



KENNEDY SPACE CENTER'S
SPACEPORT
m a g a z i n e

CASSINI MISSION ENDS



WITH FINAL PLUNGE TO SATURN

KENNEDY SPACE CENTER'S SPACEPORT MAGAZINE CONTENTS

- 4..... NASA's Cassini spacecraft makes final descent to Saturn
- 8..... Kennedy Space Center safely weathers Hurricane Irma
- 10..... Wayne Kee inducted into Public Service Hall of Fame
- 14..... Advanced Plant Habitat verification test complete
- 16..... Oil Pharmacy streamlines petroleum distribution at Kennedy
- 18..... Energy Awareness Month to focus on solar power
- 22..... Workshops provide resources, training to Florida STEM teachers



COVER: With this view, Cassini captured one of its last looks at Saturn and its main rings from a distance Sept. 11, 2017. The Saturn system has been Cassini's home for 13 years, but that journey came to an end Sept. 15, 2017, when the spacecraft made its final plunge to Saturn. Image credit: NASA/JPL-Caltech/Space Science Institute

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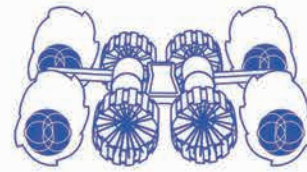
NASA'S LAUNCH SCHEDULE

Date: Nov. 10
Mission: NOAA Joint Polar Satellite System-1 (JPSS-1)
Description: JPSS is a next-generation environmental satellite system. It is a collaborative program between the National Oceanic and Atmospheric Administration (NOAA) and NASA. The polar-orbiting weather satellite will launch from Vandenberg Air Force Base in California on a United Launch Alliance Delta II rocket.
<https://go.nasa.gov/2rW4DCf>

Date: Dec. 8
Mission: Ionospheric Connection Explorer (ICON)
Description: The Ionospheric Connection Explorer will study the frontier of space, the dynamic zone high in our atmosphere where Earth weather and space weather meet. ICON will launch from Kwajalein Atoll aboard an Orbital ATK Pegasus XL rocket.
<https://www.nasa.gov/icon>

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ALWAYS EXPLORING



The Earth is the cradle of humanity, but mankind cannot stay in the cradle forever.

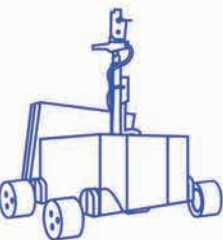
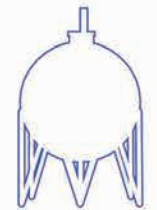
-Konstantin Tsiolkovsky



I am a robotics and design engineer and a founding member of the Swamp Works lab at Kennedy Space Center. The majority of my job entails technology development for surface systems. This basically means whether we go back to the Moon or go to Mars, we will eventually need landing and launch pads, roads and habitats, and we will need to use the resources that are available at our destination for construction and for the return propellants to get back to Earth.

The coolest part of my job is coming up with new technology that will help NASA have a sustained presence on the Moon or Mars.

When not at work, I enjoy spending time with my two daughters and my wife, and hanging out with friends. One fun fact about me that my co-workers give me a hard time about is that I have never watched any of the Star Wars movies.



To learn more about Drew Smith, go to <https://youtu.be/Y5LXs9AfF9g>



**Exploration Research and
Technology Programs**

GRAND FINALE

NASA's Cassini spacecraft makes final descent to Saturn

BY LINDA HERRIDGE



The spacecraft that revealed the remarkable planet Saturn to the world and sent back stunning images of its rings and nearby moons has completed its mission. NASA's Cassini spacecraft made its final grand finale plunge into Saturn's atmosphere Sept. 15, 2017. Cassini made distant flybys of Saturn moons Janus, Pan, Pandora and Epimetheus before making its last dive.



A seven-year journey to the ringed planet Saturn begins with the liftoff of a Titan IVB/Centaur carrying the Cassini orbiter and its attached Huygens probe. Launch occurred at 4:43 a.m. EDT, Oct. 15, 1997, from Launch Complex 40 at Cape Canaveral Air Force Station in Florida. Photo credit: NASA

The spacecraft and its attached Huygens probe launched aboard a Titan IVB/Centaur rocket on Oct. 15, 1997, from Launch Complex 40 at Cape Canaveral Air Force Station in Florida, on its seven-year, 2.2-billion-mile journey. It traveled another 1.1 billion miles while in orbit around Saturn.

Chuck Dovale, deputy program manager of the Launch Services Program at the agency's Kennedy Space Center in Florida, served as the alternate launch director for the Cassini mission.

"Truthfully, I was probably scared to death because it was such an important mission for NASA at the time," Dovale said. "It was huge for the expendable launch vehicle (ELV) community."

Dovale recalls that the day of the first launch attempt, the ELV team stood down due to high winds, which actually served as a good practice round. When they came in the second day, the actual day of launch, it felt like they had more experience.

"It was definitely hand-wringing and a lot of stress," Dovale said. "We worked anomalies through countdown. Processing and launching Cassini was such a high bar to set for the expendable launch vehicle team. And the Titan IV rocket was a pretty new vehicle to the organization at the time."

Processing Cassini was different back then compared to present

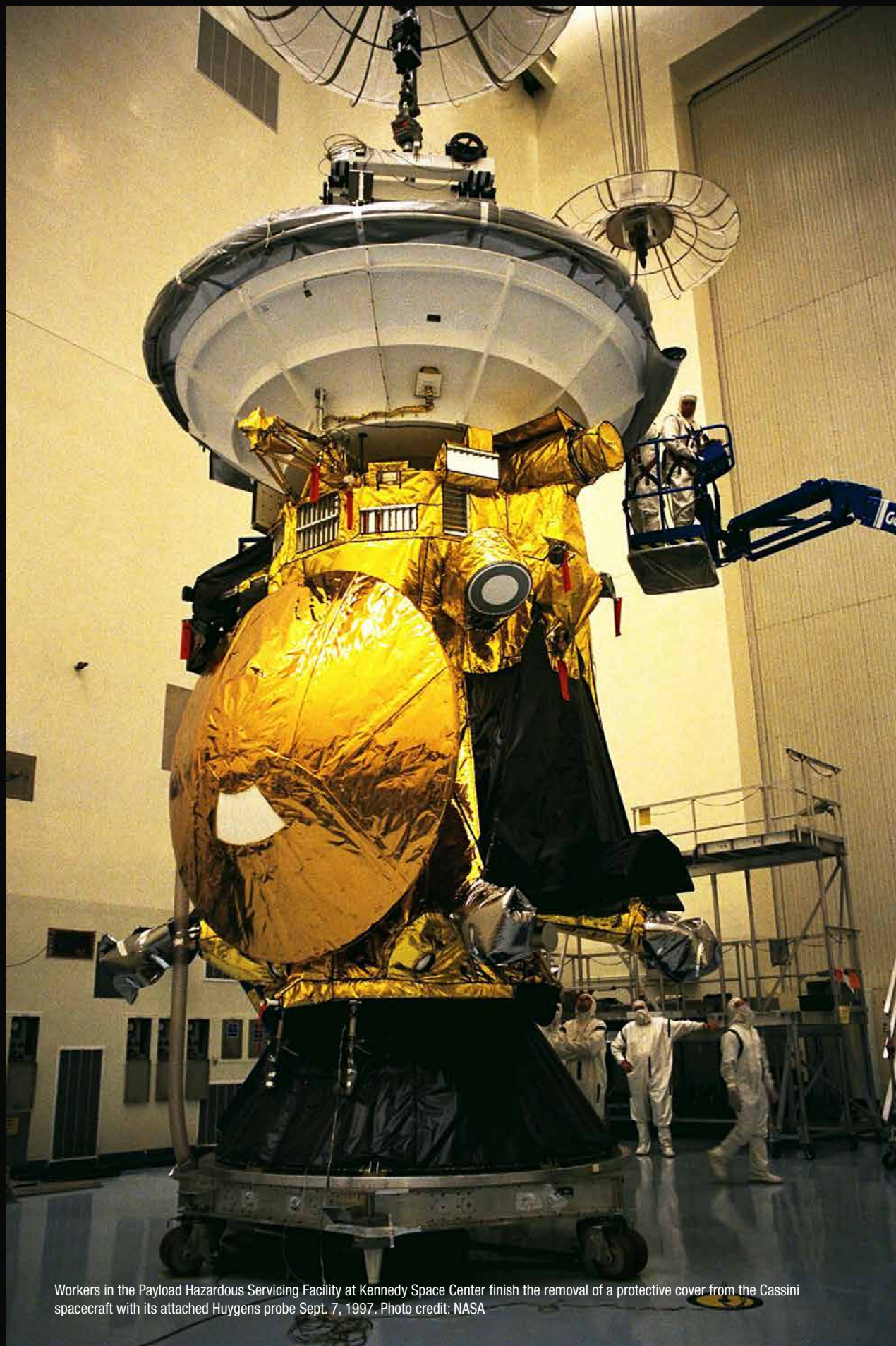
day. When Cassini arrived, it was processed in three or four different facilities at Kennedy. The Huygens probe was in one facility, Cassini in another, and three radioisotope thermoelectric generators, or RTGs, in another. Then, they all had to come together in a hazardous fueling facility.

"A larger than average Kennedy workforce was working Cassini," Dovale said. "Back then, ELV was a small part of the big picture at Kennedy. Many times the center was working on space shuttle missions and ELV was kind of set on its own. This time, the entire center came together and rallied around Cassini because of the enormity of the mission."

Cassini arrived in the Saturn system on June 30, 2004, and began a four-year mission to study the giant planet, its rings, moons and magnetosphere. The spacecraft made 22 weekly dives between the planet and its rings. It continued to beam back to Earth hundreds of gigabytes of scientific data. The Huygens probe made the first landing on a moon (Titan) in the outer solar system.

The Cassini mission helped set in motion the creation of the Launch Services Program based at Kennedy. The tasks that were spread out across three centers were now going to be consolidated at Kennedy.

Cassini gazes across the icy rings of Saturn toward the icy moon Tethys, whose night side is illuminated by Saturnshine, or sunlight reflected by the planet. Photo credit: NASA/JPL



Workers in the Payload Hazardous Servicing Facility at Kennedy Space Center finish the removal of a protective cover from the Cassini spacecraft with its attached Huygens probe Sept. 7, 1997. Photo credit: NASA



Workers install three radioisotope thermoelectric generators (RTGs) on the Cassini spacecraft Oct. 10, 1997. RTGs are lightweight, compact spacecraft electrical power systems that have flown successfully on previous U.S. missions. These generators produce power by converting heat into electrical energy; the heat is provided by the natural radioactive decay of plutonium-238 dioxide, a non-weapons-grade material. Photo credit: NASA

The program now has been launching robotic satellites for nearly two decades for the agency. Some of the same vehicles will be used by the Commercial Crew Program to launch crews to the International Space Station. Dovale said there's a lot more synergy within Kennedy and the entire agency because of that.

Some of the Cassini team from Glenn Research Center (formerly Lewis) in Cleveland, Ohio, now work in LSP at Kennedy. Two of them are Michael Carney, chief of the Flight Analysis Division, and Ayman Abdallah, Ph.D., a structural dynamics discipline expert also in the Flight Analysis Division.

Carney supported the nuclear launch approval process for Cassini. His role was leading the effort that generated the launch vehicle accident data necessary to assess the risks of launching a spacecraft with RTGs. This work was one element of a complex multi-agency process required to gain launch approval for the mission. He has been involved in launch vehicle work for nearly 35 years at Glenn and Kennedy.

"Like all aspects of the Cassini mission, nothing was easy, including the part of the mission that I supported," Carney said. "I remember the work being a great challenge, but with that challenge came much enjoyment and satisfaction. I have never worked on a mission as big and complex as Cassini before or since."

Abdallah, who at the time worked for Analex Corp., was the engineer responsible for developing NASA Glenn's Titan IV coupled loads analysis methodology for the Cassini mission. The analysis simulated all of the critical flight events (forces, stresses,

accelerations and displacements) for low-frequency vibrations and estimated the loads that would be seen during flight for Cassini and the Titan IV rocket.

"It's all special memories for me. It was a special and challenging project," Abdallah said. "I owe a lot of my current experience and knowledge to the Cassini project. I consider working the Cassini project to be the highlight of my career."

Carney and Abdallah are both proud to have worked on a mission that was so successful.

As for Cassini's final plunge, Dovale said it's a little bittersweet, but it's provided amazing images and literally is rewriting the history books. "There is stuff we're learning just from seeing storms on Saturn that are actually educating us here on how storms behave on Earth. That's incredible to know," Dovale said.

Only a handful of folks who worked hands-on with Cassini remain at the agency, and Dovale says they're always ready to share information with curious new members of the Launch Services team.

"They seek us out to ask what it was like and what's different about Cassini than it is today. There's enough of us to still tell the stories," Dovale said.

The Cassini-Huygens mission was a cooperative project of NASA, the European Space Agency and the Italian Space Agency. NASA's Jet Propulsion Laboratory in Pasadena, California, managed the mission for the agency's Science Mission Directorate. JPL designed, developed and assembled the Cassini orbiter.



Kennedy Space Center safely weathers Hurricane Irma

BY ANNA HEINEY

NASA's Kennedy Space Center and its full team of employees have returned to normal operations after a recent brush with Hurricane Irma.

A powerful Category 4 storm, Irma made landfall in the lower Florida Keys early Sept. 10, then struck mainland Florida hours later on a path that took it up the west side of the peninsula. The storm's center came within just 65 miles of the Florida spaceport during its closest approach at about 2 a.m. EDT Sept. 11.

In assessments immediately following the storm, some facilities were identified with roof damage or water intrusion. Loss of water pressure across north Merritt Island, where the spaceport is located, temporarily delayed the recovery of cooling systems and kept the center closed until Sept. 16, when it reopened following an all-clear notification.

It was Kennedy's second encounter with a hurricane in less than a year. Hurricane Matthew passed just offshore Space Coast beaches Oct. 7, 2016.

"The center learned a lot in its response to Hurricane Matthew," said Bob Holl, chief of the center's Damage Assessment and Recovery Team, or DART. "The areas that were repaired (after Matthew) fared the storm quite well because they were built to updated standards."

Space center officials and employees had several days' head start in monitoring and preparing for Irma's arrival. Early forecasting models predicted a Florida impact more than a week before the storm reached the state's shores.

As the forecast track became clear, facilities and center infrastructure were shored up, and workers secured office items and covered electronics in plastic. Kennedy closed at noon Sept. 8, and at 3 p.m. the next day, the 120 members of the center's Rideout Team took their places to await the onset of Irma's wind and rain. Meanwhile, the 250-member DART prepared to relieve the Rideout



Kennedy Space Center Director Robert Cabana boards a NASA helicopter in order to conduct an aerial survey of the spaceport after Hurricane Irma. Photo credit: NASA/Bill White

Team once the storm passed.

Kennedy Space Center Director Bob Cabana spoke with both teams before addressing employees, encouraging them to take care of themselves and their families.

"I know the center is in good hands," Cabana said. "My primary concern is for the safety of each and every one of you. Please take this storm seriously, and take all the proper precautions and evacuate if you're in a low-lying area or on the barrier islands. We can replace hardware and things, but we cannot replace you."

Based on the initial analysis provided by the Patrick Air Force Base 45th Weather Squadron, wind speeds at the center varied from 67-94 mph (59-82 knots) at the 54-foot level to 90-116 mph (79-101 knots) at the 458-foot level during the storm.

"Unlike Hurricane Matthew, Irma had the potential to be the most devastating storm that's ever hit us," said Wayne Kee, NASA



Launch Complex 39 and surrounding areas are seen during an aerial survey of NASA's Kennedy Space Center in Florida on Sept. 12, 2017. The survey was performed to identify structures and facilities that may have sustained damage from Hurricane Irma as the storm passed Kennedy. Photo credit: NASA/Bill White

Emergency Management Officer and chief of the Rideout Team. "What was startling was how long it stayed over us. It took about four-and-a-half hours to move off, and we were on the worst side of it. The wind sounded like a tornado -- that loud, roaring, train-like sound as the winds go by."

The DART officially relieved the Rideout Team on the morning of Sept. 12, and Cabana joined team members on a helicopter survey of the center. Critical repairs were prioritized, along with inspections of the various flight hardware elements being readied by both NASA and commercial partners at the multi-user spaceport. In parallel with recovery activities, small teams resumed their testing to continue support of mission-critical timelines.

"The inspection teams were able to move quickly through a number of buildings with multiple disciplines and contractors working together," Holl said.

The all-clear to reopen the center came Sept. 15, and employees were permitted to re-enter the next day. The majority of employees returned to their work sites or offices on Monday, Sept. 18. Some still were without power or water at home as area utilities continued recovery efforts.

"I know the last couple of weeks has been tough on the team and several of you have dealt with numerous challenges thanks to

Hurricane Irma," NASA Acting Administrator Robert Lightfoot told employees via email Sept. 18. "I remain amazed by this team and its resiliency. You all epitomize the spirit of the NASA family to work through challenges!"



An industrial building behind the Space Station Processing Facility shows some roof damage following Hurricane Irma. Photo credit: NASA/Bill White

STORM WATCHER HONORED



A menacing thunderstorm hovers over Launch Complex 39 at NASA's Kennedy Space Center. At left are the behemoth Vehicle Assembly Building and the Launch Control Center. Photo credit: NASA/Ben Smegelsky



NASA Emergency Manager Wayne Kee moderates an annual hurricane awareness briefing on June 3, 2014, at NASA's Kennedy Space Center. The event, held at the start of hurricane season, is attended by the center's emergency hurricane coordinators and other interested employees. Photo credit: NASA/Kim Shiflett

Wayne Kee inducted into Public Service Hall of Fame

BY BOB GRANATH

As Hurricane Irma approached Central Florida, the workforce at NASA's Kennedy Space Center looked to the leadership of experienced professionals such as Wayne Kee, the agency's emergency manager in Spaceport Integration and Services. Since 1991, he has served as incident commander and lead federal authority for hurricanes Wilma, Katrina, Floyd, Frances, Jeanne and Matthew, providing advice to management and employees as they prepare for approaching storms.

Kee's career includes service in the U.S. Air Force, as well as to the Florida spaceport and the people of Brevard County. In recognition of his efforts, Kee was inducted into the Space Coast Daily's Public Service Hall of Fame in a ceremony Sept. 23, 2017, at the Maxwell C. King Center for the Performing Arts in Melbourne, Florida.

According to the award nomination, "During more than 50 years of government service, Kee has developed programs, policies, requirements and emergency response measures necessary to protect citizens during natural and man-made disasters."

Beginning his government service career in 1966, Kee enlisted in the Air Force where he served 24 years as a fire protection specialist, assistant fire chief, deputy fire chief and fire chief. He also



In the Emergency Operations Center at NASA's Kennedy Space Center, from the left, Brady Helms, an Emergency Management analyst with Chenega Infinity, Kennedy's Protective Services contractor, and Wayne Kee, NASA Emergency Manager, monitor Hurricane Irma from inside the Launch Control Center. They were part of the 120-member Rideout Team during the recent storm. Photo credit: NASA/AI Feinberg

was a member of the Airborne Firefighter Rescue Team and was instructor superintendent at the Air Force Fire Academy.

Kee was incident commander during numerous emergencies while serving in the Republic of Vietnam. These ranged from aircraft crashes, facility fires and explosions. He later served at military locations in the United States and overseas. He culminated his military career as a chief master sergeant and fire chief at Bitburg American Air Base in Germany, the largest F-15 fighter wing in Europe.

As NASA's emergency manager at Kennedy, Kee was on the first flight out as a member of the NASA Rapid Response Team when the space shuttle Columbia was lost over Texas and Louisiana on Feb. 1, 2003. He also served as the emergency manager representing NASA for recovery efforts while temporarily assigned to the Incident Command Center at Barksdale Air Force Base, Louisiana.

In addition to his role at the Florida spaceport, Kee coordinated relief efforts for 2005's Hurricane Katrina disaster for NASA centers

and families in Mississippi and Louisiana and functioned as the senior member aboard relief and supply flights.

Kee has been the Rideout Team leader for more than 11 storms affecting the Space Coast over the last 26 years, including Hurricane Irma. Working closely with the Brevard County Emergency Operations Center, he has jointly developed exercises and shared training programs, which have enhanced the programs of both agencies.

In addition to his most recent award, Kee earned numerous military service decorations, including five Meritorious Service Medals and four Commendation Medals. He also was the recipient of the NASA Exceptional Achievement Medal for exemplary leadership in planning and execution of hurricane preparation measures, which resulted in the safety of critical national assets. Following last year's Hurricane Matthew, Kee received the NASA Outstanding Leadership Award for exceptional efforts in leading the Kennedy Rideout Team as incident commander during the storm.

NOAA's Joint Polar Satellite System-1, or JPSS-1, arrives at the Astrotech Processing Facility at Vandenberg Air Force Base in California. JPSS-1 is the first in a series of four next-generation environmental satellites in a collaborative program between NOAA and NASA. The satellite is scheduled to launch Nov. 10 atop a United Launch Alliance Delta II rocket. Photo credit: NASA/Michael A. Starobin



Advanced Plant Habitat Verification Test Complete

BY AMANDA GRIFFIN

After a month of growing plants in the Advanced Plant Habitat Flight Unit No. 1, the chamber was opened and half of the yield was harvested by Kennedy Space Center payload engineers and scientists. The *Arabidopsis thaliana* seeds that were grown during the test are small flowering plants related to cabbage and mustard that have a short lifecycle and small genome, making it an ideal plant model for research.

The harvest involved measuring pigment molecules of some of the plants with an instrument called a FluorPen, which will give the principal investigators empirical data on the health of the plants. Following those measurements, the stems and the rosettes (circular arrangement of leaves) of the plants were harvested separately, placed inside a foil packet, and then placed inside a MiniCold Bag that quickly freezes the plants. The plants will be shipped to a team at Washington State University who will examine the plants, with the goal to comprehensively understand how these plants adapt to spaceflight during the PH-01 experiment on the International Space Station later this year.

The Advanced Plant Habitat was sent to the space station in two shipments on the Orbital ATK OA-7 and SpaceX CRS-11 resupply missions. The Advanced Plant Habitat will be set up on the space station this fall and is an enclosed, closed-loop system with an environmentally controlled chamber. The habitat will use red, blue, green and broad-spectrum white LED lights and have 180 sensors to relay information back to the team at Kennedy.

Support and funding for the Advanced Plant Habitat are provided by the Space Life and Physical Sciences Research and Applications Division.



John "JC" Carver, a payload integration engineer with NASA Kennedy Space Center's Test and Operations Support Contract, uses a FluorPen to measure the chlorophyll fluorescence of *Arabidopsis thaliana* plants inside the growth chamber of the Advanced Plant Habitat Flight Unit No. 1. Half the plants then were harvested. Photo credit: NASA/Leif Heimbold



CENTRALIZED SYSTEM

Oil Pharmacy streamlines petroleum distribution at Kennedy

BY BOB GRANATH

A pharmacy is an establishment where professionals prepare and dispense medicines to keep people in good health. At NASA's Kennedy Space Center, an Oil Pharmacy has been set up to prepare and dispense petroleum products to keep a variety of machines operating properly.

The number of machines and other assets with moving parts at the sprawling spaceport is extensive. Oils are used in everything from a lathe in the Launch Equipment Shop to the crawler-transporter, to cranes in the Vehicle Assembly Building -- these and other areas of responsibility fall under Jacobs' Test and Operations Support Contract, or TOSC. The contract provides overall management and implementation of ground systems capabilities, flight hardware processing and launch operations at Kennedy.

"To meet these needs, about three years ago we assembled a team of engineers, technicians and managers to develop a standardized naming and testing process," said Tim King, Jacobs Oil Pharmacy manager. "There also was a need to set up a facility to consolidate testing, storage and distribution of oils and petroleum products used in equipment maintained under TOSC."

Jacobs' TOSC Oil Program Requirements Team found that each

shop ordered oils as needed. There was no standardized naming system for oil and petroleum products, causing some confusion when one product might have multiple names. Additionally, there was no consistent system for testing the quality of the products.

The team's recommendations led to the formation of the Oil Pharmacy, located in the east end of Kennedy's Thermal Protection System Facility. Once an inventory of machines needing oils was completed, King explained that the next step was to consolidate ordering, storage and distribution.

"After centralizing the process, we found the new system to be much more efficient," he said. "There was a significant reduction in the amount of oils being purchased, resulting in reduced costs and waste."

The team at the Oil Pharmacy became the sole point of contact for ordering oils needed throughout Jacobs TOSC. About 1,300 gallons of various oil products currently are available. King noted that once oils are accepted into stock, they are stored in color-coded containers with standardized labels. This makes it much easier to separate products of different types and weights, providing quality and efficiency.



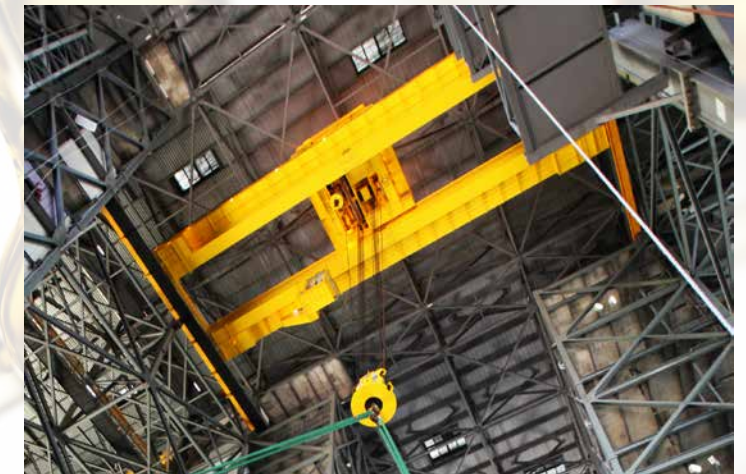
Tim King, Oil Pharmacy manager for Jacobs at Kennedy Space Center, explains operations in the Oil Pharmacy, operated under the Test and Operations Support Contract. Photo credit: NASA/Frankie Martin



An overall view of the Oil Pharmacy located in the east end of Kennedy Space Center's Thermal Protection System Facility. Photo credit: NASA/Frankie Martin



Kennedy Space Center's crawler-transporter is an example of a vehicle with moving parts that require many types of oils and petroleum products available at the Oil Pharmacy. The crawler is the vehicle that will transport the load of the Space Launch System rocket and Orion spacecraft atop the mobile launcher, moving from the Vehicle Assembly Building to Launch Complex 39B. Photo credit: NASA/Leif Heimbald



The team in the Oil Pharmacy provides a central location for distribution of oils used in everything from simple machinery cranes, such as this one in the Vehicle Assembly Building (VAB). Inside the VAB, NASA's Space Launch System rocket will be stacked with the Orion spacecraft atop in preparation for missions beyond low-Earth orbit. Photo credit: NASA/Frank Michaux

By keeping needed oils and petroleum products in stock at a single Kennedy location, users now simply contact the Oil Pharmacy and requests are filled much faster with the right oil and needed amount at the right time.

"We also implemented a sampling process," King said. "A baseline procedure was set up to test oils as they arrive from vendors. This allows us to ensure they meet our specifications."

Not only are newly arriving oils being tested to establish compatibility with the intended machines, specialists in the Oil Pharmacy take samples from equipment from around the center.

"We've found that if oil in a piece of equipment tests good, there is no need to change it on a time-based schedule," said T.J. Avitabile, a Jacobs Maintenance and Reliability technician. "This test not only is a chance to make sure the oils in machines are acceptable, it also can give us a warning of potential lubrication problems."

For example, if oil samples taken from a piece of equipment contain small metal fragments, it may be a sign that moving parts are wearing.

"Catching that early could prevent a catastrophic failure in the future," Avitabile said.

Another process taken on by the Oil Pharmacy is recycling used petroleum products for non-flight hardware. Once filtered and treated with chemicals, many of the oils are not only reusable, but much cleaner than when first received from the vendor.

"During 2016, we refined about 2,800 gallons of oils," King said.

Feedback on the work of the Oil Pharmacy from members of the Jacobs TOSC Team has been positive.

"Our team worked hard to make the Oil Pharmacy a reality," King said. "Groups across Jacobs TOSC have been supportive and helped make it a success."

LEADING THE WAY

Energy Awareness Month to focus on solar power

BY BOB GRANATH



More than 35,000 solar panels were built on five acres at Kennedy Space Center to create a solar energy complex. Completed in 2010, it produces 10 megawatts of electricity or enough to power 1,100 homes. Photo credit: NASA/Jim Grossmann

Everyday life in the 21st century requires more and more energy. From more powerful computers to larger televisions and the latest gadgets, the demand for additional power seems to increase each day. At NASA's Kennedy Space Center, experts continue to find ways to be more energy efficient and encourage the center's employees to do the same.

To highlight these efforts, Kennedy's Spaceport Integration and Services has set October as Energy Awareness Month.

"We want to not only focus on what we're doing here at Kennedy, but help employees know what they can do on an individual basis," said Nick Murdock, Energy and Water manager at Kennedy.

It's more than simply remembering to turn out the lights when you go home at the end of the day. According to Murdock, Energy Awareness Month will include messages for general energy awareness, speakers and presentations on being more energy aware.

"Many of the speakers will be making presentations on solar energy," he said. "An increasing amount of the center's electricity is coming from solar. We want to highlight that and give our

workforce information on how they could consider it for use in their homes."

Use of solar power in the space program goes back to its earliest days. Dr. Hans Ziegler, who is often regarded as the father of spacecraft solar power, saw the potential for capturing energy from the Sun as early as May 1954 after examining the solar cells developed at Bell Laboratories.

"Future development (of the solar cell) may well render it into an important source of electrical power on the roofs of all our buildings in cities and towns," he said.

The idea of spacecraft using solar panels was inspired by Ziegler, a member of Wernher von Braun's rocket team who came to the United States in the 1940s. The Vanguard 1 satellite, launched in 1958, was the first spacecraft to use solar panels.

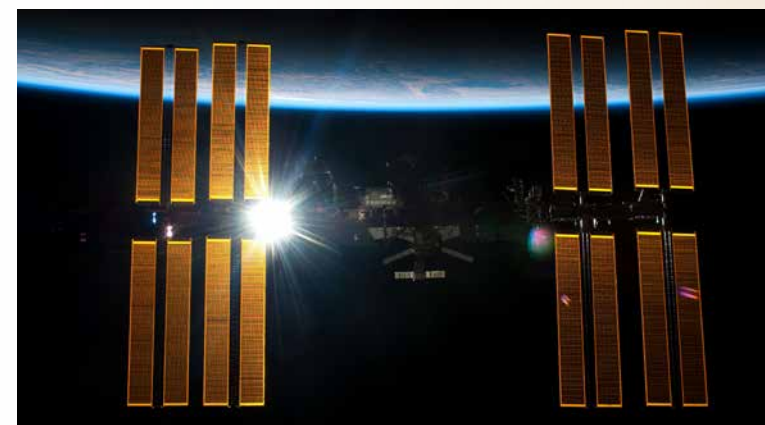
Since then, solar panels have provided power for many types of spacecraft such as the Magellan probe to Venus and the Mars Global Surveyor, as well as the Earth-orbiting Hubble Space Telescope and International Space Station.



Launched March 17, 1958, Vanguard 1 was America's second Earth satellite and was the first powered by solar cells. It was designed to test the launch capabilities of the three-stage Vanguard rocket and the effects on satellite systems in orbit. Photo credit: NASA



The Propellants North Administrative and Maintenance Facility at Kennedy Space Center produces an estimated 150 megawatt hours per year through an 80-kilowatt solar array. The system integrates two photovoltaic (PV) roof systems and a PV-covered electric vehicle charging canopy in the facility's parking lot. Photo credit: NASA/Frank Michaux



Solar panels on the International Space Station capture the Sun's rays, converting them into electricity. Photo credit: NASA

In 2009, the Kennedy Solar Energy Center established the first of two new power facilities at the center using solar panels to convert sunlight into electricity. In the center's Industrial Area south of the Vertical Integration Facility, the solar farm creates one megawatt of electricity, or enough to power 110 homes. For Kennedy, the power output equates to about 1 percent of the center's electricity usage.

A second, much larger solar energy complex was built in a former citrus grove at the south end of the center. That location has 35,000 solar panels, producing 10 megawatts of electricity and was completed in 2010. More "solar farms" are planned for the center's future.

Kennedy's Propellants North Administrative and Maintenance Facility uses more than 300 rooftop-mounted solar photovoltaic panels, just as predicted by Ziegler. As such, it is the agency's first carbon-neutral facility, which means it will produce enough energy onsite from renewable sources to offset what it requires to operate. The facility will produce an estimated 150 megawatt-hours per year through an 80-kilowatt solar array, integrating the two photovoltaic roof systems.

Murdock added that solar energy is "environmentally friendly," creates no carbon emissions and requires no fuel, such as oil or natural gas.

"It's a clean, low-cost source of power," he said. "During Energy Awareness Month, we will have information on how to take advantage of solar technology well beyond the space center."



A young heron wades in a waterway at NASA's Kennedy Space Center. The center shares a border with the Merritt Island National Wildlife Refuge. More than 330 native and migratory bird species, 25 mammals, 117 fishes and 65 amphibians and reptiles call Kennedy and the wildlife refuge home. Photo credit: NASA/Bill White

Commercial Crew Program 2018 Calendar Artwork Contest

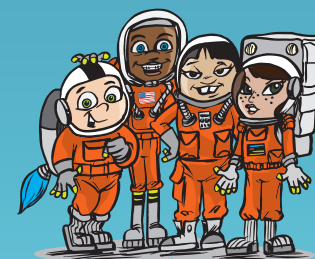
Submit entries from
**October 2 through
November 2, 2017**



Contest designed for budding artists or space enthusiasts ages 4 - 12

NASA's Commercial Crew Program is partnering with private companies to develop new spacecraft to fly astronauts on NASA missions to the International Space Station, and we want kids to have a fun way to learn more about this program while being creative! The Commercial Crew Program is holding an art contest and the winning artwork will be used to create a 2018 calendar, with each month featuring a different space-related theme.

This opportunity is truly out of this world. When complete, the calendar will be transmitted to the astronauts aboard the International Space Station!



Go to <https://go.nasa.gov/2fcql6H> for more information about the competition's themes, rules and deadlines plus the entry form.

Get your parent's permission, of course!



Focus on Educators

Network of States workshops provide resources, training to Florida STEM teachers

BY ISABEL KENNEDY
NASA EDUCATION INTERN

NASA's Kennedy Space Center's Education Office sponsored a series of multi-day workshops this summer to reach out to educators in several different regions of Florida. The workshops, called Network of States (NOS), were hosted in Miami, Jacksonville and Chipley, in the Florida Panhandle. Kennedy lead education specialist, Dr. Lester Morales, was joined by colleagues Jen Hudgins and Joshua Santora to provide NOS participants with four days of professional development and NASA STEM (science, technology, engineering and mathematics) resources.

Each day, K-12 teachers, deans, informal educators and administrators worked collaboratively in hands-on, engineering-design activities. They also engaged in a virtual lesson via NASA's



Teachers participate in hands-on activities during a Network of States workshop hosted by NASA Kennedy Space Center's Education Office in Miami, Florida. Photo credit: Phillip Talleyrand

Digital Learning Network (DLN) with Kennedy host Rachel Power, a subject-matter expert (SME) across different fields. This summer's DLN featured NASA SMEs from across the country, including Dr. Matthew Mickens of Kennedy's VEGGIE program and Lora Bleacher of NASA's Goddard Space Flight Center's Solar System Exploration Division.

Katrina Roddenbury, who previously attended NOS as a middle school teacher, returned to Chipley this summer as a program advocate and shared her favorite NASA Education resources with workshop participants. DLN's ability to connect her class with NASA experts, said Roddenbury, "opens a whole new world of possibilities in STEM careers for [my] students. NOS offers practical and relevant lessons...that engage students in higher order problem-solving tasks and [gives] them authentic experiences through the Engineering Design Process."

Although NOS activities focus heavily on STEM for K-12 classrooms, the program also stresses the importance of interdisciplinary education, such as NASA literacy and history. Sasha Kanamine, a science educator and NOS participant from Miami-Dade County, explained that NOS taught her "how to modify NASA STEM activities to each of my students... The activities are not just for the 'science-y' or advanced students... I can work these activities into almost every classroom."

"Workshops like this hold NASA to a high standard," said Kanamine. "It gives teachers and their students the ability to connect with space and bridge the gap between science fiction and science fact."

Along with the 30 hours at each workshop, educators spent another 10 hours training online through the NASA STEM Educator Professional Development Collaborative (EPDC) and became SMEs on this summer's total solar eclipse.

"[The] information and techniques that I learned from the NASA EPDC site help me teach beyond the basic course requirement," said Deborah Bloch, a science teacher from Coral Gables Preparatory Academy.

Overall, this summer's Network of States provided resources to more than 120 educators in 12 Florida school districts. Dr. Morales, Kennedy's education lead, estimates that this summer's NOS reached upwards of 3,000 K-12 students in more than 110 public, private, charter and religious schools across the Sunshine State.



Ivan Hernandez

Ivan Hernandez is a STEM (science, technology, engineering and mathematics) educator at Compass Middle Charter School in Bartow, Florida. He was inspired to pursue a career in education by his brother, who is learning disabled. After learning and understanding what makes his brother different, Hernandez devoted his life to the education field. In his career, he has served as a dean, assistant principal, principal, director of operations and education consultant.

Hernandez stresses the importance of integrating activities that focus on real-world application so that students can relate their schoolwork to their everyday lives. Overall, his goal is to mold his students into habitual scientists, enabling them to recognize that each decision they make is a scientific endeavor. Hernandez's passion for teaching is driven by student-centered learning, stating that he and his team "live for the 'Aha!' moment."

Hernandez's favorite takeaway from NOS – Miami was "the NASA team and the connections made with other people...to be able to connect with others and share ideas (is) the greatest resource." At the end of NOS – Miami, each educator was gifted a flash drive containing all of the NASA STEM resources covered during the workshop, including lesson plans, storybooks, presentations and videos, which Hernandez calls "invaluable."



Sasha Kanamine

Sasha Kanamine is an educator from Miami-Dade County Public Schools who says the NOS workshop improved her teaching capabilities in two key areas: how to better meet students' individual needs, and utilize NASA STEM activities between disciplines.

For Kanamine, the workshop taught her "how to modify NASA STEM activities to each of (her) students... (These) activities are not just for the 'science-y' or advanced students... (I) can work these activities into almost every classroom."

Kanamine is grateful for NOS – Miami. "Workshops like this hold NASA to a high standard...it gives teachers and their students the ability to connect with space (and) bridge the gap between science fiction and science fact."



Ibrihim Onbasi

When family obligations kept Ibrihim Onbasi from the NOS workshop near his home in Jacksonville, the north Florida educator was determined to attend a similar event NASA had scheduled for the other end of the Sunshine State. Not only did Onbasi drive more than six hours to south Florida, he also commuted to Miami each day from his friend's house in Ft. Lauderdale, a two-hour roundtrip. Onbasi's commitment to his students and school district should be an inspiration to all educators.

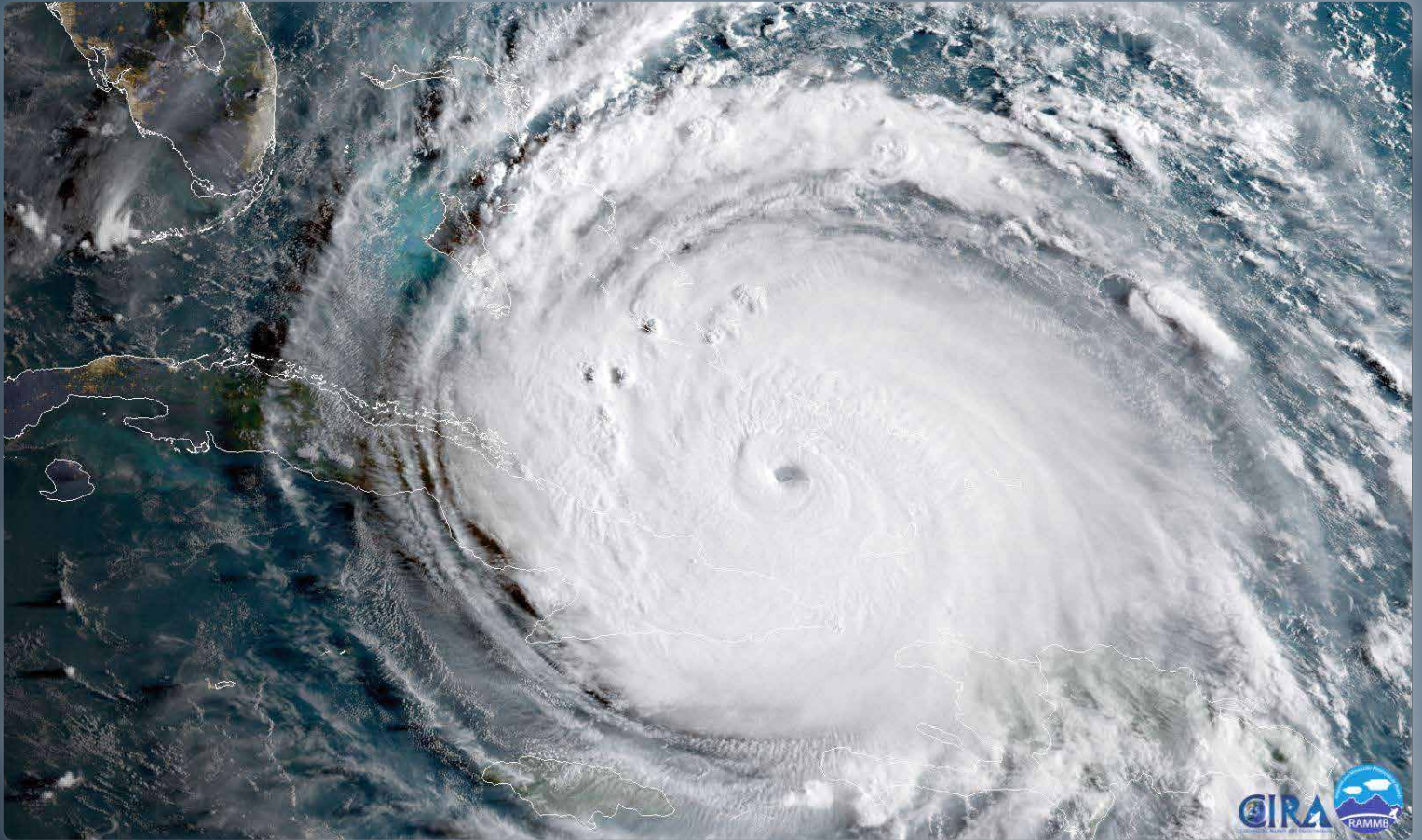


Dale Adamson

Dale Adamson is an algebra teacher serving Miami-Dade County Public Schools. He recently took over the STEM Designation Process at his school and attended NOS – Miami because he was "interested in seeing and learning activities for the MDCPS program." Adamson notes that his school's first day of classes were scheduled for Aug. 21 – the day of the 2017 solar eclipse. Thanks to NOS – Miami, Adamson has new resources and materials to integrate NASA STEM in both his program and classroom -- including solar eclipse glasses for his students!



One of two forward skirts for NASA's Space Launch System (SLS) solid rocket boosters is transported by truck Aug. 30, 2017, to the Booster Fabrication Facility (BFF) at NASA's Kennedy Space Center in Florida from Hangar AE at Cape Canaveral Air Force Station. In the BFF, the forward skirt will be inspected and prepared for use on the left-hand solid rocket booster for the agency's Exploration Mission-1. NASA's Orion spacecraft will fly atop the SLS rocket on its first uncrewed flight test. Photo credit: NASA/Kim Shiflett



NOAA's GOES-16 satellite captured this geocolor image of Hurricane Irma passing the eastern end of Cuba at about 8 a.m. EDT on Sept. 8, 2017. Created by NOAA's partners at the Cooperative Institute for Research in the Atmosphere (CIRA), the experimental geocolor imagery enhancement shown here displays geostationary satellite data in different ways depending on whether it is day or night. Photo credit: NOAA/CIRA

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