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Spaceport News

John F. Kennedy Space Center - America's gateway to the universe

Final Space Shuttle Ferry Flight

CLICK ON PHOTO NASA/Kim Shiflett

Space shuttle Endeavour takes to the sky from the Shuttle Landing Facility at Kennedy Space Center at 7:22 a.m. EDT mounted atop NASA's Shuttle Carrier Aircraft, or SCA, on Sept. 19. In the background is the 525-foot-tall Vehicle Assembly Building where the shuttles were attached to their external fuel tank/solid rocket booster stacks. Endeavour will be placed on public display at the California Science Center in Los Angeles. To watch a time-lapse video of Endeavour's preparations for the final ferry flight, click on the photo.

Endeavour heads to California

By Steven Siceloff
Spaceport News

Space shuttle Endeavour and the Shuttle Carrier Aircraft landed at Ellington Field in Houston on Sept. 19 to complete the first day of its trek from Florida to Los Angeles where the shuttle will be placed on public display.

As the SCA approached Houston, it performed a low-level flyover carrying Endeavour over some of the city's landmarks. The flight made several flyovers during its trip across the American southeast.

The aircraft combination, weighing some 475,000 pounds, took off Sept. 19 from NASA's Kennedy Space Center then flew over the Space Coast in a salute to the region that hosted the shuttles during 30 years of launches and landings. The SCA and Endeavour also soared low over Disney World in Orlando during its trip west.

Later, the Michoud Assembly Facility near New Orleans and Stennis Space Center in Mississippi, were treated to a view of Endeavour atop the modified 747.

People took to Facebook and Twitter to share comments and photos of Endeavour as they saw the shuttle pass overhead.

The flight will be the last ferry flight of the space shuttle era, capping nearly 35 years of shuttles riding atop modified 747s, counting the approach and landing tests conducted by Enterprise in 1977.

The SCA and Endeavour departed at dawn Sept. 20 and made a fuel stop at Biggs Army Air Field in El Paso before proceeding to Dryden Flight Research Facility at Edwards Air Force Base in California. As of press time, the ferry was scheduled to depart Dryden on Sept. 21 for a flyover of northern California and areas of the Los Angeles basin before landing at Los Angeles International

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Interaction at core of Innovation Expo 2012

By Steven Siceloff
Spaceport News

The research and invention taking place at NASA's Kennedy Space Center took the spotlight Sept. 6 as employees showed off their ideas and toured the center's unique labs and facilities during the first Innovation Expo.

"I really enjoyed getting around the center on our Innovation Day to see what folks are doing, and allow them to share with me the excitement they have in their projects," said Bob Cabana, director of NASA's Kennedy Space Center in Florida and a former shuttle commander. "Innovation is core to our daily work at KSC, and I think it's really important that we talk with one another and share ideas. Who knows what we'll come up with when we collaborate. Hats off to the team that made this day a reality."

Shops, laboratories and facilities offered tours and exhibits across

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Inside this issue...

Program 'kick-starts' ideas, encourages innovation

By Bob Granath
Spaceport News

As NASA's Kennedy Space Center continues developing programs and infrastructure to become a 21st century spaceport, many employees are devising ways to do their jobs better and more efficiently. On Sept. 6, 16 Kennedy employees pitched their innovative ideas for improving the center at the Kennedy Kick-Start. The competition was part of a center-wide effort designed to increase exposure for innovative ideas and encourage their implementation.

Concepts were submitted via the Kennedy Kick-Start website and screened by the Research and Technology Board in late August.

A total of 11 proposals totaling up to $5,000 each for equipment were selected to implement ideas at Kennedy. Projects selected ran the gamut from a virtual control panel and the artificial gravity effects on hydroponics grown on the International Space Station, to planetary ice mining and a Humvee 'quick-attach' mounting interface for vehicle exploration payloads.

NASA/Gianni Woods

William Merrill, of NASA's Communications Infrastructure Services Division, proposes an innovation that would make mission audio available by way of an Internet radio stream Sept. 6 in the Training Auditorium as Kennedy Kick-Start Chairman Mike Conroy looks on.

During his all-hands meeting July 13, Bob Cabana, director of Kennedy and a former space shuttle commander, stressed that spaceport workers' innovative expertise in launch vehicle, spacecraft operations and sustainable efforts, is leading the way in building a launch complex of the future.

As a part of the KSC Innovation Expo, individuals and employee teams pitched innovative ideas. The all-day expo gave the Kennedy workforce an opportunity to learn what others are doing and continue to nurture a creative and innovative culture.

NASA/Gianni Woods

An eight-member Kick-Start selection panel listens to a presentation by a Kennedy Space Center employee. Seated in the front row, left to right, are Bob Cabana, center director; Joyce Riquelme, director of Center Planning and Development; Susan Kroskey, center chief financial officer; and Josephine Burnett, director of International Space Station Ground Processing and Research. Back row, left to right are Tracy Anania Wetrich, director of Human Resources; Russell Romanella, director of Safety and Mission Assurance; Nancy Bray, deputy director of Center Operations; and Kelvin Manning, center associate director.

Before the program began, Karen Thompson, of NASA's Research and Technology Management Board, stressed the importance of developing improved ways to get things done.

"Innovators are defined as individuals who solve problems by finding new, exciting and unexpected solutions," she said.

During 90-second presentation, the employees explained their concepts to an eight-member Kick-Start selection panel representing diverse organizations at Kennedy.

"We were really happy with the variety of topics covered by the presenters," said David Miranda of NASA's Information Technology and Communications Services.

An innovation by William Merrill of NASA's Communications Infrastructure Services Division and Keith Kenyon of QinetiQ North America to make mission audio available by way of an Internet radio stream was one of those selected.

"Quite a few people have a need to listen to mission audio," Merrill said. "We felt this idea would make access easier. Since there would be much less effort to set up the capability and the necessary equipment, it also would be a money saver."

Kennedy works to spur innovation on a daily basis. By retrofitting its world-class ground systems and facilities for both government and commercial users and infusing innovative ideas into ongoing and forward-looking programs, the center and its new Kick-Start competition are helping NASA reach America's space exploration goals.

NASA/Kim Shiflett

Duane Dickey, an engineer at the Kennedy Prototype Lab, shows one of the shop's tools and what it can create to employees touring the facility during the Innovation Expo 2012 on Sept. 6.

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Kennedy and at NASA facilities at Cape Canaveral Air Force Station.

"This is a big center and there are a lot of things that go on here," said Duane Dickey, an engineer showing the machinery and techniques used at Kennedy's Prototype Development Laboratory to make early versions of devices and fixtures that play a role in spaceflight. "So many people don't know all the things that go on, so I think it's a great idea to let people get out and see and learn what's on the center."

Dickey said the crossover between the departments could encourage communication that might lead to the development of projects.

"I'm sure there are people on center designing and making things that don't know this is here," Dickey said.

That interaction was one of the primary goals for the Innovation Expo, said David Miranda, the lead organizer of the event.

"A lot of times you're constrained by your cubicle wall," Miranda said. "The exhibits and tours are going beyond that and that's really important for innovation because innovation is about taking ideas from somewhere else and applying it somewhere new."

The Innovation Expo was the brainchild of Karen Thompson, chief technologist at Kennedy, Miranda said. It came together in about two months, which is a quick timeline for a center-wide event.

Exhibits in the spirit of a world's fair were set up at several buildings at Kennedy, and the halls filled quickly with researchers and observers.

"It's great to find out what my cohorts are doing and get cross talk going," said Walt Turner, who was displaying an experiment in the Operations and Checkout Building related to Alzheimer's research. "Once you find out what other people are doing, it's a short walk to find out how you might help them and how they might help you."

A robot that processed cans for recycling was the star of the display set up by the center's Sustainability Office.

Alice Smith, Sustainability and Recycling Program manager, said the event allowed her to show the STAR system, a software tool for tracking and reusing recyclable materials.

There still are people who don't know that Kennedy is focused on recycling materials, said Annie Williams, recycling coordinator, so the Innovation Expo was a natural platform for showing that to people.

Miranda said the expo went well and could become a regular event at the center.

"I think overall it's been good, there've been a lot of lessons learned," Miranda said. "Hopefully (we'll host one) every year."

Researchers look to alien soils for heat shield

By Steven Siceloff
Spaceport News

NASA

A 2-inch by 4-inch brick is heated by a welding torch to test a concept for making heat shields from the soil of other worlds.

Ten small samples performed well this week during testing to see whether a heat shield made from the soil of the moon, Mars or an asteroid will stand up to the searing demands of a plunge through Earth's atmosphere.

At stake is the possibility that future spacecraft could leave Earth without carrying a heavy heat shield and instead make one on the surface of another world and ride it home safely. The weight savings opens new possibilities ranging from using smaller rockets to carrying many more supplies on an exploration mission.

Michael Hogue, a researcher at Kennedy Space Center, came up with the idea during a brainstorming session last year covering different ways to use extraterrestrial soils, known as regolith.

"Others were talking about how regolith can be used to make bricks or landing pads and I said, 'Well, if it's good for that, why can't it be used to make atmospheric entry heat shields?' " Hogue said.

> *"Others were talking about how regolith can be used to make bricks or landing pads and I said, 'Well, if it's good for that, why can't it be used to make atmospheric entry heat shields?' "*
>
> **Michael Hogue, researcher at Kennedy Space Center**

NASA funded the concept research through its NASA Innovative Advanced Concepts, or NIAC, program.

Since then, a team of engineers has been trying out various mixtures and techniques to find out whether the idea has any potential. So far, the tests have been very successful, with small bricks of material standing up well to the intense heat of a blowtorch which is similar to entry heating. A sensor placed behind the brick recorded temperatures of about 200 degrees F compared to the approximately 4,000 degrees F the front side endured.

"I expected some to fail," Hogue said. "There is an optimum range of density you need to hit for each material where it's light enough to have low enough thermal conductivity, but also structurally strong enough to survive the forces of atmospheric entry. All of our formulations that we tested with a cutting torch at least passed that."

The dome-shaped bricks, each 2 inches thick and 4 inches in diameter and made of different combinations of material, faced their toughest test when they were placed inside the arc jet facility at NASA's Ames Research Center in California. There, they were subjected to a scorching plasma stream that will put the bricks through heating conditions similar to those seen during entry. Some of the samples saw some melting, but none were destroyed, Hogue said.

"That will ultimately determine whether this idea is feasible or not," Hogue said.

The concept, while promising, is far from becoming operational. At this point, Hogue puts the concept at a technology readiness level, a 1 on a scale of 9, with 9 being an operational element. Working it up the technology readiness level (TRL) scale will take a series of evaluations, adaptations and inventions, including potentially trying out a sample disc on the bottom of a cargo spacecraft returning from the International Space Station.

Hogue said his attitude has gone "from guarded skepticism to hopeful enthusiasm" on the effort.

The potential weight-savings is too great to ignore, Hogue said.

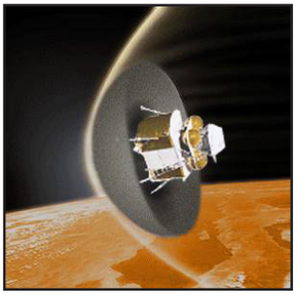
Making the heat shield in space would likely be the work of a robotic device, or at least a heavily automated system to either mix the regolith with a rubbery substance in a mold or heat a large disc of regolith until the soil elements fuse together. The heat shield then could be cut and shaped as needed.

The primary advantage is that getting the finished heat shield off an asteroid or Martian moon would take very little force because the gravity is so low. The heat shield could be as big as anyone would want. It could be used to insulate a spacecraft whether it is going to the Martian surface or back to Earth.

The weight savings is critical to the plan because the regolith material is anything but light. A brick of regolith, actually made from Mars and moon soil simulant instead of actual extraterrestrial dirt, feels the same in the hand as a brick from which one builds a house on Earth.

Also, the heat shield would not be reusable, but would be designed to have some layers fleck or burn off, a process called ablating. All heat shields except the space shuttles' were made of ablative material.

"You can make it massive and if it heats up and ablates off, all the better because the ablated mass takes heat with it," Hogue said. "After about five minutes you jettison the shield over the water and you're done."



NASA

An artist's concept of a spacecraft using a heat shield made from regolith, soil of another world.

Kennedy balances great outdoors, launch operations

By Rebecca Regan
Spaceport News

In a place where rockets and spacecraft are prepared for trips out of this world, there lies a paradise that has been protected from commercial and residential development for nearly 50 years. It's the harmony of NASA's Kennedy Space Center and the landscape it shares with the Merritt Island National Wildlife Refuge that piqued the interest of dozens of employees to take a field-guided boat tour of the area during Kennedy's first Innovation Expo on Sept. 6.

Inomedic Health Applications, or IHA, led the tour called "Living Outdoor Laboratory for Environmental Sustainability," which ferried employees through areas that have been closed to the general public for decades because of launch operations taking place at Kennedy and the adjacent Cape Canaveral Air Force Station.

"The goal out here, of course, is to launch rockets," said IHA aquatic biologist Eric Reyier. "We're tasked with protecting the natural habitat in as healthy a state as possible."

CLICK ON PHOTO *NASA/Rebecca Regan*

Aquatic biologists Eric Reyier, left, and Doug Scheidt with Inomedic Health Applications, or IHA, prepare for a field-guided boat tour of Kennedy Space Center. As part of the center's first-ever Innovation Expo, the tour, called "Living Outdoor Laboratory for Environmental Sustainability," is giving employees the opportunity to see the unique estuarine ecosystems that are protected from development by the presence of Kennedy and the Merritt Island National Wildlife Refuge. To watch a video about how Kennedy co-exists with nature, click on the photo.

During the tour, Reyier pointed out the refuge's countless nooks and crannies that are providing habitats for more than 1,500 species of plants and animals. He also outlined some of the innovative partnerships Kennedy has embarked on with other government agencies and universities to help monitor the local ecosystem.

For example, biologists are able to track the movements and survival rates of sport fish, sharks and protected sea turtles with the Florida Atlantic Coast Telemetry, or FACT, Array. The strategically placed constellation of sensors tracks tagged animals as they move through Kennedy and the rest of the Indian River Lagoon. They've even detected other researchers' animals from as far north as Connecticut and New York.

"The technology is sort of expensive, and so by teaming up with these other groups, we're able to only provide a fairly small percentage of the infrastructure but we're able to answer some pretty important ecological questions," Reyier said.

Aquatic biologist Doug Scheidt also has been working on finding answers to some of those tough ecological questions. Right now, for example, the lagoon's normally clear water is murky. Scheidt said it's partly due to an algae bloom, which he and his group see about once or twice a year. They're working to understand what causes the bloom and how it affects the lagoon's seagrass, which is a natural source of food for Florida's endangered manatees.

"From a regional standpoint, we have over 70 percent of the wetlands," Scheidt said. "We also have one of the largest expanses of seagrass beds in the area, which are important to other animals outside Kennedy's gates because these are high-quality habitats. So, animals can move into the area and conversely some of these animals can actually move outside the region and can actually move globally."

The reasons for protecting the area are three-fold, according to biologists. First, federal mandates are in place to protect the wetlands and surrounding lagoonal waters, as well as several threatened or endangered species of animals. Second, through stewardship, the space agency is working diligently to execute its mission without compromising our planet's resources. Third, there is a substantial role that the ecological health of Kennedy's wildlands and the refuge play in our economy.

"The economic value of the Indian River Lagoon was estimated at about $3.7 billion with a 'B' every year," Reyier said. "Fisheries alone is worth $330 million a year to the region in terms of benefit. That's got to be hundreds of jobs directly or indirectly. And by preserving this habitat and the wildlife in a fairly healthy state, we preserve that economic benefit as well."

Just as the jobs of Kennedy technicians and engineers are pretty demanding and of national importance, it's no different for the biologists and scientists working with IHA.

"There's no doubt that we're able to enjoy the view while we work. Today, for example, we saw dolphins, manatees and a bald eagle all within 30 seconds of each other," Scheidt said. "The fact that we get to do science that benefits the ecological community here and elsewhere makes coming to work every day a pleasurable experience."

Volunteers remove 6,000 items of trash from Kennedy's beach

By Frank Ochoa-Gonzales
Spaceport News

Of the 72 miles of beach that line the eastern side of Brevard County, Fla., about six of those miles line NASA's Kennedy Space Center.

On Sept. 14, about 120 volunteers from the Kennedy workforce, U.S. Fish and Wildlife Service, and the Ocean Conservancy spent several hours scouring the sand for items that had washed ashore.

Unlike what might be found along a public beach, all of the debris that litters Kennedy's restricted beaches usually washes up from items discarded at sea.

They collected about 6,000 items including syringes, aerosol cans, gasoline, and a flare.

It was the first time Kennedy had partnered with the Ocean Conservancy's International cleanup efforts. The combined effort was supported through donations from about 20 sponsors.

Like other beach cleanups, the volunteers found a mother lode of stray items, from trash tossed overboard by cruise passengers to messages in bottles launched from faraway places. Also, a surprisingly large number of shoes were found.

"I think it's a good idea and good for the environment," said Diane Fleming of the Marshall Resident Office at Kennedy Space Center. "I was surprised at the amount of trash we found out here."

The volunteers collected about 60 large bags of trash between three sites, much of which was being recycled. This includes 180 pounds of plastic, 240 pounds of glass and one pound of aluminum.

Trash can disturb a sensitive nesting ground for several types of sea turtles.

With the center's beaches part of the No. 1 nesting area in the Western Hemisphere for loggerhead sea turtles, it is important to understand the environmental impact of trash and debris along the coast.

"When the turtles come up, we want to reduce any type of obstructions that might get in their way," said Susan Waldron, a volunteer for the Merritt Island National Wildlife Refuge. "When the turtles leave, we want to reduce anything they might get tangled up in."

In the end, the success of the cleanup can't be measured just by the debris collected, but also by the heightened awareness.

Waldron said, "We found a lot of lollipop sticks . . . which proves that anytime you have an opportunity to pick up human trash, it's worth it."

Scenes Around Kennedy Space Center

CLICK ON PHOTO *NASA*

NASA's Space Shuttle Program across all centers received an award from the American Institute of Aeronautics and Astronautics (AIAA) at the AIAA Space 2012 Conference and Exposition in Pasadena, Calif., on Sept. 12. Accepting the award on behalf of Kennedy Space Center is former shuttle launch director Pete Nickolenko, deputy director of Ground Processing, third from right. To read more about the shuttle era, click on the photo.

NASA

Major League Baseball's Minnesota Twins welcomed Kennedy Center Director and Minneapolis native Bob Cabana to start the Minnesota Aerospace and Aviation Week by signing a baseball which was launched by a balloon on Sept. 16.

CLICK ON PHOTO *NASA/Jim Grossmann*

Astronaut Drew Feustel, and other members of the STS-134 crew, visited with Kennedy workers Sept. 17 in the OSB II fifth floor conference room. To read more about STS-134, click on the photo.

CLICK ON PHOTO *NASA/Bill Ingalls*

Attendees of the memorial service for Neil Armstrong sing a hymn, Sept. 13, at the Washington National Cathedral. Armstrong, the first man to walk on the moon during the 1969 Apollo 11 mission, died Aug. 25. To read more about Armstrong's contributions to America's space program, click on the photo.

From **SHUTTLE**, Page 1

Airport between 11 a.m. and noon PDT. In October, Endeavour will be moved to the California Science Center to begin a new mission inspiring future explorers.

The pilots of the aircraft carrying space shuttle Endeavour across the country to California know what it's like to lead an aerial parade.

"The Washington beltway was pretty packed with people," said Jeff Moultrie, chief pilot of the Shuttle Carrier Aircraft, about the crowds the crew witnessed gathered around Washington, D.C., in April as they delivered space shuttle Discovery to the Smithsonian's Air and Space Museum. "In fact, I think it stopped. We could see people stopped in their cars and up on buildings and such."

That ferry flight and a similar one a few days later that flew over New York City with Enterprise were two of a very few times a shuttle has been flown over northeastern cities. Enterprise was flown to the nation's capital in 1985 before going on display at the Smithsonian.

"We weren't sure what to expect, since we had never done something like this before with the space shuttle on top of the 747. What would be the reaction?" said SCA pilot Bill Rieke. "When that happened and we saw the reaction, that was priceless."

The flight crew for the SCA is expecting much the same interest this time.

"We're proud to show off work that NASA's done," Rieke said.

Moultrie said much more effort goes into setting the courses for the flights delivering the retired space shuttles to their display locations than did the ferry flights that carried the spacecraft back to Florida after a California landing.

Large aerial corridors are assigned for the ferry flight so no other planes can use the airspace while the shuttle and SCA are flying through, for example. Also, the flyovers call for the aircraft to pass into restricted airspace around some notable sites.

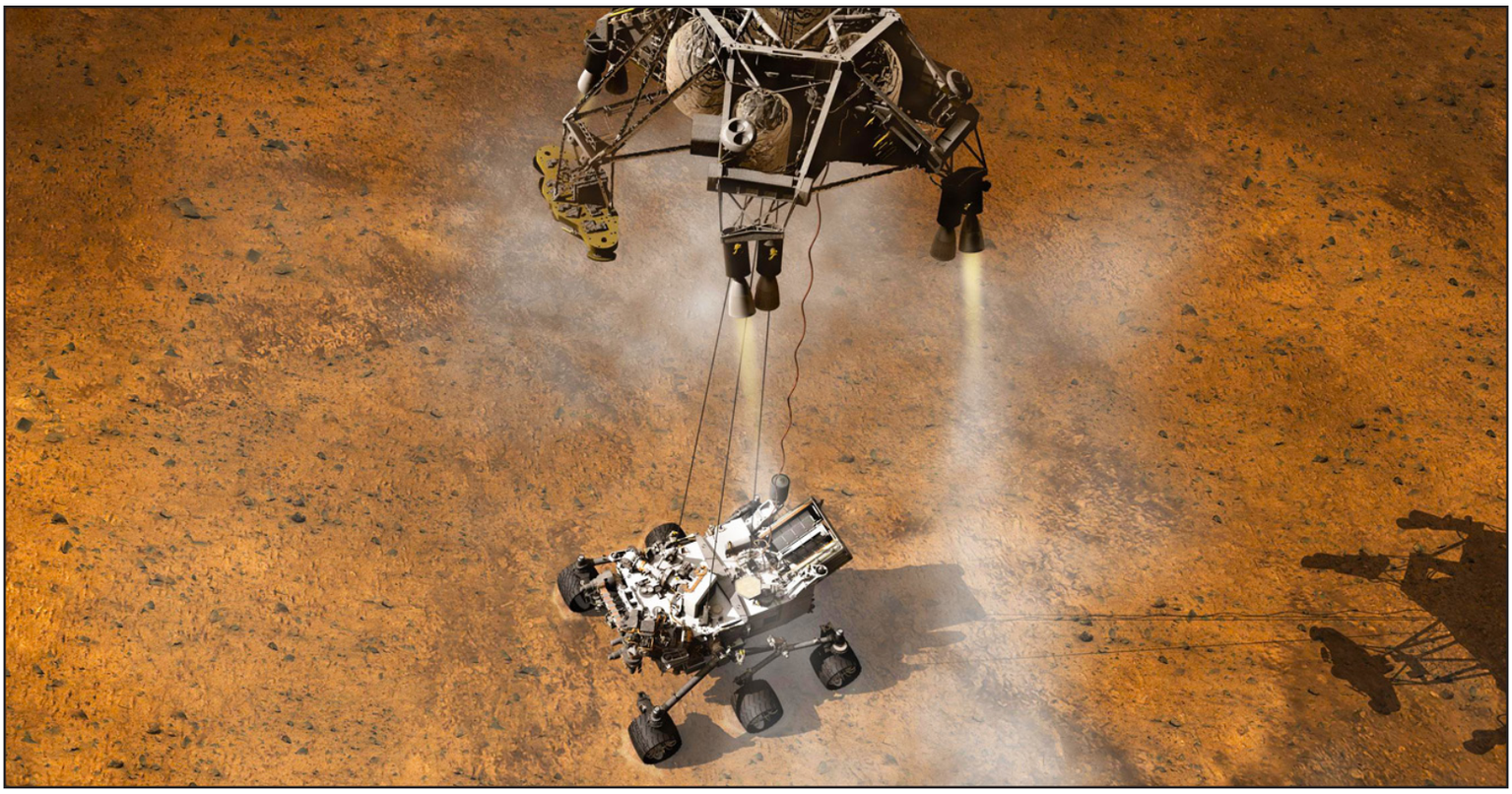
"We coordinate with the Federal Aviation Administration," Moultrie said. "Regular ferry flights required none of this. Other than some flyovers on arrival that we did as a bonus, we really didn't do flyovers."

Although they saw the crowds from inside the cockpit of the 747, Moultrie and Rieke said they made sure not to get distracted by them.

"We still have a mission to do and that is, we need to deliver it safely where it belongs and that is the part I'm focused on," Rieke said.

The flight also makes a few special demands of pilots as they line up the best way to approach a landmark so the flyby can be recorded in the best way.

"To do this type of flying, we need to consider the photography aspects, the sun angle, what the geometry with the chase ship needs to be, that type of thing," Moultrie said. "This is obviously the biggest thing I've done in aviation and probably the biggest thing I ever will do."



CLICK ON PHOTO NASA/JPL-Caltech

In this artist's rendering, the Mars Science Laboratory's descent stage uses rocket engines to hover, while its sky crane lowers the Curiosity rover with a 25-foot tether to a soft landing on the surface. Photographs show there were some rocks and dust kicked up by the rocket engines on the skycrane lowering the Curiosity lander onto the Martian surface Aug. 6. To learn more about NASA's mission on Mars, click on the photo.

Landing pads designed for extraterrestrial missions

By Bob Granath
Spaceport News

When the Mars Science Laboratory's Curiosity rover landed on Aug. 6, it was another step forward in the effort to send humans to the Red Planet. Using the lessons of the Apollo era and robotic missions to Mars, NASA scientists and engineers are studying the challenges and hazards involved in any extraterrestrial landing.

The technology is known as "vertical takeoff-vertical landing." According to a group working in NASA's Engineering and Technology Directorate at Kennedy Space Center, the best approach requires a landing pad already be in place.

"One of the greatest challenges to Apollo astronauts landing on the moon was dust, rocks and debris obscuring their vision during the final part of the descent," said Rob Mueller, a senior technologist in Kennedy's Surface Systems Office and Lunar Destination co-lead for NASA's Human Spaceflight Architecture Team. "When the Apollo lunar modules reached the 30-meter point (about 100 feet), the dust was like a fog making it difficult to see their landing site. Similarly, photographs show there were some rocks and dust kicked up by the rocket engines on the skycrane lowering the Curiosity lander onto the Martian surface."

As the Mars Science Laboratory's descent stage used rocket engines to hover, its sky crane lowered the Curiosity rover with a 25-foot tether to a soft landing on the surface.

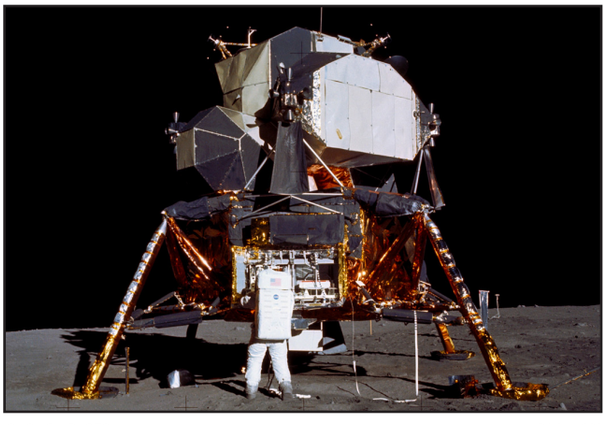
Mueller and others are working on ways to develop landing pads that could be robotically constructed in advance of future human expeditions to destinations such as the moon or Mars. These specially constructed landing sites could greatly reduce the potential for blowing debris and improve safety for astronauts who make the trip to Mars or other destinations.

"Our best estimates indicate that descent engines of the Apollo landers were ejecting up to one-and-a-half tons of rocks and soil," said Dr. Phil Metzger, a research physicist in Kennedy's Granular Mechanics and Regolith Operations Laboratory. "It will be even more challenging when we land humans on Mars. The rocket exhaust will dig a deep hole under the lander and fluidize the soil. We don't know any way to make this safe without landing pads."

Building a landing site in advance of human arrival is part of the plan.

"Robotic landers would go to a location on Mars and excavate a site, clearing rocks, leveling and grading an area and then stabilizing the regolith to withstand impact forces of the rocket plume," Mueller said. "Another option is to excavate down to bedrock to give a firm foundation. Fabric or other geo-textile material could also be used to stabilize the soil and ensure there is a good landing site."

Metzger explained that one of the ways to ensure an on-target landing would be to have robotic rovers place homing beacons around the site.



CLICK ON PHOTO NASA file/1969

Using the lessons of the Apollo era and robotic missions to Mars, NASA scientists and engineers are studying the hazards involved in any extraterrestrial landings. They are seeking ways to avoid the rocks and soil visible in the foreground of this image of Buzz Aldrin working at the lunar module during the Apollo 11 moonwalk in July 1969. To read more about Apollo 11, click on the photo.

Crew access arm balances new, heritage technologies

By Linda Herridge
Spaceport News

Kennedy Space Center's Ground Systems Development and Operations Program engineers in Florida are combining heritage technology and new innovations to design the crew access arm for the tower on the mobile launcher that will be used for NASA's Orion spacecraft atop the Space Launch System (SLS) rocket.

Orion will be the most advanced spacecraft ever designed and carry astronauts farther into space than ever before. SLS is designed to be flexible for launching spacecraft for crew and cargo missions and will enable new missions of exploration and expand human presence across the solar system. It will first launch Orion in 2017.

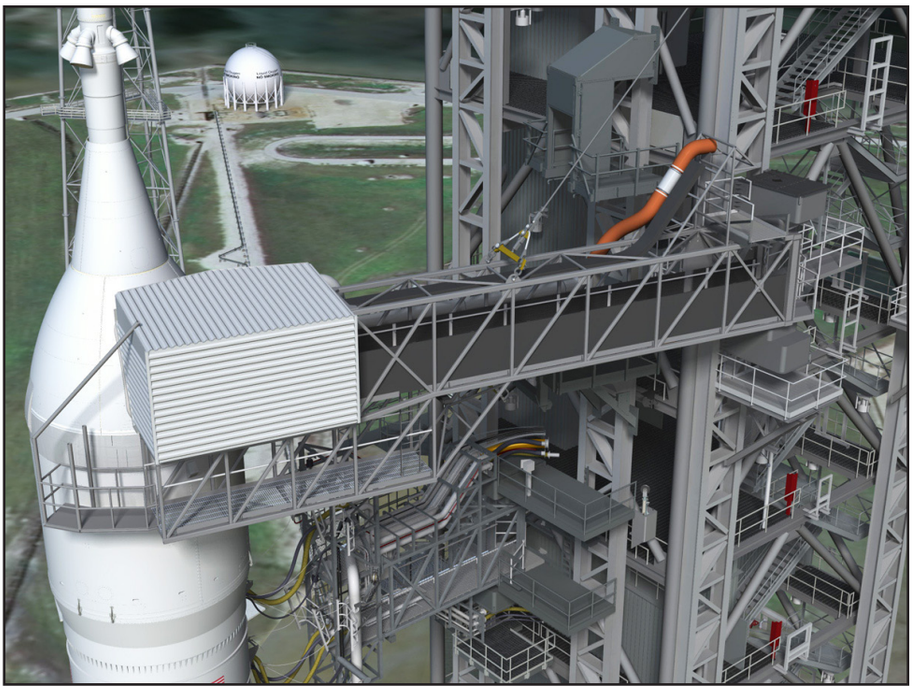
According to Kelli Maloney, a mechanical design engineer in the center's Engineering Directorate, the mobile launcher's new 60-foot-long hydraulic arm will be similar in length and speed to the arm used during the Apollo missions. It will have two levels and incorporate hardware from NASA's Apollo and Space Shuttle Programs.

Located at about 270 feet high on the 355-foot-tall tower, the upper level will include a new White Room that provides access to the Orion crew module. The White Room will contain a six-foot-long access platform, also nicknamed the "diving board," that will extend through Orion's outer door to the crew module door. Refurbished Apollo-era control console and accumulators also will be part of the new arm.

The lower-level walkway will provide access to two panels on the spacecraft's service module.

CLICK ON PHOTO NASA file/2011

The mobile launcher made the 4.2-mile trek along the crawlerway Nov. 11, 2011, from Launch Pad 39B to the park site near the Vehicle Assembly Building after a two-week stay on the pad for structural and functional engineering tests. To watch a video of the move, click on the photo.



CLICK ON PHOTO NASA/Boeing

A computer-aided design image of the crew access arm that is being developed for the mobile launcher tower. To learn more about NASA's Space Launch System, click on the photo.

Maloney said design elements from the inflatable dock seal on the shuttle's orbiter access arm will be reused, as well as storage cabinets and safety equipment from the shuttle-era White Room.

The access arm will rotate out to the crew module on giant Apollo-era hinges. The hinges will be refurbished and retrofitted with new digital encoders to accurately obtain the arm's position.

"This information will be fed back to the Program logic controllers in an electrical room on the mobile launcher tower in order to achieve precise control of arm position," Maloney said.

Platforms from Launch Pad 39B's fixed service structure will be installed on the mobile launcher tower and provide access to the hinges for inspection and repair.

Maloney said new 3-D design visualization tools are being used to view the concept throughout the design process.

"It's a challenge, because you have to think about every detail," Maloney said. "It's very diverse."

> *"Having access to 3-D scanning capabilities is very helpful so that we can see how the design will fit into the existing structures, such as the mobile launcher, the Vehicle Assembly Building and Launch Pad 39B."*
>
> **Kelli Maloney, mechanical design engineer in Kennedy Space Center's Engineering Directorate**

During the process, heritage parts planned for reuse, such as the Apollo-era control consoles, are scanned and then uploaded into a special 3-D design software program. Maloney said this process save the time and costs of modeling existing components.

"Having access to 3-D scanning capabilities is very helpful so that we can see how the design will fit into the existing structures, such as the mobile launcher, the Vehicle Assembly Building and Launch Pad 39B," Maloney said.

The White Room also can be removed and replaced on the upper level of the arm to accommodate access to larger, planned SLS cargo vehicles and other possible future launch vehicles.

The design team, comprising NASA and Engineering Services Contract engineers, is working toward a 60 percent design review in January 2013. Design work on the crew access arm, as well as other access arms and umbilicals, will continue through 2013. Fabrication of the access arm could begin in 2014, with testing in the Launch Equipment Test Facility at Kennedy in 2015.

Looking up and ahead . . .

*** All times are Eastern**

2012

Oct. 4	USAF Launch/Cape Canaveral Air Force Station (SLC-37B): Delta 4, GPS 2F-3 Launch window: 8:10 to 8:29 a.m.
Under review	NASA Launch/Wallops Flight Facility, Va., (OA): Antares Launch window: TBD
Oct. 7	SpaceX Launch/Cape Canaveral Air Force Station (SLC-40): Falcon 9, Dragon C3 Launch window: 8:34:57 p.m.
Targeted for October	NASA Launch/Baikonur Cosmodrome Kazakhstan: Expedition 33/34, Soyuz TMA-06M Launch window: TBD
Oct. 25	USAF Launch/Cape Canaveral Air Force Station (SLC-41): Atlas V, Orbital Test Vehicle (OTV) Launch window: TBD

To watch a NASA launch online, go to **www.nasa.gov/ntv**.

In celebration of Kennedy Space Center's 50th anniversary, enjoy this vintage photo . . .

FROM THE VAULT

NASA file/1962

President John F. Kennedy toured the Launch Operations Center on Sept. 11, 1962. Here a briefing is given by Major Rocco Petrone (not pictured) to President Kennedy during a tour of Blockhouse 34 at the Cape Canaveral Missile Test Annex, now the Cape Canaveral Air Force Station. Also in attendance were Vice President Lyndon Johnson, Center Director Kurt Debus, and Secretary of Defense Robert McNamara (not pictured).

Fire and Rescue workers dedicate 9/11 memorial at Fire Station 1

At right, Fire and Rescue personnel salute or stand as the American flag is lowered during the 9/11 memorial dedication ceremony at Fire Station 1 at NASA's Kennedy Space Center on Sept. 11.

Above, a horseless carriage transports a coffin, a symbolic gesture in memory of firefighters lost on 9/11, during the ceremony.

Below, Fire and Rescue personnel and Kennedy Center Director Bob Cabana, at front row right, share a moment during the 9/11 memorial dedication.

Kennedy Fire and Rescue Services commemorated the 11th anniversary of 9/11 with a ceremony that included a minute of silence at 10:28 a.m., which was the moment of collapse of the north tower of the World Trade Center.

Kennedy centerwide emergency units dispatched by Fire Control engaged in one-minute sirens, the new memorial was dedicated and the Honor Guard performed a flag-folding ceremony.

Photos by NASA/Dimitri Gerondidakis

John F. Kennedy Space Center

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