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National Aeronautics and
Space Administration

KENNEDY SPACE CENTER'S

SPACEPORT magazine

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K-9 Unit Keeps Kennedy Safe

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SPACEPORT MAGAZINE

National Aeronautics and Space Administration

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A crane lowers the Space Launch System Core Stage pathfinder into High Bay 3 in the Vehicle Assembly Building at NASA's Kennedy Space on Oct. 16, 2019. The pathfinder was used by Exploration Ground systems and its contractor, Jacobs, to practice offloading, moving and stacking maneuvers, using important ground support equipment to train employees and certify all the equipment works properly. Photo credit: NASA/Ben Smegelsky

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Kennedy Space Center has its own monthly podcast. Welcome to the "Rocket Ranch."

Check out **Episode 16: An ICONic Launch**. The air-launched Northrop Grumman Pegasus XL was the vehicle selected to launch NASA's Ionospheric Connection Explorer, or ICON. Read the full transcript and catch up on missed episodes at https://www.nasa.gov/kennedy/rocketranch.

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I am KENNEDY

SPACE CENTER

DANA HUTCHERSON

My name is Dana Hutcherson. I am the deputy program manager for the Commercial Crew Program (CCP) at NASA's Kennedy Space Center in Florida. Along with my responsibilities as deputy manager, I also am responsible for the budgeting, contracting, safety and technical areas of CCP at Kennedy.

I joined the nation's space program at Kennedy in 2000. I have been in my current role since September 2019. Prior to this, I served as the deputy manager of the CCP Systems Engineering and Integration Office. I managed and maintained program requirements, and prioritized, planned, tracked and integrated the certification of the Boeing and SpaceX crew transportation system designs for the Commercial Crew Transportation Capability contracts. I also served as deputy manager of the Launch Vehicle Office.

One of the biggest challenges in this job is the very fast-paced environment with many activities happening simultaneously with both providers and our NASA team. We overcome those challenges by relying on an outstanding team!

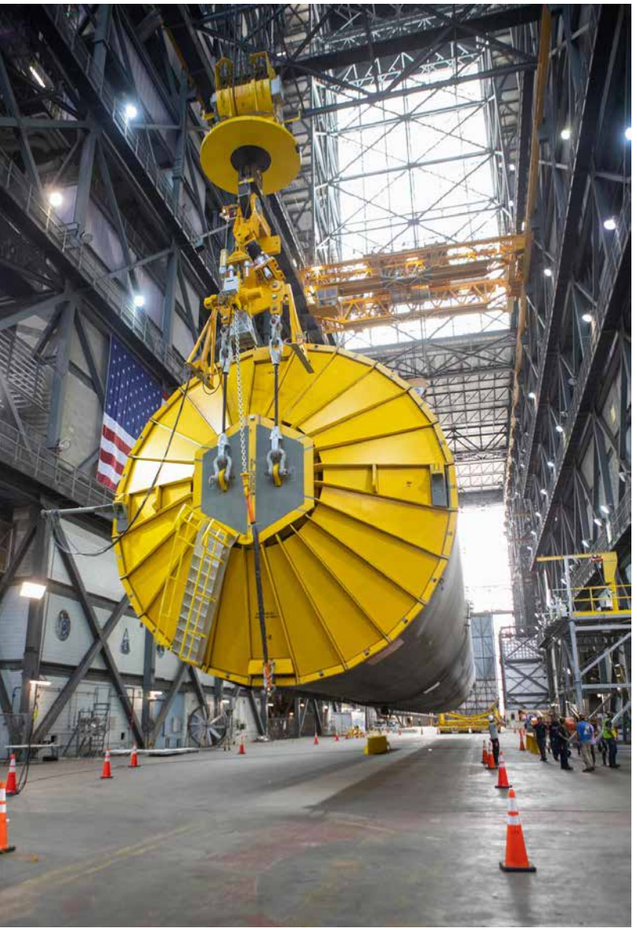
I have many favorite memories working in CCP, but one high point was getting to the first uncrewed test flight, SpaceX's Demo-1. I enjoyed being part of the teams, both NASA and SpaceX, and rallying together to achieve a significant milestone.

What's next on the horizon? More flight tests and launches. I've been with CCP for nine years, and I'm ready to get into the next phase.

PRACTICE MAKES PERFECT

EGS completes heavy lift of core stage pathfinder to prepare for Artemis missions

BY LINDA HERRIDGE



Inside the Vehicle Assembly Building at NASA's Kennedy Space Center, two cranes are used to lift the Space Launch System Core Stage pathfinder horizontally in the transfer aisle on Oct. 15, 2019. A cover, called a spider, is in view on the top of the pathfinder. A crane is attached to the spider to help lift the pathfinder. Photo credit: NASA/Ben Smegelsky

What does it take to lift and stack NASA's **Space Launch System (SLS)** rocket, the largest rocket ever built for flight? Weighing in at nearly 225-thousand pounds, the core stage of the SLS is one of the largest and heaviest pieces of hardware that will be processed for **Artemis** missions. To accomplish the task of processing and preparing SLS for launch, **Exploration Ground Systems** and its contractor, Jacobs, practiced lifting procedures of the core stage using a full-scale mock-up, called a **pathfinder**, in the **Vehicle Assembly Building** at the agency's Kennedy Space Center in Florida.

The team rehearsed moving and lifting maneuvers so that crews are trained on how to handle the core stage and certified all ground support equipment works properly before the actual core stage arrives for Artemis I.

"Practicing handling operations with full-scale pathfinders offers the respective teams essential hands-on experience for working with such immense structures before the one-of-a-kind hardware arrives," said Mark Prill, core stage pathfinder lead at the agency's Marshall Space Flight Center in Huntsville, Alabama.

The 212-foot-long pathfinder, similar in size, shape and weight to the massive core stage, arrived at Kennedy's Launch Complex 39 turn basin wharf on Sept. 27, 2019, aboard NASA's **Pegasus barge**. The pathfinder was the first delivery on the Pegasus barge in support of the agency's Artemis missions. It was offloaded and transported to the VAB on Oct. 1.

Inside the VAB transfer aisle, a lifting fixture, called a spider, was attached to the top, or forward ring of the core stage pathfinder. A transportation and integration fixture, developed at Marshall, was used to move the spider to the core stage pathfinder to enable installation. With the spider secured in place, another crane was attached to the pathfinder's aft end lifting brackets. Workers practiced using the cranes to lift the pathfinder horizontally up from its transporter. Then, crane operators performed a procedure called a breakover to slowly move the pathfinder into the vertical position and lift it up and over Level 16 into High Bay 3. A reverse sequence also was performed, with the core stage lifted up from the high bay, lowered down to the transfer aisle, returned to a horizontal position and secured in its transporter.

Workers watch as two cranes are used to lift the Space Launch System Core Stage pathfinder high up in the transfer aisle of the Vehicle Assembly Building at NASA's Kennedy Space Center on Oct. 16, 2019. Photo credit: NASA/Ben Smegelsky

The Space Launch System Core Stage pathfinder is lowered into High Bay 3 of the Vehicle Assembly Building on Oct. 16, 2019. Photo credit: NASA/Ben Smegelsky

In this view looking up inside the Vehicle Assembly Building at NASA's Kennedy Space Center, workers use a crane to lower the Space Launch System Core Stage pathfinder into High Bay 3 on Oct. 16, 2019. Photo credit: NASA/Ben Smegelsky

"Core stage pathfinder is the first opportunity for the entire Kennedy team to verify, validate and execute the engineering and planning associated with handling of the SLS core stage flight hardware, setting the stage for an experienced workforce and efficient processing for the historic Artemis missions," said Jim Bolton, EGS Core Stage Element Operations manager.

The team repeated the process several times to ensure Kennedy engineers and technicians are all trained and certified for future core stage operations.

"Experience is the best teacher," Prill said. "Pathfinders allow crews to practice the lifting and transporting techniques that we can't otherwise do with the actual flight hardware. This practice with the pathfinder reduces risk and builds confidence."

Kennedy's multi-user spaceport is preparing the facilities and ground support equipment for NASA's Artemis missions to the Moon and on to Mars. The agency is planning to send the first woman and next man to the lunar surface.

The core stage pathfinder remained at Kennedy through most of October. On Oct. 28, the pathfinder was moved from the VAB back to the Pegasus barge at the turn basin wharf. It was loaded into the barge and secured for its trek back to the Michoud Assembly Facility in New Orleans.

Watch 360-view videos of the Core Stage pathfinder lift in the Vehicle Assembly Building.
https://www.youtube.com/watch?v=lxGlxbSXrR0 and https://www.youtube.com/watch?v=zS77Mi1wVP4

Boeing's Starliner Completes Pad Abort Test for Commercial Crew

Boeing's CST-100 Starliner spacecraft completed a critical safety milestone on Nov. 4, 2019, in an end-to-end test of its abort system. The Pad Abort Test took place at Launch Complex 32 at the U.S. Army's White Sands Missile Range in New Mexico.

The test was designed to verify each of Starliner's systems will function not only separately, but in concert, to protect astronauts by carrying them safely away from the launch pad in the unlikely event of an emergency prior to liftoff. This was Boeing's first flight test with Starliner as part of NASA's Commercial Crew Program to return human spaceflight launches to the International Space Station from American soil.

"Tests like this one are crucial to help us make sure the systems are as safe as possible," said Kathy Lueders, NASA's Commercial Crew Program manager. "We are thrilled with the preliminary results, and now we have the job of really digging into the data and analyzing whether everything worked as we expected."

During the test, Starliner's four launch abort engines, and several orbital maneuvering and attitude control thrusters simultaneously ignited to rapidly push the spacecraft away from the test stand. Five seconds into flight, the abort engines shut off as planned, transferring steering to the control thrusters for the next five seconds.

A pitcharound maneuver rotated the spacecraft into position for landing as it neared its peak altitude of approximately 4,500 feet. Two of three Starliner's main parachutes deployed just under half a minute into the test, and the service module separated from the crew module a few seconds later. Although designed with three parachutes, two opening successfully is acceptable for the test parameters and crew safety. After one minute, the heat shield was released and airbags inflated, and the Starliner eased to the ground beneath its parachutes.

The demonstration took only about 95 seconds from the moment the simulated abort was initiated until the Starliner crew module touched down on the desert ground.

"Emergency scenario testing is very complex, and today our team validated that the spacecraft will keep our crew safe in the unlikely event of an abort," said John Mulholland, Vice President and Program Manager, Boeing's Commercial Crew Program. "Our teams across the program have made remarkable progress to get us to this point, and we are fully focused on the next challenge—Starliner's uncrewed flight to demonstrate Boeing's capability to safely fly crew to and from the space station."

Boeing's next mission, called Orbital Flight Test, will launch an uncrewed Starliner spacecraft to the station on a United Launch Alliance Atlas V rocket from Cape Canaveral Air Force Station's Space Launch Complex 41. Launch is targeted for Dec. 17.

Learn more about NASA's Commercial Crew Program at:
http://www.nasa.gov/commercialcrew

Boeing's CST-100 Starliner's four launch abort engines and several orbital maneuvering and attitude control thrusters ignite in the company's Pad Abort Test, pushing the spacecraft away from the test stand with a combined 160,000 pounds of thrust, from Launch Complex 32 on White Sands Missile Range in New Mexico. Photo credit: NASA

Boeing's CST-100 Starliner's airbags inflate in preparation for landing in the New Mexico desert in the company's Pad Abort Test for NASA's Commercial Crew Program. The test, conducted Nov. 4 at the White Sands Missile Range, was designed to verify that each of Starliner's systems will function not only separately, but in concert, to protect astronauts by carrying them safely away from the launch pad in the unlikely event of an emergency prior to liftoff. This is Boeing's first test flight for NASA's Commercial Crew Program, which is working to launch astronauts on American rockets and spacecraft from American soil for the first time since 2011. Photo credit: NASA

Dragon Will Deliver Experiments, Supplies to International Space Station

COMMERCIAL RESUPPLY SERVICES MISSION:
SpaceX CRS-19

LAUNCH:
NET December 4, 2019, at 12:51 p.m. EST

LIFT OFF:
Space Launch Complex 40 at Cape Canaveral Air Force Station in Florida

LAUNCH VEHICLE:
SpaceX Falcon 9, 230 feet tall

SPACECRAFT:
Dragon cargo module, 20 feet high, 12 feet in diameter

PAYLOAD:
Dragon will deliver science investigations, supplies and equipment to the International Space Station. Scientific investigations include the areas of biology and biotechnology, physical sciences, Earth and space science. Experiments include testing the effectiveness of a device to separate and capture water droplets suspended in an air stream, delivering a next-generation spaceborne system to image Earth in higher spectral resolution than currently possible, and testing conditions to develop an inexpensive and scalable process to manufacture optical materials in space.

RETURN TO EARTH:
After about one month attached to the space station, Dragon will return with results of earlier experiments, splashing down in the Pacific Ocean off the coast of Baja California.

A SpaceX Falcon 9 rocket lifts off from Space Launch Complex 40 at Cape Canaveral Air Force Station in Florida at 6:01 p.m. EDT on July 25, 2019, carrying the Dragon spacecraft on the company's 18th Commercial Resupply Services (CRS-18) mission to the International Space Station. The uncrewed Dragon spacecraft delivered about 5,000 pounds of science and research, crew supplies and vehicle hardware to the orbiting laboratory. Photo credit: NASA/Tony Gray and Kenny Allen

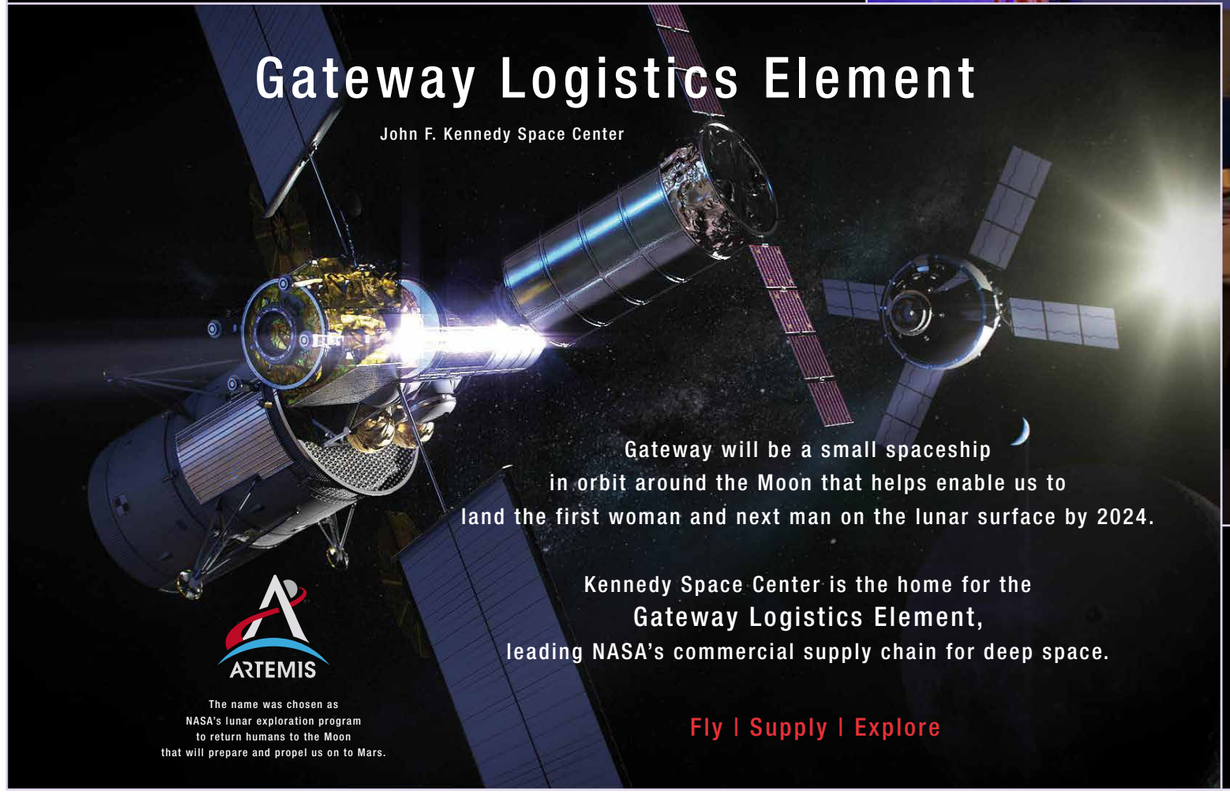
Artist's impression of the European Space Agency's Solar Orbiter spacecraft. Image credit: ESA/ATG medialab

The Solar Orbiter spacecraft is placed on a truck for transportation from the Launch and Landing Facility (formerly the Shuttle Landing Facility) at NASA's Kennedy Space Center to the Astrotech Space Operations Facility in nearby Titusville on Nov. 1, 2019. The spacecraft was delivered to the Florida spaceport aboard an Antonov An-124 cargo plane from Munich, Germany. Solar Orbiter is a European Space Agency mission with strong NASA participation. The mission aims to study the Sun, its outer atmosphere and solar winds. The spacecraft will provide the first images of the Sun's poles. NASA's Launch Services Program based at Kennedy is managing the launch. Liftoff is scheduled for Feb. 5, 2020, from Cape Canaveral Air Force Station aboard a United Launch Alliance Atlas V rocket. Photo credit: NASA/Ben Smegelsky

Putting a Woman on the Moon by 2024: Launching Artemis

Mark Wiese, Gateway Logistics Element manager at NASA's Kennedy Space Center, co-hosted the panel, "Putting a Woman on the Moon by 2024: Launching Artemis," during a Florida Chamber of Commerce Future of Florida economic forum in Orlando on October 28, 2019.

Wiese spoke to more than 500 attendees and members of the media about the crucial role Florida is playing in NASA's Artemis lunar exploration plan. He also discussed the importance of partnerships and collaboration with private industry that will help drive the mission forward to step back on the Moon by 2024.



Mark Wiese, Gateway Logistics Element manager served as a co-host of a panel discussion at the Florida Chamber of Commerce economic forum in Orlando on Oct. 28, 2019. Seated at left is Frank DiBello, Space Florida president and CEO and panel co-host. Photo credit: NASA/Tammy Long

NASA's Kennedy Space Center Innovators' Launchpad:

Jenna Fothergill

Jenna Fothergill, project manager for the Exploration Research and Technology programs at Kennedy Space Center, is honored to play a role in helping NASA pursue its missions. Photo credit: NASA/Kim Shiflett

Please explain your job in a single sentence.

I help enable the success of technical teams at **Kennedy Space Center** that are working to design, build and test new technologies by providing management of the team's funding, labor and material resources.

What do you find most exciting about your job as a project manager for the Exploration Research and Technology programs at Kennedy Space Center?

I have to pinch myself sometimes when I take a moment out of my hectic day and soak in the reality that the place I work is the place that launched the first explorers to the **Moon**. People travel from all over the world to tour Kennedy Space Center on their vacation. Seeing all of the historic and unique infrastructure at Kennedy and watching a rocket launch are once-in-a-lifetime experiences for most people. Working at a place with so much historical significance that **continues to break boundaries**, enabling the private sector to accomplish new feats in space utilization and exploration, as well as planning to land the first woman and next man on the Moon as part of the **Artemis program**, makes coming to work each day exciting.

Being surrounded by so many brilliant minds and innovative thinkers is exceptionally rewarding as well, especially when we have the opportunity to have detailed discussions and brainstorming sessions about novel concepts for tackling challenges related to space exploration.

What is a typical day like for you?

A typical day for me includes participating in meetings with teammates to make decisions about project technical details or plan upcoming operations, as well as time at my desk to work on tasks such as writing and reviewing documents, purchasing materials or coordinating support and resources. Some days I get to spend a portion of my time in one of our shops or labs, participating in hands-on work with the hardware we are developing and testing.

How does your job contribute to NASA's effort to go forward to the Moon and to Mars?

There are numerous **technologies** that NASA and our commercial and international partners need to develop to facilitate sustainable long-term missions on the **Moon and Mars**. I work on various technology development projects to ensure our technical principal investigators are successful in **developing hardware** to solve issues, such as in-space refueling of spacecraft, robotic construction of both habitats and rocket landing pads built using local resources.

What is your educational background and why did you choose to study those areas?

I have a Bachelor of Science degree in industrial systems and manufacturing engineering from the University of Michigan. I chose this area because I was interested in the methods of applying efficiency to small and large-scale systems, and because I believed it to have a broad range of applications in any industry I wished to pursue.

What motivated you to want to work for NASA?

Honestly, if you would have told me when I was in school that I would have a future career as an engineer for NASA, I would not have believed you. It just goes to show that we should not be intimidated to pursue a **dream job**. NASA is one of the top, if not the top, most widely recognized and highly respected organizations in the world for its inspiring and ground-breaking accomplishments **benefiting humankind**. It is an absolute humbling honor to play my small role in this organization. I've always strived to give my best to the opportunities set before me, and I believe NASA shares that same spirit in the pursuance of its missions.

Why does conducting research and developing new technology matter to you?

Advancing research and technologies matters to me because no matter what missions we pursue in space, if we take an honest look around, we still have so many problems here on this planet that can benefit from innovation. Natural resource depletion, food and fresh water scarcity, the effects of natural disasters – these are all things that can be improved through innovations developed by NASA as we apply the discoveries we've made in overcoming similar challenges in the harsh environments of space exploration. Conducting research and developing new technologies can drastically improve living conditions on Earth and even save lives.

How do you think your NASA research or the agency as a whole benefits people on Earth?

NASA is continually pushing the boundaries of technology development to meet the unique challenges of space exploration. We are making products smaller and lighter to reduce precious space and weight when launching items into space. We are developing products to work in some of the most extreme environments of space, which in turn helps products work in extreme environments here on Earth. I believe NASA also is extremely beneficial in that we inspire people of all ages all over the world to harness their own ingenuity and apply it to solving challenges in their own spheres of influence.

The Orion crew and service module stack for Artemis I was lifted out of the Final Assembly and Test (FAST) cell on Nov. 11, 2019. The spacecraft has been stationed in the FAST cell since July for mating and closeout processing. The service module and crew module were moved separately into the cell, stacked and connected together for the mission. After lifting out of the cell, Orion will be attached to a tool called a verticator that rotates the stack from its vertical configuration to a horizontal configuration for transport to NASA's Plum Brook Station in Sandusky, Ohio. At Plum Brook, it will undergo full environmental testing to certify the complete vehicle for flight. Once the vehicle returns to Kennedy in several months, it will return to the FAST cell for installation of final panels left off for environmental testing purposes and the service module's four solar arrays. Photo credit: NASA/Rad Sinyak

BADGE of HONOR

Kennedy Space Center recognized as NASA's first Purple Heart Entity

BY DANIELLE SEMPSROTT

As our nation stopped this Veterans Day to honor those men and women who have served – and continue to serve – in the United States Armed Forces, NASA's Kennedy Space Center held its own observance event on Nov. 7, 2019. Here, Kennedy was recognized as a Purple Heart Entity by the **Military Order of the Purple Heart**, becoming the first NASA center to receive this designation for support and services provided to veterans through the spaceport's **Veterans employee resource group**.

Christopher Vedvick, commander of the Military Order of the Purple Heart Department of Florida, and Ernie Rivera, national adjutant of the Military Order of the Purple Heart, presented a proclamation and plaque stating this recognition to Kennedy's Associate Director, Technical, **Kelvin Manning**, and Veterans employee resource group chair Ana Contreras and executive champion Edwin Martinez. The event took place in the Florida spaceport's Training Auditorium and was attended by Kennedy employees, including more than 20 individuals who have been awarded a Purple Heart – one of the oldest military decorations presented to members of the armed forces who have been wounded or killed by America's enemies.

"Kennedy Space Center being the first space center to be a part of this is amazing," said Vedvick. "The amount of veterans who are here who have served their country and continue to serve – you did your job, and then you decided to come back here and serve again and help our nation in its exploration to space. We couldn't be more proud of you and being around you – that's the whole reason we're here. We are inspired by you, and we are inspired by the sacrifices that you make every day."

Following this award presentation, attendees had the opportunity to hear Vedvick, United States Army retired, speak about his experience serving in the Army, his involvement with the Military Order of the Purple Heart and the purpose of the organization. Vedvick joined the Army's airborne infantry and went into active duty in 2000, first deploying to Afghanistan in 2002.

"We deployed and we thought we were trained up," said Vedvick. "But what we discovered is that none of us were really ready for war."

While engaged in combat, he was wounded by three hand grenades – all landing within six feet of him, damaging the left side of his body. After the four-hour fight ended, he was medevacked out and returned home.

"It was at that point that I vowed I would always try to make it better for the next guy," he said. "Nobody should have to endure what we went through, or have to navigate the channels in which we had to navigate, to make things better."

Vedvick spent the rest of his career with special operations, deploying five more times to Afghanistan and once to Iraq. Retiring just a few years ago, he knew he wanted to continue serving his community and found a fit with the Military Order of the Purple Heart.

"They really gave me a home," he said. "It's hard to talk about these kinds of things, and it's great to be able to talk about these experiences with people who've been there – maybe not down on the same soil but definitely in the same kind of situation."

The Military Order of the Purple Heart is a congressionally chartered organization that provides support to veterans and their families throughout the nation, though members comprise those who were wounded in combat. Serving as commander of the department in Florida, Vedvick — and other Florida members — provide veterans a number of support services within the state, such as fellowship, any type of relief or assistance, including disaster relief, and equipping veterans with mobility devices free of charge.

From left, Kennedy Space Center Associate Director, Technical, Kelvin Manning, Kennedy's Veterans employee resource group chairperson Ana Contreras, and executive champion Edwin Martinez are photographed with the proclamation designating Kennedy a Purple Heart Entity on Nov. 7, 2019. The proclamation was presented by the Military Order of the Purple Heart during a Veterans Day observance held at the center. Photo credit: NASA/Kim Shiflett

"We believe that it's our duty to ensure that this population is taken care of," he said. "We are truly honored that you wanted to participate in this program. It helps all of us pay homage to those who sacrifice so much for our country."

Manning provided closing remarks at the ceremony, pointing out that veterans have contributed largely to NASA's success story, beginning with the agency's first astronauts and those early leaders who played an integral role in first getting us to the Moon and building some of the well-known facilities that we still use today. Now, there are more than 300 NASA employees who are veterans at Kennedy, including seven of the center's 10 directors.

"We would not be successful without our veteran contributions," he said. "Veterans take the lessons they have learned, and the experiences they have gained, and continue their service to our nation by strengthening our community. Our future is bright, and veterans will continue to play a vital role in securing the legacy of America's space program."

Christopher Vedvick, a combat wounded veteran and Military Order of the Purple Heart department of Florida commander, speaks at a Veterans Day observance event on Nov. 7, 2018, at NASA's Kennedy Space Center. Photo credit: NASA/Kim Shiflett

TOP DOGS

Kennedy Space Center's K-9 Unit Keeps Workforce, Facilities Safe

By Linda Herridge

Safety of people and assets are the number one priority at NASA's Kennedy Space Center in Florida. Some of the hardest working employees keeping the center safe perform their jobs on four paws. They are the specially trained K-9s in Kennedy's Protective Services Office in the Spaceport Integration and Services Directorate.

Though the space shuttle is no longer launching, there is plenty of work for the K-9s to do as the multi-user spaceport prepares for Artemis launches to the Moon and on to Mars, and commercial partner launches to the International Space Station.

"We are here to protect the employees and the assets," said Chris Vaughn, K-9 supervisor and kennel master with Chenega Infinity LLC. "This is our mission. It's all about safety."

A normal day's activities include sweeps of designated facilities, parking lots and random vehicle inspections at entrance gates. During rocket launches, they are out and about performing sweeps of facilities and launch site viewing areas.

Before arriving at Kennedy, each of the dogs is selected by Vaughn. They are mostly Belgian Malinois from Holland. There are certain traits or qualities Vaughn and his team are looking for, including their inherent drives for hunting, retrieving, playing and fighting to name just a few.

"These drives enable the dogs to be trained to the high standards required by the Kennedy Space Center's K-9 Unit. They have to be the best of the best," Vaughn said. "The K-9s are meant to be used as a deterrent."

Kennedy's K-9 unit is all male, with median ages of 2 to 11 years old. The dogs are put through three months of training focusing on detection, criminal apprehension and man tracking when they first arrive at the center. Each K-9 Unit goes through an additional 10 weeks of training with their assigned officer/handler tailored to Kennedy requirements, which includes narcotics and explosives detection, criminal apprehension and man tracking to assist with the center's Emergency Response Team and tracking felons trying to evade arrest.

K-9 Handler Officer John McGee leads K-9 Spike through a detection exercise in the parking lot at the Law Enforcement Academy at Kennedy Space Center. Photo credit: NASA/Kim Shiflett

Above: K-9 Spike is ready for the next training exercise with his handler K-9 Officer John McGee. Photo credit: NASA/Kim Shiflett

Left: K-9 Handler Officer Scott O'Rourke watches as K-9 LJ works his way through a row of bags and containers to locate one with a suspicious substance. Photo credit: NASA/Kim Shiflett

"The K-9s become their handlers' partners," said Roger Langevin, Kennedy Protective Services special agent and chief of Security. "We depend on them just as we would depend on another law enforcement officer."

The K-9s are hard workers, supporting the center 24/7, 365 days. They have a lot of ground to cover, including Kennedy property, which includes some property outside of the gates, and the Merritt Island National Wildlife Refuge. That's about 140,000 acres. They can detect the presence of narcotics and explosives, track criminals and even locate lost people. When called upon, the K-9 unit also supports local law enforcement requests.

When the dogs aren't out in the field, they are at the kennel where they are put through daily training and exercise routines. They also receive additional training on a weekly, monthly and annual basis to keep up-to-date on certifications.

As K-9s retire from active service, they either retire home with their handler or remain on center at the Law Enforcement Academy, where they continue to receive care. They may make occasional appearances at events on the center.

Making Connections

Business Opportunities Expo 2019 showcases exhibitor capabilities, networking opportunities

BY LINDA HERRIDGE

NASA's Business Opportunities Expo 2019 was held Oct. 23, at Port Canaveral in Florida. As in the past, the expo drew hundreds of attendees to this annual event that featured about 200 vendors, including 50 women-owned businesses, from a variety of product and service areas, such as engineering and communications, IT and computer technology, and construction and safety. Exhibitors from 47 states, plus Puerto Rico and India participated.

"The expo provides exhibitors and attendees an opportunity to showcase their capabilities to NASA, to federal agencies and to other small businesses," said Janet Petro, Kennedy Space Center's deputy director. "Kennedy is physically the largest NASA center, and I think, the most vibrant. So, I think it's entirely appropriate that this expo, being NASA's largest Small Business outreach event, is held very near to our center."

Currently, the center has 285 partner agreements with private-industry partners. And that number continues to grow. Today, these partnerships enable industry in making contributions to NASA's space endeavors.

"Women-owned businesses have provided some of the most innovative solutions to help NASA achieve its mission. Just recently, NASA conducted its first all-female spacewalk from the International Space Station. It is a milestone worth noting," Petro said.

Now in its 29th year, the annual expo is facilitated by Kennedy Space Center's Office of **Small Business Programs** and Prime Contractor Board in conjunction with the U.S. Air Force 45th Space Wing and Canaveral Port Authority. Expo participants include Office of Small Business Programs representatives from each NASA center and Kennedy prime contractors, including Jacobs, Lockheed Martin Space, Northrop Grumman Innovation Systems, SpaceX and The Boeing Company.

"This one-day event brings together a vast array of businesses, featuring information sessions and networking opportunities," said Joyce McDowell, Small Business specialist at Kennedy. "Our mission is to help small businesses achieve their business goals by bringing some of the brightest minds and best resources from around the county and beyond together."

A banner marks the entrance to the exhibitor area at NASA's Business Opportunities Expo at Cruise Terminal 10 at Port Canaveral in Florida. The event was held Oct. 23 and featured more than 200 small and large business exhibitors. Photo credit: NASA/Kim Shiflett

Attendees wind their way through an aisle of exhibitors at NASA's Business Opportunities Expo 2019 on Oct. 23 at Cruise Terminal 10 at Port Canaveral in Florida. Photo credit: NASA/Kim Shiflett

Exhibitors at NASA's Business Opportunities Expo 2019 talk to attendees on Oct. 23, at Cruise Terminal 10 at Port Canaveral in Florida. Photo credit: NASA/Kim Shiflett

Kennedy Space Center Deputy Director Janet Petro welcomes business leaders, exhibitors and attendees to NASA's Business Opportunities Expo 2019 on Oct. 23, at Cruise Terminal 10 at Port Canaveral in Florida. Photo credit: NASA/Kim Shiflett

An exhibitor greets an attendee at NASA's Business Opportunities Expo 2019 on Oct. 23, at Cruise Terminal 10 at Port Canaveral in Florida. Photo credit: NASA/Kim Shiflett

For example, Alertgy, a small business located in Melbourne, Florida, is working to develop the world's first real-time non-invasive continuous blood glucose monitor technology for diabetes. Ryan Bailey, director of innovative engineering for the company, said the technology currently is in pilot studies in a clinical environment.

The company's Chief Executive Officer Marc Rippen is working on vetting this technology with NASA to illustrate how the monitoring results could be tailored to detect the radiation levels of astronauts in space.

Rebecca Granger is a senior project manager with Alluvionic, an 8(a) woman-owned company, also located in Melbourne. "We've been in business six years now and have participated in this business expo since 2016," Granger said. The company's CEO and President Wendy Romeu credits the networking opportunities of the expo for its partnership with Millennium Engineering and Integration Company, a contractor at Kennedy.

Many of the small business exhibitors are veteran-owned, service-disabled and/or located in Historically Underutilized Business Zones (**HUBZones**).

Human Capital Resources and Concepts Inc. (HCRC) is a woman-owned company with offices in Winter Haven, Florida, which is designated a HUBZone, and Springfield, Virginia. HCRC also is SBA 8(a) certified. Marnice D. Miller, president and CEO, says the majority of her clients are Federal government agencies. "This event is very special to me," Miller said. "One of my first contracts came from the first business expo I attended and a contact I made through the networking opportunities."

Leak Tight Analysis, with offices in New Church, Virginia, and Merritt Island, Florida, is another success story. In business since 2011, the company attended its first business expo in 2018. Paul Tronti Jr., the company's vice president, said participating was very beneficial. "We were awarded a small business contract with J.P. Donovan to provide quality control, inspections and testing of the pressure systems for mobile launcher 1. It's exciting to be part of NASA's Artemis missions to the Moon and on to Mars."

"This expo is very special to me. It's an opportunity to develop relationships in order to do business, which for me is always a very good thing," said Glenn Delgado, associate administrator, NASA's Office of Small Business Programs. "Small businesses are critical to NASA's mission. For example, through Artemis, NASA and a growing host of partners will establish a sustainable human presence on the Moon by 2028."

Throughout the day, breakout session speakers provided information on topics covering solutions for enterprise-wide procurement, doing business with the U.S. Department of State and how to get on a GSA schedule.

"It's important to know how important small business is to NASA. Small business touches every one of our missions," Delgado said.

The Small Business Industry and Advocate Awards were announced during the Business Opportunities Expo welcome ceremony.

Fiscal Year 2019 Small Business Industry Award Winners

Small Business Prime Contractor of the Year:
Chenega Infinity, LLC

Small Business Subcontractor of the Year:
Aerodyne Industries, LLC

Large Business Prime Contractor of the Year:
Jacobs Technology, Inc.

Fiscal Year 2019 Small Business Advocate Award Winners

Procurement Person of the Year:
Rose Dougherty

Technical Person of the Year:
Brian Graf

Program Person of the year:
Natalie Colvin

Small Business Specialist of the Year:
Joyce McDowell

Repeat Performance

Apollo 12 achieves second Moon landing

BY LINDA HERRIDGE

It wasn't an easy task to follow Apollo 11, the first Moon landing, but the crew of **Apollo 12** achieved the second Moon landing despite a few challenges along the way. The first hurdle occurred during liftoff. The Saturn V rocket, carrying the Apollo capsule, was struck twice by lightning as it lifted off from Launch Pad 39A at NASA's Kennedy Space Center in Florida on Nov. 14, 1969, at 11:22 a.m. EST.

Aboard the Apollo 12 capsule, nicknamed the Yankee Clipper, were Commander **Charles "Pete" Conrad Jr.**, Pilot **Richard F. Gordon** and Lunar Module Pilot **Alan L. Bean**. Conrad had previously flown on Gemini V in August 1965 and served as commander of Gemini XI in September 1966. He commanded the first crew on Skylab, the first U.S. space station. Gordon previously served as pilot on the Gemini XI mission. Following the Apollo program, Bean launched as commander of the second Skylab crew.

As the Saturn V rocket propelled upward, launch controllers lost telemetry contact at 36 seconds, and again at 52 seconds, when the launch vehicle was struck by lightning.

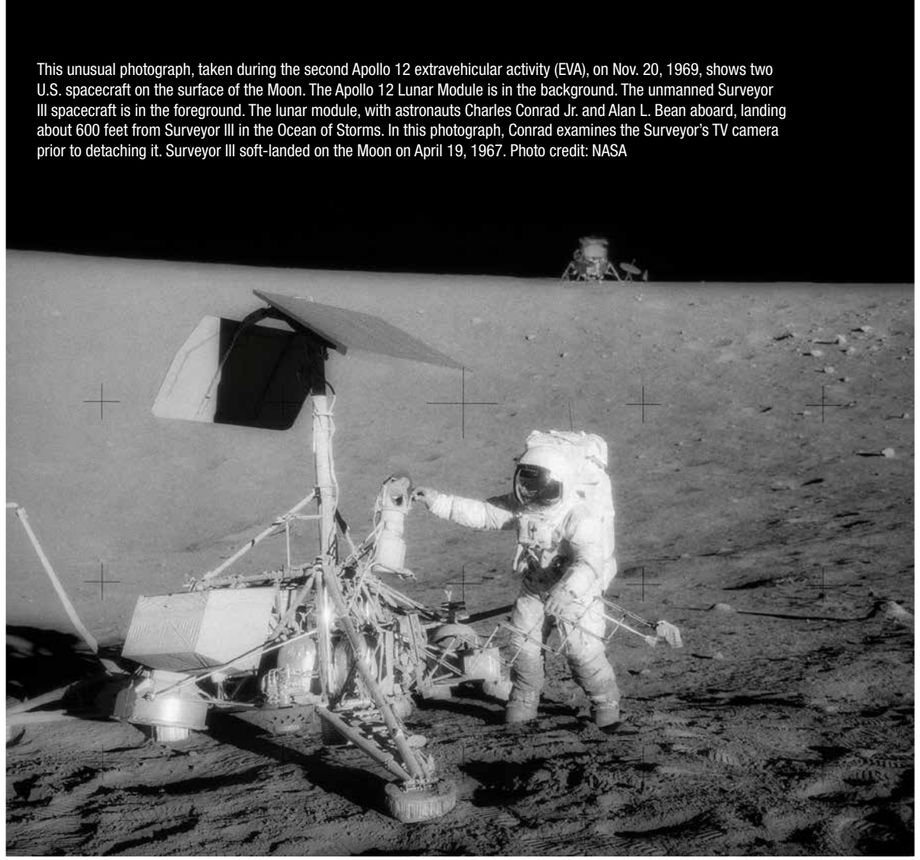
"I guess the most serious thing was the second lighting strike, which we weren't aware of," Conrad said during a technical debrief after the mission. "I was under the impression that we lost the platform because of low voltage but apparently that's not the case."

The rocket booster's first stage continued firing and launched Apollo 12 into an Earth-parking orbit of about 117.9 miles above the planet's surface. The electrical circuits were checked out, revealing no significant problems.

With all looking good, the Saturn S-IVB re-ignited for a second burn of five minutes and 45 seconds and placed Apollo 12 into a free-return translunar trajectory. About 40 minutes later, the command and service module (CSM) separated from the third stage, transposed and then docked with the lunar module (LM), nicknamed "Intrepid." The Saturn S-IVB was jettisoned but failed to go into the planned heliocentric orbit. Instead, it was placed into an elliptical Earth-orbit, where it remained for 42 days before burning up in Earth's atmosphere

Apollo 12 astronaut Alan Bean climbs down the lunar module Intrepid, joining Pete Conrad on the Moon, on Nov. 19, 1969. The second lunar landing mission, Apollo 12 proved the astronauts could make a precise landing. It also gave the crew a chance for a unique rendezvous with the robotic explorer Surveyor III, which had been on the Moon since 1967. Conrad and Bean spent more than 31 hours on the surface before rejoining crewmate Dick Gordon orbiting overhead in the command module Yankee Clipper. Image Credit: NASA

The official crew insignia for Apollo 12, NASA's second lunar landing mission. The clipper ship signifies that the crew is all Navy and symbolically relates the era of the clipper ship to the era of space flight. The portion of the Moon shown is representative of the Ocean of Storms area in which Apollo 12 will land. Image credit: NASA



This unusual photograph, taken during the second Apollo 12 extravehicular activity (EVA), on Nov. 20, 1969, shows two U.S. spacecraft on the surface of the Moon. The Apollo 12 Lunar Module is in the background. The unmanned Surveyor III spacecraft is in the foreground. The lunar module, with astronauts Charles Conrad Jr. and Alan L. Bean aboard, landing about 600 feet from Surveyor III in the Ocean of Storms. In this photograph, Conrad examines the Surveyor's TV camera prior to detaching it. Surveyor III soft-landed on the Moon on April 19, 1967. Photo credit: NASA

On Nov. 15, a midcourse maneuver changed Apollo 12's trajectory to prepare for later insertion into a non-free-return lunar orbit, the first "hybrid" trajectory in Apollo flights. On Nov. 17, Apollo 12 went behind the Moon at about 97 miles up and the first lunar orbit insertion burn began, placing the spacecraft into an elliptical orbit. On Nov. 18, a second lunar orbit insertion burn altered Apollo 12 to an orbit 76 miles above the Moon. That same day, Conrad and Bean entered the LM. They separated from the CSM at 107 hours and 54 minutes into the flight.

On Nov. 19, the LM began its powered descent to the Moon. When the CSM emerged from behind the Moon and telemetry contact was re-established with Earth, a discrepancy in orbit data readings of the LM and those in Mission Control in Houston was discovered. Using a newly developed powered-flight data processor, the actual trajectory data, as well as correction maneuver information, were communicated to the LM crew.

Conrad controlled the descent semi-manually during the last 500 feet, with a precision landing in the Ocean of Storms at about 110 hours, 32 minutes into the mission. About three hours after landing, on Nov. 19, Conrad emerged from the LM and descended the ladder to become only the third person to step on the Moon. He was followed by Bean.

As Conrad descended and stepped on the Moon, he was talking to Houston: (**TV still)** "Oooh, is that soft and queasy." (Pause, holding on to the ladder as he tests the footing) "Hey, that's neat." (Pause) "I don't sink in too far." (Pause) "I'll try a little..."(Letting go of the ladder and stepping out of the LM shadow) "Boy, that Sun is bright. That's just like somebody shining a spotlight in your hand." (Pause) "Well, I can walk pretty well, Al, but I've got to take it easy and watch what I'm doing."

The primary mission objectives while on the Moon included an extensive series of lunar exploration tasks. On Nov. 19, they deployed the Apollo Lunar Surface Experiments Package (ALSEP), which remained on the Moon's surface to gather seismic scientific and engineering data during a long period of time. Bean took a 16-inch-deep core sample of the lunar surface before both returned to the LM to eat, recharge their backpacks, rest and prepare for the next day's extravehicular activity (EVA).

On Nov. 20, the moonwalkers traveled up to 1,300 feet from the LM, located and retrieved portions of the **Surveyor III** spacecraft, which had soft-landed on the Moon on April 20, 1967, a short distance from Intrepid's selected landing site. Other tasks included a selenological inspection, or study of the Moon's features; surveys and samplings in landing areas; deployment and retrieval of other scientific experiments; and photography of candidate exploration sites for future missions.

Nearly four hours into the second EVA, Conrad and Bean traveled back to the LM and re-entered the spacecraft, where they removed their life support backpacks and other moonwalking gear and jettisoned them on the Moon. About six hours later, the LM ascent stage fired and Intrepid was propelled into orbit about 54 miles above the Moon. About 3.5 hours later, the LM rendezvoused and docked with the CSM and the crew transferred back to the Yankee Clipper.

As the CSM orbited the Moon, Gordon conducted a multi-spectral photographic survey of the lunar surface and photographed future landing sites. The service propulsion system, or SPS, ignited to place Apollo 12 into a trans-Earth trajectory on Nov. 21.

The 10-day mission of Apollo 12 came to an end with the capsule splashdown on Nov. 24, 1969, at 3:58 p.m. EST in the Pacific Ocean. The crew was retrieved by the USS Hornet. The mission duration was 10 days, 4 hours, 36 minutes and 25 seconds. Conrad and Bean had spent a little more than 31 hours on the Moon.

The launch of Apollo 12 was the only time a sitting president, Richard M. Nixon, attended the launch of an Apollo mission.

NASA achieved the second Moon landing and demonstrated the capability to achieve pinpoint landings on the lunar surface.

"There was a reason for this pinpoint landing," Gordon said during a NASA Oral History interview in June 1999. "If you look at the geological features later on in the Apollo Program, (13,000-foot mountains, Mount Hadley, rills, high plateaus, valleys), that kind of accuracy must be attained to be able to land in those particular places. So, the Surveyor III spacecraft that had been there almost two years ahead of our landing was our target."

The huge, 363-foot-tall Saturn V rocket with the Apollo 12 space vehicle lifts off from Launch Pad 39A at 11:22 a.m. EST on Nov. 14, 1969, at NASA's Kennedy Space Center in Florida. Photo credit: NASA

Left: In this photograph, one of the Apollo 12 astronauts on the Moon's surface is holding a container of lunar soil. The other astronaut is seen reflected in his helmet. Photo credit: NASA

Below: USS Hornet, prime recovery vessel for the Apollo 12 lunar landing mission, moves toward the Apollo 12 Command Module to retrieve the spacecraft. A helicopter from the recovery ship, which took part in the recovery operations, hovers over the scene of the splashdown. Photo credit: NASA

"It (is) difficult to describe the beauty of our universe in words alone." *–Alan Bean*

Moonwalk

Artist: **Andy Warhol**
Year: **1987**
Material: **Silk screen**

A Handful of Emeralds

Artist: **David Stone**
Year: **1987**
Material: **Oil on canvas**

Reach for the Stars

Artist: **Alan LaVern Bean**
Year: **1997**
Material: **Acrylic on Aircraft Plywood**

Mars Surface Glider

Artist: **Kahn and Selesnick**
Year: **2007**
Material: **Photograph**

STS-4 AT 00.52 SEC.

Artist: **Ren Wicks**
Year: **1982**
Material: **Oil**

The art shown is mostly from the NASA art collection.

Chip and Batty Explore Space

Artist: **William Wegman**
Year: **2001**
Material: **Photograph**

Honoring the Apollo 12 Mission

Crew: Charles Conrad Jr., Alan L. Bean, Richard F. Gordon Jr.

Launch: Nov. 14, 1969; 11:22 a.m. EST

Splashdown: Nov. 24, 1969; 3:58 p.m. EST, Pacific Ocean

"Through the talents, skills and graceful strokes of a brush, we share in the passion and pride that is an important step toward reaching the stars and bringing together the worlds of art and science,"
-Luis Berrios, NASA's program design specialist

Staff and docents gather for a group photograph during an appreciation event hosted by the Communication and Public Engagement Directorate on Nov. 1, 2019. Photo credit: NASA/Emily McLeod

SUPPORT STAFF AND DOCENTS RECOGNIZED AT APPRECIATION EVENT

By Linda Herridge

Kennedy Space Center's team of more than 500 support staff and docents were recognized during an appreciation event hosted by the center's Communication and Public Engagement Directorate on Nov. 1, 2019.

The gathering honored the efforts of current and retired NASA civil servant and contractor employees and docents for their tireless efforts and support staff hours spent sharing the NASA story with the public and members of the media.

"We've seen so many of you with this wealth of knowledge, who have gone on and retired and returned to support NASA," said Hortense Burt, director of Communication and Public Engagement. "We need to take the time to thank all of you and recognize you for all of your efforts."

Docents donated more than 6,500 hours meeting visitors and sharing updates on NASA's space program at the Atlantis exhibit and the Apollo Saturn V Center at nearby Kennedy Space Center Visitor Complex. NASA and contractor support staff and docents spent more than 16,000 hours reaching thousands of people at community and special events and VIP tours. During the past year, they reached more than 1.2 million guests, including the general public, families, children and teachers.

Special guest speaker Crystal Jones, SpaceX Integration lead for Ground and Mission Operations, NASA's Commercial Crew Program, gave an update on the program and the milestones accomplished to date by partners Boeing and SpaceX. The two companies are working to send U.S. astronauts to the International Space Station aboard U.S. spacecraft.

"Our Docents and supporters are such an impressive group, we are glad to be able to celebrate them and look forward to doing so again," said Emily McLeod Sulkes, Docent Program coordinator with Apache Logical. "If anyone is interested in joining the programs we're always happy to talk. Looking ahead to NASA's next year, we'll all have a lot to celebrate next time around."

Our Refuge

NASA'S KENNEDY SPACE CENTER
NATIONAL WILDLIFE REFUGE

Pollinators

BY REBECCA BOLT
KENNEDY ENVIRONMENTAL AND MEDICAL CONTRACT (KEMCON)

Pollination happens when pollen grains (male gametes) are transferred from the male anther of a flower to the female stigma of a flower, allowing fertilization and the subsequent production of seeds. Pollination is plant sex!

What are pollinators?

Anything that transfers pollen can be considered a pollinator. Pollen is carried by a number of different entities, including wind, water, insects, birds, and mammals. Even people can be pollinators.

Besides wind and water, how many kinds of pollinators are there?

Globally, there are around 250,000 species of invertebrate and 2,000 species of vertebrate pollinators. The U.S. is home to 4,000 species of native bees.

Which pollinators are the most essential?

Most of the pollinators are insects, including ants, beetles, bees, butterflies and moths, with honeybees doing the most pollinating. Of the birds, hummingbirds are the top pollinators.

Are different pollinators attracted to different flowers?

Yes, and the pollinators have likely evolved to pollinate specific plants. For example, bees are most

A bee visits a flowering plant. Photo credit: KEMCON/Tim Kozusko

attracted to bright blue and violet flowers. Butterflies like yellow, orange, pink and red flowers, and prefer flat petals to sit on while they feed. Hummingbirds, with their long beaks, favor tubular flowers that are red, pink, fuchsia and purple. Nocturnal moths and bats use fragrance to find night-blooming plants. Many trees and grasses that do not have flashy flowers or nice aromas rely on wind-driven pollination.

How does pollination benefit the pollinators?

Pollinators do not go to flowers with the intention of spreading pollen; they go to find food (nectar) and pollination is a consequence of the process. However, spreading pollen allows the plants to reproduce, thereby providing a food source for the pollinators. It's a mutually beneficial relationship.

A black swallowtail butterfly hovers over a flowering plant. Photo credit: KEMCON/Tim Kozusko

A viceroy butterfly perches on a leafy plant at NASA's Kennedy Space Center in Florida. Photo credit: KEMCON/Tim Kozusko

How do pollinators benefit us?

More than 80% of the plants in the world, including 450 crop plants, depend on a carrier of pollen to reproduce. Bats pollinate over 300 species of fruit such as mangoes, bananas and guavas. Honey bees are the United States' primary pollinators. According to the USDA, managed honey bees add roughly $15 billion a year by increasing crop quality and quantity, while wild, unmanaged pollinators (mostly bees) contribute $9 billion to the value of crops. And these facts are just the tip of the iceberg!

What's all the buzz about pollinators being in trouble (no pun intended)?

Credible scientific research has shown that many species of wild pollinators are threatened with extinction, primarily caused by habitat loss and pesticides. In addition, disease, parasites and environmental stressors have reduced the number of managed bee colonies in the U.S. by more than 50% since 1945. The pollinator crisis is real.

How can I help the pollinators?

Start thinking of your yard as being pollinator habitat and move away from the well-groomed "golf course" look. Plant a variety of native plants that will bloom at different times so your yard will provide resources year-round. Choose some plants that will feed the immature stages of insects as well as some to feed the adults (e.g., caterpillars and butterflies). Supply a drinking water source by filling a shallow basin with small stones and water and placing it on the ground. Some bees and many butterflies prefer mud puddles for drinking spots. "Unkept" areas with leaf litter, standing dead wood, and unmowed areas in your yard will offer pollinators shelter and nesting sites. Avoid pesticides, even organic ones can still harm pollinators. If you absolutely must use pesticides, read the labels and find one that is the least hazardous. Most importantly, do your homework. Learn about pollinators and educate others. This is a good example of when "Think globally; act locally" can make a real difference. Enjoy!

A white peacock butterfly perches on a flower at NASA's Kennedy Space Center in Florida. Photo credit: KEMCON/Tim Kozusko

NASA astronaut Drew Morgan waters Mizuna mustard plants growing in the Veggie plant growth system for VEG-04B on the International Space Station on Oct. 27, 2019. Photo credit: NASA

National Aeronautics and Space Administration

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