facility first opened in 1964 for the assembly and testing of the Apollo spacecraft, and continues to play a vital role in spaceflight history as the agency prepares to embark on the next giant leap in



space exploration.

Renovations began in May 2005 and concluded in June 2013, incorporating modular offices and modernized conference rooms, energy-efficient lighting, and new communications, data networks, fire sprinkler system and heating ventilation and air-conditioning (HVAC) systems.

Since the upgrade, potable water use has been reduced by a third, and connected lighting power density has been reduced by 15 percent. More than 89 percent of construction waste during the project was diverted from the landfill, and 95 percent of furnishings were redistributed throughout the center or repurposed. Energy star-rated equipment and appliances are installed throughout the facility, and 12 percent of the total building material content, by value, was manufactured using recycled materials.

# DID YOU KNOW?

**The United States uses an estimated 13 billion pounds of paper towels a year.**

**If everyone used one less paper towel a day we would save 5,710,230 pounds of paper a year (that is more than 7,000 trees).**



# ENERGY IMPROVEMENTS TO OPERATIONS SUPPORT BUILDING II

The Operations Support Building II in Kennedy's Launch Complex 39 area received several modifications designed to improve energy use.

Known as OSB II, the 189,000-square-foot facility opened in 2006. The project aimed to improve the five-story building's overall energy efficiency and ensure a sustainable and effective work environment for employees. A variety of heating ventilation and air-conditioning (HVAC) and building control system upgrades made the improvements a reality.

Center Operations led the effort with the design-build company SGM Engineering of Orlando, Florida. The project was awarded in September 2011 and modifications were substantially complete in April 2014.

A year of energy and water data collection will end in May 2015, paving the way for Center Operations to apply to the U.S. Green Building Council for LEED certification.



# DID YOU KNOW?

According to the Environmental Protection Agency, you can save enough energy to operate a laptop computer for 52 hours or a 60W CFL light bulb for 200 hours by recycling just ten aluminum cans.



# DID YOU KNOW?

For every million smart phones recycled, we can recover 35,274 pounds of copper, 772 pounds of silver, and 75 pounds of gold and 33 pounds of palladium. To conserve on these precious natural resources and help protect our planet, please consider donating, selling or recycling your phone.





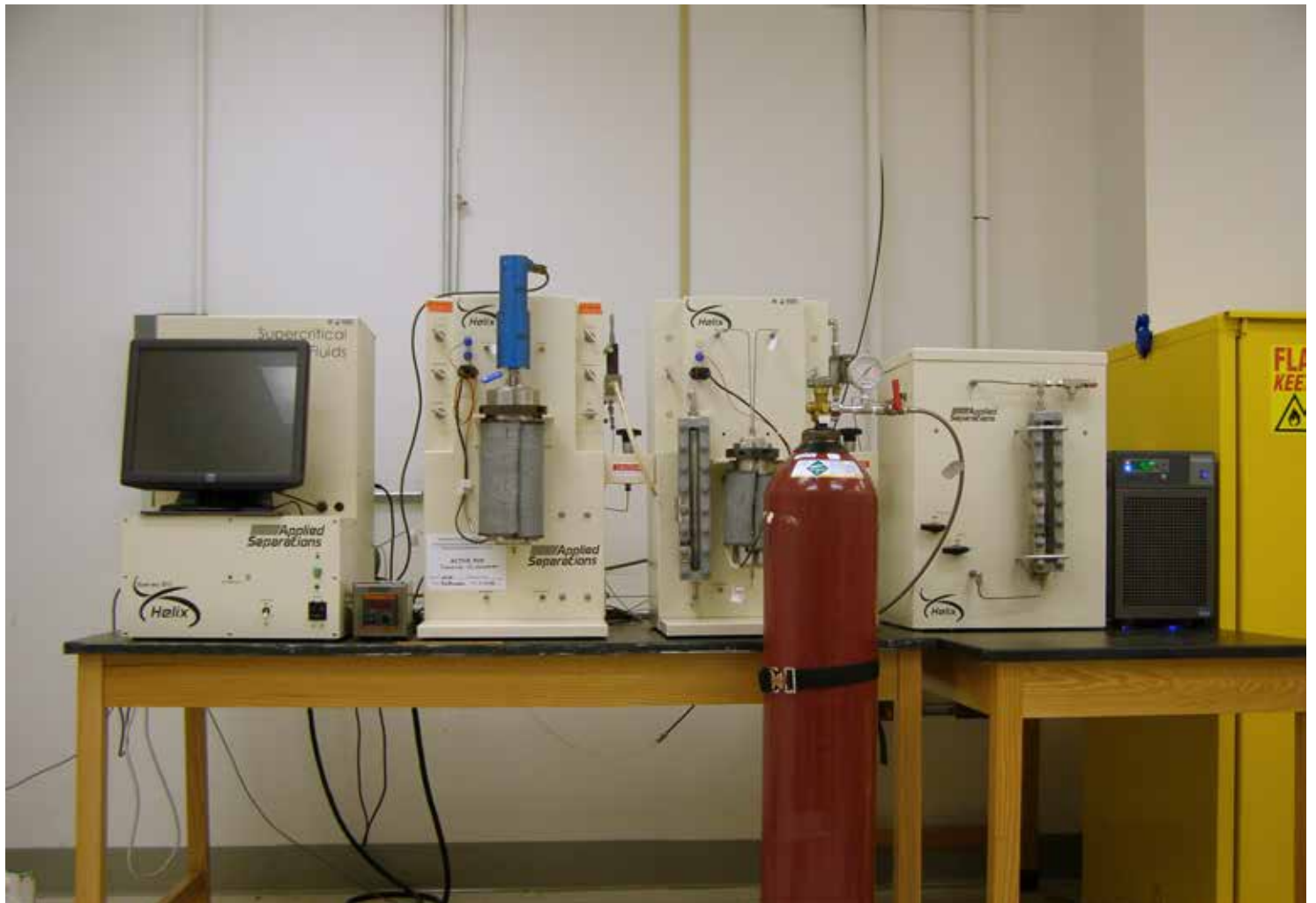
# LIQUID-FREE PRECISION CLEANING

Two newly developed liquid-free, precision cleaning methods offer all the benefits of a solvent – without the environmental risks.

Cleaning solvents have a history of polluting groundwater, destroying Earth's ozone layer and potentially contributing to climate change. In the past, solvents would be phased out due to new environmental regulations, but because the replacement solvents typically were not much better, they also would be phased out over time.

With support from the agency's Ground Systems Development and Operations Program, a team of NASA civil servants, NASA postdoctoral fellows, and contractors sought to develop truly sustainable precision cleaning technologies that would comply with regulations for the long term.

One technology relies on a plasma, while the other cleans with supercritical carbon dioxide. But both are used in the same manner: parts are placed inside the cleaning vessel, and when the process is complete, the cleaned, dry parts can be removed. These technologies have been demonstrated to effectively clean greases and oils on a small scale in the laboratory setting, and the team currently is evaluating their performance on larger-scale valves, pipes and tubing. If the new cleaners are proven to work, they'll be ready to use across Kennedy Space Center.





# GSDO, CORROSION LAB TEST NEW COATINGS FOR ALUMINUM GROUND SUPPORT EQUIPMENT

Kennedy Space Center continues to transform into a multi-user spaceport of the future, and many of the center's facilities are undergoing upgrades and modifications to support processing and launch of NASA's Space Launch System and Orion capsule in 2018 and beyond.

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 Program (GSDO) 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.

"It is rewarding to partner with the TEERM team as they continue to successfully research alternatives that benefit the environment and reduce corrosion control costs at the center," said Bill Simmonds, GSDO project manager for Environment and Infrastructure.

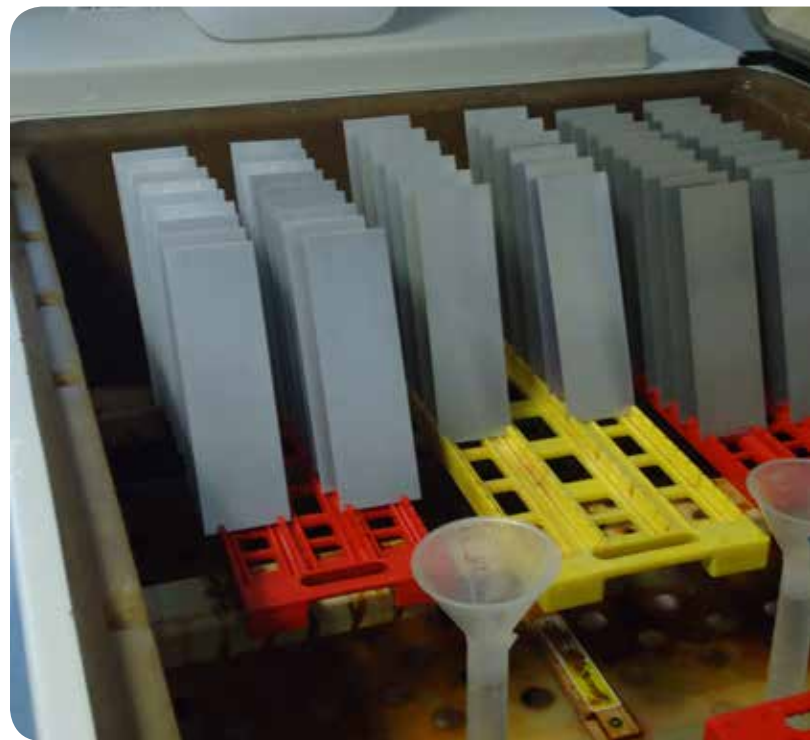
The center has used hex-chrome coatings on aluminum structures because of its self-healing and corrosion resistant properties. Kennedy is looking for environmentally-friendly alternative coatings that will meet performance requirements in corrosion protection, cost, operability, health and safety, as well as conform to Occupational Safety and Health Administration requirements.

"NASA's Technical Standard (NASA-STD-5008B) includes a list of approved primers and topcoats for carbon steel, stainless steel and aluminum on launch structures, facilities and ground support equipment," said Joni Richards, TEERM program manager. "One of our goals is to update several sections of the standard in order to correct or improve the use of these specified coatings based on Kennedy's test results thus far."

Kurt Kessel, a project manager with ITB Inc. is overseeing the testing of alternative coating samples at the Corrosion Technology Lab in the Operations and Checkout Building

and the Beachside Atmospheric Test Facility. The project is a continuation of work begun during the Space Shuttle Program.

Phase I testing began in March 2013 and focused on conversion coatings. Aluminum test panels were immersed in two alternative trivalent chromate conversion coatings, and tested in the corrosion lab for salt spray resistance at the beachside facility. Direct Current resistance measurements also were taken at the beach during specified intervals.



"Both alternative conversion coatings passed both tests," Kessel said. "They performed as well as, and in some cases, better than hex-chrome."

During Phase II, which began in late August 2013, Kessel investigated how well a primer coating would perform when added on top of the trivalent chromate conversion coating. Three different coating systems, selected from the

NASA Standard of primers and coatings, were tested in the corrosion lab for 2,000 hours in October and November 2013, and at the Beachside Test Facility for 10 months so far. The tests were performed to determine which of the three would be deselected and not move on to Phase III testing.

“There are many variables that need to be considered when looking at primers and coatings for flight or ground support equipment,” Kessel said. “We are gathering test results and sharing them with GSDO on a monthly basis.”

During Phase III testing, which began in April 2014, one coating product was selected for the test. The conversion coating was eliminated, and the test product was sprayed directly onto the aluminum in what is called a single step direct-to-metal application.

Kessel said the coating passed the adhesion test and

performed very well. Salt spray tests in the corrosion lab are in progress. Corrosion tests at the Beachside Test Facility will be completed in the fall.

The TEERM project office is preparing to test four more direct-to-metal coatings in August. Kessel said three of the selected coatings are on the approved NASA Standards list but in the past have been used in tandem with a conversion coating.

“These results could lead to significant cost savings if the direct-to-metal, single coat process, meets performance requirements,” Kessel said.

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.



*“These results could lead to significant cost savings if the direct-to-metal, single coat process, meets performance requirements.”*

# DID YOU KNOW?

**Only 15% of plastic water bottles are recycled while 66 million bottles end up in landfills or in the ocean every day.**



# HEADQUARTERS HVAC RETROCOMMISSIONING

Kennedy's Headquarters Building has served as the administrative backbone of the Florida spaceport for nearly 40 years. Through retrocommissioning, the facility's heating, ventilation, and air conditioning (HVAC) system now is being optimized for improved energy efficiency.

The Headquarters Building's HVAC energy consumption had been high due to excessive cooling and heating.

Retrocommissioning improves the function of existing equipment and systems to enhance performance.

Retrocommissioning efforts at the facility began in 2014 with a focus on tuning and optimizing air handling unit fan speeds, cooling and heating temperature set points, and system control programs. The ISC Energy Office and HVAC shop is leading the effort, along with ISC and Center Operations system maintenance engineers.

The building's monthly rate of energy consumption is expected to decrease further as optimization continues.

Retrocommissioning efforts eventually will be expanded to other facilities across Kennedy.



# DID YOU KNOW?

**Each year the United States uses 30 billion plastic and 10 billion paper grocery bags, requiring approximately 14 million trees and 12 million barrels of oil.**



# COOLANT RECOVERY PROJECT

Innovations at Kennedy's Launch Equipment Shop (LES) have dramatically reduced the amount of controlled waste while making the shop a healthier work environment.

The combination of a reusable coolant and a new coolant recovery system resulted in a 90 percent drop in controlled waste sent out for disposal.

Historically, the LES produces 1,100 gallons of coolant waste per year. The coolant recovery system installed in September 2014 transfers used fluid to a recovery unit that uses a centrifuge to clean it. After the fluid is cleaned, 90 percent of it is recovered and automatically mixed with de-mineralized water, making it ready to use once again. The remaining 10

percent contains solids and is discarded as controlled waste. The LES also switched to CIMFree, a reusable and biodegradable coolant that meets all environmental and industrial requirements. The LES has replaced the coolant on seven of the 15 machines that will use CIMFree, which eventually will be cleaned and reused indefinitely.

Led by TOSC Asset Management, this project has not only reduced controlled waste, but has made the machine shop a better workplace by eliminating noxious odors and airborne biohazards present in used coolant.



# E-MOTORCYCLE CONVERSION



Ever wish you could get to work for only a few pennies? For Otis Deal, who works in the Prototype Lab at Kennedy Space Center, it's only that much.

Deal, an engineering technician, grew tired of the cost of gasoline and converted a gas-burning internal combustion engine 1993 Kawasaki Vulcan 500 into a fully electric motorcycle, which he named Shocker.

"I have always been into motorcycles and thought an electric motorcycle would be a great platform to try this on," Deal said. "I also did it because I thought it'd be a cool thing to do."

Deal took out the engine and replaced it with 24 battery cells, creating a 72-volt system. The only major change Deal

made was replacing the forks, which was necessary to fit/support the batteries.

"Otis Deal did a great job on building his e-motorcycle," NASA transportation officer Bruce Chesson said. "I applaud him for his spirit and wanting to reduce petroleum and save money on energy as well as challenging himself to take on such a project."

Green initiatives are important to the center as they are to employees. Kennedy operates 78 low-speed electric vehicles on the center and at the visitor complex.

"We have driven electric vehicle conversions on center for five years. They were a Smart Car and a PT Cruiser and from time to time we have had additional (electric vehicles)



# SAVES WORKER GAS MONEY

such as the Smart convertible and a Mini Cooper,” Chesson said. “NASA Transportation has demonstrated almost every electric vehicle, low-speed and high-speed that has been available to the market, including Hydrogen Fuel Cell vehicles which are electric vehicles which use hydrogen as its energy source instead of battery packs.”

Deal, who spent \$7,500 to build Shocker, said a smart charger came with the battery system. There are two ports that plug into the bike from a standard 110-volt outlet. When the batteries get to 50 percent depth of discharge, it takes

***The biggest drawback  
“I can’t do  
wheelies.”***

about two to three hours to charge them. Once the charge is complete, the charger turns off automatically.

One might think that Deal has a degree in electrical engineering or, at the very least, is very knowledgeable about electronics. But, he claims, he’s not even close to being an expert.

“I’ve never been good with electronics and I previously had no knowledge of electronics,” Deal said, “so I thought this would be a great way to learn.”

According to Deal an average Joe can build one a bit cheaper depending on set up, battery selection, chassis selection, the look, etc. Deal said there are several ways to set up an electric motorcycle. It depends on requirements for the build: how far one may need to travel; and what speed one wants to go; and how often one can charge, among other smaller factors.

Shocker, which weighs 400 pounds, can go up to 65 mph and travel 40 to 50 miles on a single charge depending on conditions.

Deal did a comparison by cost per mile. It costs 27 cents and 24 cents a mile to drive his gas-powered car and truck, respectively, to work; and less than a penny a mile to drive Shocker to work. And believe it or not, Deal’s motorcycle

actually does better in the city than the highway.

While Deal was inspired by the lower cost of fuel, he also welcomed the zero emissions from an electric motorcycle. “They say every little bit helps and I figure I’m doing a very small part,” Deal said.

Chesson added that Kennedy is scheduled to receive some electric vehicles as replacement GSA lease vehicles that include a mix of GM Volts, Ford C-Max Plug-in Hybrids and



the Ford Focuses.

“We continue to strive to green our fleet as well as work toward a solution that will allow charging for government and public on center as well as for our guest that come to the visitor complex,” Chesson said.

Deal hopes to inspire the center to support workers who want to ride or drive to work using electricity.

“Maybe someday we will be allowed to plug in out here on center,” Deal said. “If employees know we can plug in EVs (electric vehicles) out here, maybe it will inspire other people to buy or build their own EVs.

“Some people commute from too far away to buy an EV that could make it to work and back home without charging it here. When we can charge up out here, maybe others will be inspired to buy or build something that can be a little greener for our environment.”

Deal hopes someday he can build an electric car on a rail buggy platform.

The biggest drawback for Deal? He said, “I can’t do wheelies.”



# DID YOU KNOW ?

**According to the EPA if every home replaced one standard bulb with an Energy Star bulb, we'd save enough energy to light 2 million homes for a year.**

# FLORIDA COMMUTER CYCLE

John H. Jones' bright-yellow ride may turn heads with its appearance – but its fuel-efficient performance is even more noteworthy.

The custom-built single-seater gets 150 miles per gallon at 55 mph and can travel more than 600 miles per fill-up. Weighing in at only 288.4 pounds, the three-wheeled cycle comprises an epoxy resin/fiberglass cloth aerodynamic fairing on a MIG-welded steel tube frame. Jones rides in a reclined driving position, using joystick-interlinked motorcycle controls for steering, braking and signaling. The spoked front wheel sets came from 1978 Honda Express mopeds, and the rear wheel set from a 1971 Honda Scrambler.

Douglas Malewicki of Irvine, California, designed the cycle to meet the strict California state transportation laws for freeway-legal vehicles. Its

construction satisfies the requirements of Florida state statutes pertaining to motorcycles.

It's also a past record-holder. For many years, Jones' commuter cycle took the record for highest gas mileage for a freeway-legal vehicle in the "Guinness Book of World Records."



# DID YOU KNOW?

**An estimated 12 million barrels  
of oil is required to make the 380  
billion plastic bags that are used  
in the U.S. every year.**



# NEW, POWER-EFFICIENT DATA CENTER

Multiple data centers at Kennedy now are consolidated into a single new, power-efficient Data Center, demonstrating more efficient use of power and space.

At only 16,000 square feet, the Data Center replaces approximately 49,000 square feet previously dedicated to data centers and IT support areas. Server removals have thus far resulted in an \$800,000 annual power savings. The new facility not only adds to that savings, but represents a reduction in the Kennedy footprint by allowing the demolition of the 136,000-square-foot Central Instrumentation Facility, an Apollo-era building that for decades was the hub of instrumentation and data processing operations.

This consolidation is a part of a focused effort to meet the center's environmental sustainability and energy reduction goals. Work on the new facility began in November 2013 and construction is nearly complete. It is expected to be ready for occupancy in May 2015.

The project is on target to receive Silver certification under the U.S. Green Building Council's LEED rating system.





National Aeronautics and Space Administration

**John F. Kennedy Space Center**  
Kennedy Space Center, FL 32899

[www.nasa.gov](http://www.nasa.gov)

SP-2015-02-046-KSC