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Spaceport News

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

Inside . . .

NASA/Kim Shiflett

The planned launch of NASA's Radiation Belt Storm Probes (RBSP) on Aug. 24 was delayed at least 24 hours when the Eastern Range reported a drift in the signal of a C-band transponder aboard the Atlas V rocket as employees in the Atlas V Spaceflight Operations Center on Cape Canaveral look on. It was not known as of press time if the issue was in the ground-based range detection equipment or in the Atlas V transponder.

Delay keeps RBSP grounded

By Anna Heiney
Spaceport News

Encircling the Earth's equator are two concentric, wide rings of high-intensity particles known as the Van Allen radiation belts. This dynamic region changes in response to the sun, with the potential to affect GPS satellites, satellite television and more.

NASA's Radiation Belt Storm Probes (RBSP) mission aims to study this ever-changing environment in greater detail than ever before.

"We live in the atmosphere of the sun. So when the sun sneezes, the Earth catches a cold," explained Nicky Fox, deputy project scientist at Johns Hopkins University Applied Physics Laboratory (APL) in Laurel, Md. "So whatever is happening on the sun, the Earth will feel an effect and will respond to that changing space weather."

The mission features nearly identical twin probes, each carrying a suite of advanced instruments to help scientists monitor and characterize changes within the radiation belts.

"The Radiation Belt Storm Probes will give us a better understanding of how the radiation belts actually work, and allow us to do a better job of predicting and protecting against the radiation that's up there in the future," said mission systems engineer Jim Stratton, also of APL.

The RBSP mission is part of NASA's Living with a Star program, which is managed by the agency's Goddard Space Flight Center in Greenbelt, Md. The APL team built the RBSP spacecraft and will manage the two-year mission for NASA.

The discovery of the radiation belts dates back to the dawn of the space age. Their existence was detected in 1958 by a Geiger counter on NASA's first spacecraft, Explorer 1, built by James Van Allen and his team from the University of Iowa.

Now, more than half a century later, RBSP packs a comprehensive set of instruments designed to look at not only the particles within the radiation belts, but also the plasma waves, electric fields and magnetic fields

See **RBSP**, Page 2

Bolden touts strides on tour

By Rebecca Regan
Spaceport News

NASA Administrator Charlie Bolden took a few dozen media on a road show tour of the agency's Kennedy Space Center and adjacent Cape Canaveral Air Force Station on Aug. 23 to show the progress being made for future government and commercial space endeavors that will begin from Florida's Space Coast.

During his first stop at the Space Exploration Technologies (SpaceX) processing facility on Cape Canaveral's Space Launch Complex 40, Bolden announced that the company has completed its Space Act Agreement with NASA for Commercial Orbital Transportation Services (COTS). As the first private company ever to carry cargo to the International Space Station, SpaceX now is scheduled to launch 12 contracted cargo flights to the station for NASA's Commercial Resupply Services (CRS) Program.

Inside SpaceX's facility, a Falcon 9 rocket and Dragon capsule are being prepared for the first CRS mission

See **BOLDEN**, Page 2

From **BOLDEN**, Page 1

targeted for October. The company also is working with NASA under the Commercial Crew Integrated Capability (CCiCap) phase of the Commercial Crew Program to launch astronauts from U.S. soil in the next five years.

"We cannot sustain the International Space Station if America does not have a capability to get our crews and cargo to space, and that's where the commercial entities come in," said Bolden "They are not a 'nice to have' anymore, they are an essential part of our International Space Station program."

Two other industry partners, Sierra Nevada Corp. (SNC) and The Boeing Company, are working under CCiCap to develop America's next-generation crew transportation systems. SNC completed its first CCiCap milestone last week with a kick-off meeting outlining implementation plans for its Dream Chaser and United Launch Alliance (ULA) Atlas V rocket. Boeing is hosting a similar meeting this week for its CST-100 spacecraft and integrated Atlas V.

CLICK ON PHOTO *NASA/Kim Shiflett*

NASA Administrator Charlie Bolden announces new milestones Aug. 23 inside the Space Exploration Technologies, or SpaceX, processing facility near NASA's Kennedy Space Center in Florida.

Next, the administrator joined ULA's James Sponnick and Radiation Belt Storm Probes (RBSP) deputy project scientist Nicky Fox in front of an Atlas V at Cape Canaveral's Space Launch Complex 41. There, RBSP is awaiting an overnight launch to Earth's radiation belts to help scientists better understand the sun's influence on space weather and how it affects our planet.

"Most spacecraft try to avoid the radiation belts; they either don't have other orbits that go through them or they have sensitive equipment," Fox said. "We have to live in them, we have to work in them, so we are two incredibly, incredibly rugged spacecraft."

Bolden said studying radiation levels in space is just one piece of thread that the agency will use to tie together its robotic and human exploration missions. RBSP, for example, could provide answers about radiation's effect on humans, which NASA could glean from as it prepares for its first crewed mission to Mars aboard the Orion Multi-Purpose Crew Vehicle (MPCV).

Inside Kennedy's Operations and Checkout Building (O&C), Bolden showed media the progress being made on Orion's Exploration Flight Test-1 (EFT-1) vehicle, which is scheduled to fly uncrewed in 2014 to evaluate how the spacecraft behaves during launch, in space and through re-entry.

The tour came to a close at Orbiter Processing Facility-3 (OPF-3), which is being leased by Boeing through an agreement with Space Florida for the manufacturing and assembly of its CST-100. The company expects to add about 550 jobs along Florida's Space Coast as it begins to process and launch the crew capsule.

Throughout Bolden's tour, the common theme was that NASA is investing in American companies and American ingenuity without giving up on its ambitious desires to further explore our solar system.

"Most importantly, we're keeping the United States the undisputed world leader in space exploration and helping to inspire the next generation of scientists, engineers and astronauts."

From **RBSP**, Page 1

that transport and guide those particles.

The mission needed two probes, Fox explained, because scientists want to be able to distinguish transient features from those that are there for a longer period, or may be changing.

"If you imagine having two buoys in the ocean, and one goes up, and comes down again, you don't know anything about what caused that to go up and down," Fox said. "If both of them go up, then you know you've got a very big feature that is affecting both of them at the same time. If one goes up, then the other goes up, you can measure how fast that wave has traveled between them, and what direction it's going into. And if only one goes up and comes down again, then you've got a very, very localized feature that didn't travel anywhere.

"So in order to be able to really understand what is going on these very fine-scale features in our radiation belts, we have two spacecraft to do that," she said.

The eight-sided probes weigh more than 1,400 pounds each and measure about six feet wide by three feet high. But the electric and magnetic fields sensors extend outward on booms that distance these instruments from the immediate vicinity of the spacecraft, which could generate its own electric and magnetic fields. Data filters and metal shielding on spacecraft electronics offer additional prevention against interference, as well as protection from the intense environment the probes will encounter daily.

"Definitely the biggest challenge that we face is the radiation environment that the probes are going to be flying through," Stratton said. "Most spacecraft try to avoid the radiation belts -- and we're going to be flying right through the heart of them."

RBSP is launching on the tried-and-true Atlas V built by United Launch Alliance.

"NASA has an excellent history with the Atlas V rocket. As a matter of fact, we are 100 percent, six for six, launching on Atlas V," said Tim Dunn, RBSP launch director for NASA's Launch Services Program (LSP).

"Since 2006, we have launched missions to Jupiter, Pluto, the sun, the moon, and two missions to Mars."

Based at NASA's Kennedy Space Center in Florida, LSP has been involved in prelaunch planning for the RBSP mission for several years.

"The team has been preparing in total for about six years for the RBSP mission. The early planning began that long ago, back in about the 2006 time frame. The core team came in at about contract award time in March of 2009," Dunn said. "So we've been very heavily involved with RBSP for the last three years."

Rex Engelhardt, LSP's mission manager for RBSP, has been working on the project since 2006. He pointed out that ensuring the separation of both spacecraft from the Centaur upper stage, after launch, required some extra attention. The probes will be deployed one at a time into separate orbits, so the Centaur will spin up, deploy the first probe, stop its spin, and then turn to aim the second probe toward its orbit.

"Then you've got to point it in the right direction, spin it back up again, separate the second (probe), then you've got to spin the Centaur back down again, and quietly back away," Engelhardt said.

Once the probes are placed in their proper orbits, they'll undergo a two-month "commissioning period." This offers the team plenty of time to extend the instrumentation booms, check out the probes' health and safety, and ensure the electronics are working.

"After you launch, after you get through the environments of launch and when you're up there in the space environment, you want to make sure everything's working perfectly," Stratton said. "So that takes about 60 days after launch, and then we'll start our prime mission as soon as that commissioning period is done."

According to Fox, the data from the RBSP mission will allow scientists dramatically to improve current models of how the radiation belts form and change in response to the sun.

"That is important because it will allow us to design better spacecraft; we'll be able to protect them better and we also won't do costly overdesign," Fox explained. "It will help us protect astronauts that are out in Earth orbit, and it will benefit the science community by giving us a lot more information about fundamental particle physics."

Boeing tests heat shield for CST-100 parachute

By Rebecca Regan
Spaceport News

The Boeing Company recently completed a jettison test of its forward heat shield, which will protect the parachutes of the company's CST-100 spacecraft during future missions to and from low Earth orbit. The forward heat shield jettison will start the parachute deployment sequence and provide a safe landing for the capsule and its crew members. The test was part of Boeing's work supporting its funded Space Act Agreement (SAA) with NASA's Commercial Crew Program (CCP) during Commercial Crew Development Round 2 (CCDev2).

"Without the parachutes, the crew wouldn't survive landing. We need to slow them down to a safe landing velocity," said Mike Burghardt, director of Spacecraft Development for Boeing's CST-100. "It is key to be able to get that forward heat shield released at the right time so we can deploy the parachutes."

Testing of the composite-based forward heat shield took place at Bigelow Aerospace's headquarters outside of Las Vegas on June 5, 7 and 11. Surrounded by dry mountain air, Burghardt and his team set up a series of high-speed and high-definition cameras to capture the shield's deployment, a sequence that begins with four piston-like thrusters firing at an altitude of between 20,000 and 30,000 feet. Once the thrusters fire, they are designed to push the shield out of the way of the spacecraft, allowing the drogue parachute to deploy to stabilize the descending crew module followed by the three main parachutes.

During the test, accelerometers and strain gauges measured the shocks and loads that were transmitted during the deployment sequence. The team also tested the ability to jettison the forward heat shield if one of the thrusters were to fail. The thrusters connect to the forward heat shield using breakaway joints, which are designed to fail if one of the thrusters does not fire during re-entry.

"The joint is designed so it won't break when exposed to nominal loads. However, if we did have a thruster failure case, the joint would break to allow the heat shield to be jettisoned from the spacecraft," Burghardt said.

The shield is an adaptation of what Boeing used for its Apollo moon capsules and is similar to the design NASA's Orion spacecraft will use for human exploration missions to deep space.

In March 2011, the agency signed a $92.3 million SAA with the company for the continued development of its Crew Space Transportation (CST), which is a reusable, capsule-shaped spacecraft designed to carry up to seven people, or a combination of people and cargo to low Earth orbit. Optional milestones valued at $20.6 million also were approved and will be completed later this year.

Boeing also tested the CST-100 service module propellant tanks on July 2 to make sure they can handle the extreme requirements of a launch abort scenario.

"The earlier you can do testing and the more testing you do accelerates what you learn," Burghardt said. "There's nothing like building something and then going to test it to find something you didn't think you knew about or you didn't remember."

Boeing will have the opportunity to conduct more testing on its CST-100 during NASA's Commercial Crew Integrated Capability (CCiCap) phase, which began earlier this month with three American companies that are advancing integrated spacecraft and launch vehicle designs. Boeing partnered with United Launch Alliance to integrate its capsule with an Atlas V rocket for launches to complete its integrated Commercial Crew Transportation System. CCiCap will set the stage for a crewed orbital demonstration mission in 2016, the start of operations that will lead to providing commercial transportation services to the agency to send crews to the International Space Station.

Boeing completed testing of the forward heat shield (FHS) jettison system for the Crew Space Transportation-100 spacecraft (CST-100) July 24 as part of the CCDev2 program. The testing was performed at Bigelow Aerospace facilities in Las Vegas, Nev.

NASA eyes certifications for future support of space station

NASA recently provided new details about its plans for certifying commercially developed spacecraft and launch systems that could support future crewed missions to the International Space Station.

"We're spurring an industry capability to and from low Earth orbit and working to ensure the U.S. ends its reliance on foreign crew transportation to the space station," said Ed Mango, manager of NASA's Commercial Crew Program (CCP). "We've decided now would be the best time to begin certification efforts to reduce the risk of technically challenging or costly redesigns to systems in the future."

Through CCP, NASA is facilitating the development of a U.S. commercial crew space transportation capability with the goal of achieving safe, reliable and cost-effective access to and from the space station and low Earth orbit. After the capability is matured and expected to be available to the government and other customers, NASA could contract to purchase commercial services to meet its station crew transportation needs.

NASA will take a two-phase approach to see that commercial missions are held to the same safety standards as government human space transportation system missions.

During the first phase of certification efforts, NASA plans to award Certification Products Contracts (CPC) to between two and four contractors for up to $10 million each. CPC Phase 1 will last about 15 months. In this time, the companies will develop products that will help ensure required standards and safety processes are met before a transportation system could be approved to fly NASA astronauts to the space station. The contracts are expected to be awarded in February 2013.

"In order to eventually certify these systems for space station missions, NASA needs to make sure their designs are meeting the intent of our safety and mission requirements," said Brent Jett, CCP's deputy manager.

At the conclusion of CPC, the agency anticipates more than one company will be ready to compete for the second certification phase, Crew Transportation System, also called CTS . The second phase will build on the first phase, and will be open to companies with systems at the design maturity level of Phase 1. The second phase will include development, testing, evaluation and certification activities enabling NASA to assess the CTS capability for performing space station missions in compliance with NASA requirements.

"Competition has been a key aspect to the success of this program," Mango said. "We still believe that having more than one company, through as much of the certification process as possible, will provide significant advantages and will ensure we have the safest and most affordable systems possible."

-- By Rebecca Regan
Spaceport News

Innovation Expo to spur tomorrow's great ideas

By Frank Ochoa-Gonzales
Spaceport News

Innovation always has been a part of the work done at NASA's Kennedy Space Center. Now, as the center and the agency transition into a new era of space exploration, employees must find new and exciting ways to collaborate and innovate. Because Kennedy is one of the space agency's largest centers both in population and square miles, many workers have only visited a few buildings during the course of their careers.

That will change on Sept. 6 as workers are given the opportunity to participate in the first KSC Innovation Expo. The one-day event, open to civil service and contractor employees, will allow the Kennedy workforce to see what great work their neighbors are doing, meet some of those co-workers for the first time, learn about their new and innovative ideas, and hear some thoughts about innovation and collaboration from people outside their normal day-to-day work life.

"There is a big variety of work that goes on here, but many times we don't get to see what is just on the other side of the cubicle wall," said NASA engineer David Miranda, chairman of the 2012 Innovation Expo. "The expo will give all of us an opportunity to absorb as much as possible. Who knows what great ideas will result when we wake up the next morning?"

Some 16 tours will give employees an understanding of how innovation is shaping the future of the center and the agency.

The event will be a great opportunity to tour unfamiliar parts of the center and see how they all fit into Kennedy's master plan.

All of the tours, except for the Vehicle Assembly Building (VAB) guided tour, will be conducted like an open house. The VAB tour requires advance online registration.

The expo will be made up of several components, including the Kennedy Kick Start, an event in which employees will quickly share (in 90 seconds) their new and innovative ideas in hopes of receiving a $5,000 funding "kick start"; the Innovation Forum, a series of short talks from numerous industry speakers; the Kennedy Showcase, featuring exhibits from all across the center; Solve It, KSC!, a networking activity with group icebreakers and problem-solving; and Expo Tours of facilities and labs across the center.

These activities will take place from 8:30 a.m. to 4 p.m. at various locations on both the north and south ends of the center.

More online

For more information, visit **http://innovationexpo.ksc.nasa.gov**.

For more information about the Expo Tours, visit **https://sp.ksc.nasa.gov/sites/InnovationExpo/2012/Pages/Tours.aspx**.

To sign up for the VAB tour, visit **www.surveygizmo.com/s3/1001313/Innovation-Expo-VAB-Tour-Sign-up**.

Astronaut recalls 'historic' expedition to space station

By Bob Granath
Spaceport News

International Space Station astronaut Ron Garan returned to NASA's Kennedy Space Center on Aug. 8 and spoke to employees about his experiences during Expeditions 27 and 28, a time of transition for the orbiting laboratory.

"It was a very historic mission," he said. "We saw the last two shuttle missions come up and dock, but we also saw the transition from construction to utilization of the International Space Station."

Garan along with Russian cosmonauts Alexander Samokutyaev and Andrey Borisenko lifted off aboard Soyuz TMA-21 from the Baikonur Cosmodrome in Kazakhstan on April 4, 2011.

"We launched almost 50 years to the day and from the same pad as Yuri Gagarin," said Garan, a Yonkers, N.Y., native who has been an astronaut since 2000.

Gagarin, the first human to fly in space, circled the globe one time on April 12, 1961. Garan believes the work on the space station is equally important.

"I truly believe that history books will show that the International Space Station has made life significantly better on planet Earth," he said. "The research and experiments we do on the space station simply cannot be done anywhere else on the planet."

CLICK ON PHOTO NASA/Gianni Woods

During his presentation to Kennedy Space Center employees Aug. 8, astronaut Ron Garan, right, presented a photo montage with images from Expeditions 27 and 28 to Center Director Bob Cabana.

Garan's pride is validated by the station's microgravity experiments, which have resulted in breakthroughs such as:

- Candidate treatments for forms of muscular dystrophy and cancer.
- The discovery that poisonous microbes increase in the microgravity of space, allowing scientists to develop new candidate vaccines.
- Nutrition studies that show diets rich in Omega-3 fatty acids are correlated with reduced bone loss.

"We've always talked about the different spinoffs from the space program, and those are all still very important," Garan said. "Now, for the first time, we have the opportunity to bring from space direct tangible benefits. The research that we are doing on board the space station is improving life on planet Earth."

Garan believes credit for these achievements goes to all who made the International Space Station possible.

"Everybody involved with the program, everybody who was involved with the hardware, with the training, with the operations had a direct impact in making the world a better place," he said. "All the people here at the Kennedy Space Center and all the other centers around the world that are involved had a hand in that."

Once Garan and his two Soyuz crewmates joined Russian cosmonaut Dmitry Kondratyev, NASA astronaut Catherine Coleman and European Space Agency astronaut Páolo Néspoli of Italy on April 6, 2011, they went right to work.

"We had to get acclimated to life on the space station quickly because very shortly after we got there, our first visitors arrived and that was the crew of STS-134 aboard the space shuttle Endeavour," Garan said. "It was a busy mission."

STS-135, the final flight of the space shuttle, arrived during July 2011, delivering the Raffaello Multi-Purpose Logistics Module packed with supplies and spare parts for the station. While Atlantis was docked, Garan and Fossum performed a spacewalk to transfer a failed ammonia pump to the shuttle's cargo bay and move the Robotic Refueling Mission hardware to the station.

"The investment is not only in technology, but in international cooperation," he said. "This is the best investment we have in our future, bar none."

Scenes Around Kennedy Space Center

CLICK ON PHOTO *NASA/Dimitri Gerondidakis*

A crane is used to load a space shuttle solid rocket booster on a truck Aug. 14 The solid rocket boosters, or SRBs, will be displayed at the California Science Center in Los Angeles. The external tank soon will be transported for display at the Wings of Dreams Aviation Museum at Keystone Heights Airport between Gainesville and Jacksonville, Fla.

CLICK ON PHOTO *NASA/Glenn Benson*

Dave Zeiters, a senior systems engineer with Stinger Ghaffarian Technologies Inc., under the Engineering Services Contract at Kennedy Space Center, recently received the Catalyst Award from the Center Planning and Development Office. The Catalyst Award is given to members of the Kennedy workforce who have made significant contributions to the vitality of the space industry.

CLICK ON PHOTO *NASA/Kim Shiflett*

NASA's Commercial Crew Program (CCP) Manager Ed Mango and Florida's Lt. Gov. Jennifer Carroll check out CCP's "Same Crew, New Ride" poster at the National Space Club Florida Committee's luncheon Aug. 14. During the luncheon, Mango talked to about 350 space club members and guests about the efforts of NASA and CCP as they work to close the gap to safe, affordable and reliable U.S. commercial crew space transportation capabilities to and from low Earth orbit and the International Space Station. Carroll discussed the positive impacts the aerospace industry has on Florida and congratulated the agency's newest Commercial Crew Integrated Capability (CCiCap) partners who have plans to operate in the sunshine state. Download your own "Same Crew, New Ride" poster by clicking on the photo.

CLICK ON PHOTO *NASA/Kim Shiflett*

Members of the Kennedy Space Center team who helped process the space shuttles Endeavour and Atlantis, gather for a group picture after the two spacecraft were brought together for a brief photo opportunity Aug. 16. Endeavour moved from Orbiter Processing Facility-2 (OPF-2) to switch places with Atlantis which had been in the Vehicle Assembly Building. In the OPF, Atlantis will undergo final preparations for its transfer to the Kennedy Space Center Visitor Complex, targeted for November.

High-altitude drop tests Rocket University engineers

By Steven Siceloff
Spaceport News

An experimental payload went 25,000 feet higher than planned during a recent test flight but still performed well and will be the basis for a larger flight test next year.

"I think avionics-wise it went beautifully," said Chris Iannello, part of the team at NASA's Kennedy Space Center in Florida that launched a high altitude balloon to the edge of the atmosphere and then tracked an instrument package they built as it free-fell back to Earth. "We were all real pleased with it."

The engineers intended for a shoebox-sized capsule loaded with instruments to be carried under the balloon to about 80,000 feet and dropped to test the capsule's aerodynamic design.

But when a wire didn't burn through correctly, the package held onto the balloon as it floated up to 105,000 feet. The balloon burst at that height, sending the instrument package into a terminal velocity free fall before automatically deploying its parachute.

CLICK ON PHOTO NASA

The capsule and instruments built by Rocket University participants begins its descent to Earth from 105,000 feet July 26.

"It sent data all the way, recorded data on board, changed collection rates as programmed during descent, and performed its automatic chute deployment spot on," Iannello said. Teams that launched the payload from Melbourne Beach recorded the instrument readings and tracked the package as it descended, eventually landing near Kissimmee.

Johnson Space Center in Houston designed the capsule to find out whether it can work as a design for returning payloads safely from space.

Kennedy teams built the large scale version of the capsule and the electronics inside that would control the flight. These electronics, which were test flown on this small scale launch included components to measure navigational data such as attitude and position and a camera. These sensors were connected to a central control processor that was programmed to carry off tasks at an appointed time.

Known more for their work with rockets, the engineers who built the instruments and launched the balloon are taking part in Rocket University, a program designed to challenge NASA engineers. Rocket University, or just "Rocket U," lets engineers perform hands-on work they might not otherwise do, and requires them to work with other centers and apply techniques to different disciplines.

The balloon flight was the second major test flight for the Rocket University group at Kennedy. The first one, with a smaller set of instruments, was also successful. This time, the instrument requirements were more precise, the capsule was bigger, and the balloon and other parts had to be larger, too.

The demands for precision also were greater, without being suffocating. In other words, if things went wrong, the engineers didn't have to worry about losing an expensive mission.

"The first flight was a lot of 'just get it to work,' " said Nicole Otermat, who took part in both missions but had just given birth when the first flight took off. "I have an appreciation for why you go through months of design and systems hardware."

The payload demands will increase again on the Rocket U participants as they prepare a 200-pound capsule to fly on a much larger balloon next year provided by Wallops Flight Facility from a launch site in New Mexico.

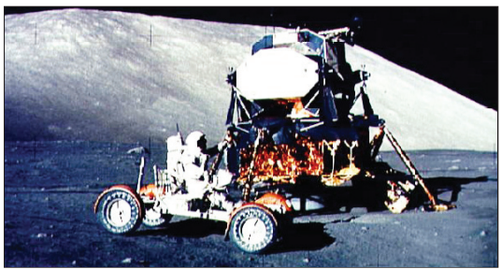
"We're learning by doing, working our way up through hardware and methods," Iannello said. "We're doing it in the logical progression with the next step being real-time operating systems, and from there, Field Programmable Arrays with soft-core processors."

Kennedy aims to protect lunar sites from future visitors

By Kay Grinter
Spaceport News

What are the most important human archaeological sites identified to date? "Space archaeologists" have a unique perspective. For them, the Apollo lunar landing sites hold that distinction, according to Philip Metzger, a senior research physicist at Kennedy Space Center.

Metzger is recognized for his contributions to the development of NASA guidelines for "protecting the lunar heritage sites from the effects of visiting spacecraft," the topic of his Kennedy Engineering Academy presentation on Aug. 17.



NASA

Artifacts left on the lunar surface 40 years ago during the Apollo Program, such as the lunar roving vehicle pictured here, can provide invaluable information to aerospace engineers about how various materials are impacted by exposure to the space environment. Employees can learn more about the Kennedy Engineering Academy presentations by clicking on the photo.

Competitors for the Google Lunar X PRIZE are on target to land on the moon and visit the historic Apollo sites within the next two years. The rocket exhaust of these landers will propel dust, sand and gravel at velocities which will sandblast and possibly damage the hardware and surrounding terrain.

Of special concern is preservation of the Apollo 11 and Apollo 17 sites which have symbolic significance as the first and last places visited by the Apollo astronauts, Metzger said.

Kennedy has been leading the effort to predict lunar and Martian rocket-blast effects.

According to the models developed, damage may not be confined to the lunar surface. Orbiting spacecraft also are at risk, Metzger said. It is an "urban myth" that rocks don't blow around.

Evidence collected employing the same technology used to examine the space shuttle's windows for damage between flights found pitting on coupons returned from the Surveyor 3 spacecraft on the Apollo 12 mission.

Outer space law differs from maritime law in that the U.S. retains ownership of all its hardware and equipment remaining on the lunar surface, Metzger said. "Finders-keepers" does not apply. However, no country can claim possession of extraterrestrial real estate, no matter how many flags may have been planted.

U.S. artifacts on the moon include the remains of the Ranger, Surveyor and LCROSS missions, as well as Saturn IVB stages and lunar module ascent stages. In fact, maps showing where every flag, golf ball and tool rest on the moon are kept at the Smithsonian's Air and Space Museum in Washington.

More online

To learn more about the guidelines, "NASA's Recommendations to Space-Faring Entities," or to download a copy of the report, go to **www.nasa.gov/directorates/heo/library/reports/lunar-artifacts.html**.

To find out who is competing for the X PRIZE, visit **www.googlelunarxprize.org**.

Launch Pad 39B modified for very near future

By Bob Granath
Spaceport News

NASA's Kennedy Space Center Launch Pad 39B recently went though another round of pad upgrades and currently is laying the groundwork for multiple launch vehicles including the Space Launch System (SLS), which could take astronauts farther into space than ever before.

"With new systems, upgrades and refurbishment to pad B, it will be almost like new," said Jose Perez-Morales, NASA's Pad Element Project manager for the Ground Systems Development and Operations Program. "All of the pad systems and structures will either be refurbished or modified for the future vehicles. Work is on schedule to have the pads ready by 2017."

Unlike the Apollo and Space Shuttle programs, the Pad 39B of the future will have the ability to support multiple types of launch vehicles, including commercial rockets and SLS, and its Orion spacecraft. SLS will be an advanced heavy-lift launch vehicle providing a new capability for human exploration beyond low Earth orbit.

After the final shuttle launch from Pad 39B, three 600-foot-tall lightning protection towers were built. Following the Ares I-X flight, the fixed and rotating service structures were dismantled. However, there are more changes under way than meet the eye.

"That's the visible part of the work," Perez-Morales said. "There's a great deal more. Each lightning tower has a complete weather station. Data will be collected on four levels which can be relayed to the firing room."

More than 1.3 million feet of cables, some dating back to the Apollo era, have been removed and replaced with fiber optics. All the shuttle era electronic systems also have been removed and upgraded with state-of-the-art hardware. A new "universal" flame deflector is being designed for use not only with SLS, but with various commercial vehicles. Propellant storage tanks have been completely drained and are being refurbished and painted.

"The liquid hydrogen and liquid oxygen propellant tanks should now be ready to support launch operations for the next 20 to 30 years," Perez-Morales said.

In other ways, some future systems will more closely resemble those of Apollo.

"One example of this is having the launch umbilical tower back on the mobile launcher. With this configuration, we can complete a great deal of the prelaunch preparations in the VAB," said Perez-Morales.

During the shuttle program, the vehicles were rolled to the pad 30 to 60 days before launch. That time factor should be reduced considerably in the future.

"Much of the work at the pad during shuttle involved completing the many connections between the vehicle and the pad tower," he said. "Doing more in the VAB also reduces the exposure to the elements and the delays caused by Florida's all too familiar thunderstorms."

Apollo 4 opened a new era 45 years ago. In 1981, STS-1 began the second generation of vehicles launching from Florida's spaceport. Today, preparations are well under way for Kennedy's third era of exploration.

Historic rollout created path of exploration 45 years ago

By Bob Granath
Spaceport News

The Saturn V rocket for the uncrewed Apollo 4 mission was the first flight vehicle stacked in the Vehicle Assembly Building, or VAB, and the first to lift off from Kennedy Space Center. The mission's historic rollout to the launch pad took place 45 years ago this month.

That first launch from Kennedy paved the way for flights that would take Apollo astronauts to orbit around the moon and land on its surface.

Apollo 4's rollout began early Aug. 26, 1967. Scores of news reporters from around the world were on hand to record the event as the 363-foot-tall Saturn V atop the mobile launcher and crawler transporter made for an 18 million pound vehicle. It lumbered along at less than 1 mph on its way to Launch Pad 39A, about three miles away.

The crucial Apollo 4 mission was an "all-up test," meaning all rocket stages and the spacecraft were fully functional on that initial flight, an unprecedented step for NASA.

"All the elements that constitute the launch vehicle were, for the first time, put together here and put to the test," said Dr. Kurt Debus, Kennedy's director at the time.

The big exam came Nov. 9, 1967, and Saturn passed with flying colors. The five massive engines in the first stage ignited, building up to 7.5 million pounds of thrust. The Saturn V slowly lifted off the pad as the firing room erupted in cheers from members of the launch team. The flight lasted almost nine hours, with the command module splashing down in the Pacific Ocean. The mission was declared a complete success, demonstrating the structural and thermal integrity of the Saturn launch vehicle and Apollo spacecraft.

"It was really an expert launch all the way through, launching exactly on time to performance of every single stage," said Dr. Wernher von Braun, director of the Marshall Space Flight Center where the Saturn had been designed.

Maj. Gen. Sam Phillips, NASA's Apollo program manager, also had high praise for the people of Kennedy.

"I was tremendously impressed with the smooth teamwork as the combined government/multi-industry team pulled together," he said. "It was smooth, it was professional, it was confident."

From 1967 to 1975, 13 Saturn Vs and 4 Saturn 1Bs launched from Pads 39A and B.

In the late 1970s, modifications prepared the pads for three decades of space shuttle missions. In a 30-year span, Kennedy launched the shuttle fleet 135 times.

The final shuttle launch, Atlantis on the STS-135 mission, was launched from Pad A in July 2011. Pad 39B was last used for the Ares I-X launch in October of 2009.

NASA file/1967

This Saturn V vehicle (AS-501) for the Apollo 4 mission rolls out on a crawler-transporter from the Vehicle Assembly Building on Aug. 8, 1967. Apollo 4 was the first operational rocket rolled to the launch pad at the Kennedy Space Center. Apollo 4 launched from Launch Pad 39A on Nov. 9, 1967.

NASA Employees of the Month: August

NASA/Rick Wetherington

Employees for the month of August are, from left, Alyssa Matthews, Procurement Office; Anthony Muscatello, Engineering Directorate; Steven Horn, Chief Counsel Office; Anton Kiriwas, Ground Processing Directorate; Janice Everett, Center Operations; Dennis Bayon, Chief Financial Office; and Kelli Maloney, Engineering Directorate. Not pictured are Robert Henry, Ground Systems Development and Operations; Jessica Williams, Safety and Mission Assurance Directorate; Matt English, ISS Ground Processing and Research Project Office; and Mark Mertz, Launch Services Program.

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

FROM THE VAULT

NASA file/1968

A fisheye lens gives a strange view Feb. 13, 1968, from high in the Vehicle Assembly Building at Kennedy Space Center where the 250-ton bridge cranes operate. The cranes are used to move the three stages of the 363-foot-tall Saturn V and ultimately to stack them into one vehicle.

Looking up and ahead . . .

*** All times are Eastern**

2012

Sept. 6	Innovation Expo, Kennedy Space Center
No earlier than Sept. 13	USAF Launch/Vandenberg Air Force Base (SLC-3E): Atlas V (AV-033), NROL-36 Launch window: TBD
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.
October TBD	SpaceX Launch/Cape Canaveral Air Force Station (SLC-40): Falcon 9, Dragon C3 Launch window: TBD
Oct. 26	USAF Launch/Cape Canaveral Air Force Station (SLC-41): Atlas V, OTV 3 Launch window: TBD
Dec. 6	NASA Launch/Cape Canaveral Air Force Station (SLC-41): Atlas V, Tracking and Data Relay Satellite-K (TDRS-K) Launch window: 12:29 to 1:09 a.m.

2013

No earlier than January	NASA Launch/Cape Canaveral Air Force Station (SLC-40): Falcon 9, Dragon C4 Launch window: TBD
No earlier than Jan. 18	USAF Launch/Cape Canaveral Air Force Station (SLC-37B): Delta 4, WGS 5 Launch window: TBD
No earlier than Jan. 22	NASA Launch/Vandenberg Air Force Base (L-1011): Pegasus XL, Interface Region Imaging Spectrograph (IRIS) Launch window: 9:32 to 9:37 a.m.
No earlier than Feb. 11	NASA Launch/Vandenberg Air Force Base (SLC-3E): Atlas V, Landsat Data Continuity Mission (LDCM) Launch window: 1:04 to 1:48 p.m.

John F. Kennedy Space Center

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