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Spaceport News

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

Orion recovery tests done off Cali coast

By Linda Herridge
Spaceport News

About a hundred miles off the coast of San Diego, in the Pacific Ocean, a U.S. Navy ship's well deck filled with water as underway recovery operations began Feb. 18 on a test version of NASA's Orion crew module, tethered inside, to prepare for its first mission, Exploration Flight Test-1, in September.

Building on the knowledge gained from previous Orion recovery tests performed in calm waters near NASA's Langley Research Center in Virginia, the agency's Ground Systems Development and Operations (GSDO) Program began the next phase, seeking turbulent water off the west coast in which to practice recovering the Orion crew module, one parachute and a forward bay cover, which keeps Orion's parachutes safe until being jettisoned, just before the parachutes are needed.

During the testing, the tether lines were unable to support the tension caused by crew module motion that was driven by wave turbulence in the well deck of the ship. NASA and the U.S. Navy called off the week's remaining testing to allow engineers to evaluate the next steps.

"Even though the testing didn't go as we had planned, we're learning lessons that will help us be better prepared to retrieve Orion after it travels more than 3,600 miles into space and comes home," said Bill Hill, assistant deputy associate administrator for exploration systems development at NASA Headquarters in Washington. "The Orion testing work we do is helping us work toward sending humans to deep space."

Several of the objectives were accomplished before the remaining tests were called off.

NASA and the U.S. Navy were able to successfully recover the forward bay cover and parachute, and demonstrations of the coordination required between the team onboard the ship and mission control in Houston were accomplished.

Controllers at Johnson Space Center in Houston simulated the launch and splash down of the Orion capsule. An F-18 jet flew from 13,000 feet into a dive to simulate Orion's descent through the atmosphere and splashdown, as Johnson confirmed tracking and cleared the airspace. Helicopters were stationed in the air to observe the "Orion capsule" during descent, as they would be during an actual retrieval mission.

Mike Generale, the Orion recovery operations manager and test director at Kennedy Space Center, said the underway recovery test allows GSDO to verify recovery operations and procedures, demonstrates capabilities and incorporates partnership efforts with the U.S. Navy and Lockheed Martin.

"The next steps will be to incorporate lessons learned and modify Orion recovery hardware," Generale said.

NASA

The Orion crew module is positioned on the deck of the USS San Diego in San Diego, Calif., for an underway recovery test in the Pacific Ocean on Feb. 18. For more information about Orion and how it will serve as NASA's future exploration vehicle, click on the photo.

Photos by NASA/Kim Shiflett

Lockheed Martin Space Systems Deputy Program Manager for Orion, Larry Price, said Orion is on track for its landmark test flight later this year during his address at the February National Space Club Florida Committee meeting Feb. 11.

Lockheed Martin preps Orion for EFT-1

By Linda Herridge
Spaceport News

An Orion spacecraft in development to fly into space on a landmark flight test later this year is on track to make the historic mission, said Larry Price, Lockheed Martin Space Systems deputy program manager for Orion.

"There's an accumulation of a lot of work that's been coming together over the last five years," Price said during a presentation to the National Space Club Florida Committee on Feb. 11. "Our spacecraft is coming together in the Operations and Checkout Building at Kennedy Space Center. Orion includes suppliers from 45 states."

Price said the team is focused on building an advanced spacecraft that can safely return a crew from long-duration missions in deep space. Near term, Exploration Flight Test-1 (EFT-1) in September will test designs and systems most critical to crew safety. Some of the top risks are heat shield performance, guidance and navigation, electronics and protection from space radiation.

Price explained the scale of deep-space exploration. "In the 50 years that we've been in space, more than 600 people have gone into space, but only 27 have gone beyond low-Earth orbit.

"We're going to go explore. It's like Lewis and Clark. It's like the Louisiana Purchase," Price said.

Recent accomplishments of the Orion program include the Launch Abort System test at White Sands Test Facility in New Mexico; parachute tests in Yuma, Ariz.; Orion water impact tests at NASA's Langley Research Center in Virginia; Orion recovery tests near Langley; heat shield work at NASA's Ames Research Center in Moffett Field, Calif.; fairing separation tests in Sunnyvale, Calif., and forward bay cover jettison tests in Denver, Colo.

"We've been running software end-to-end in the Orion integrated test lab in Denver and at Kennedy for about a year, and adding on more and more components to the system so all of the software and hardware are operating in the loop like flight," Price said.

Meanwhile, according to Price, Congress is strongly defending NASA and the work developing the Space Launch System and Orion spacecraft for safe return from long-duration, deep-space missions.

"Our challenge is to do what is economically possible so we can get to these missions as totally as possible. Congress has been extremely supportive of us. The SLS budget has been level for five years with all of the turbulence that's going on," Price said.

"We're building a machine to do whatever the scientists determine we need to do," Price said. "We're going to go to 3,600 miles high. Humans have not done this since Apollo."

But for now, the first step to deep space is EFT-1.

NASA has contracted with United Launch Alliance to launch EFT-1 aboard a Delta IV Heavy vehicle from Launch Complex 37 targeted for September of this year. During Exploration Flight Test-1, an uncrewed spacecraft will travel 15 times farther than the International Space Station before returning to Earth at speeds as fast as 20,000 mph and temperatures above 4,000 degrees Fahrenheit to evaluate the spacecraft's heat shield and other systems.

Photos by NASA/Kim Shiflett

Members of the National Space Club Florida Committee and guests gathered for a luncheon Feb. 11 at the Radisson Resort at the Port in Cape Canaveral.

NASA

On Feb. 12, the Kennedy Space Center Emergency Response Team presented Center Director Bob Cabana the trophy it won during the 2013 International SWAT Round-Up.

Emergency Response Team earns top 5 in contest

By Linda Herridge
Spaceport News

Kennedy Space Center Director Bob Cabana is committed to and makes safety at the center a top priority. As part of that commitment, a well-trained Emergency Response Team (ERT) protects the center's workforce and assets 24 hours a day, seven days a week.

Recently, the ERT placed in the top five overall at the 2013 International SWAT Roundup in Orlando, Fla. The competition featured more than 50 teams from Florida, the U.S. and other countries around the world.

During the competition, Kennedy's eight-member team of security officers employed by Chenega Security Support and Solutions, had the opportunity to train with other teams, shared information about past events and discussed best practices that could help other ERTs cope with emergencies and provide more effective training environments.

"This is the third year in a row that the ERT Team has finished in the top five at the Swat Roundup," said Mark Borsi, the chief of security. "Their unprecedented success in this tough and prestigious competition demonstrates the teams' consistent dedication to duty and the rigors of staying prepared to resolve security emergencies safely and quickly. Tragedies at Fort Hood, the Washington Navy Yard, and even Johnson Space Center, remind us of the error in believing, 'it can never happen here.' "

ERT members play a vital role in all of the day-to-day security operations at Kennedy. They can handle anything from a traffic stop, to an active shooter to a terrorist threat, and also assist with certain high-level VIP visits to the center.

"We have an extensive training regimen," said an ERT member. "We train daily between operations. We train weekly at the end of our shifts. And we also cap it off with a yearly training exercise that lasts two weeks."

The ERT members recently completed intensive annual training at the NASA Protective Services Training Academy and other facilities around the center to keep their competencies and skills current. A wide variety of assets were used during the training, including land vehicles, helicopters, abandoned facilities, special equipment and other resources.

"ERT team members are chosen based on their leadership abilities, their ability to deal with stress, and their ability to overcome physical obstacles they may see day to day," said an ERT training supervisor.

Another ERT team member said: "The professionalism of the ERT Team is paramount. We have people from various backgrounds ranging from law enforcement to military. They're all born leaders and they're ready to put it on the line for Kennedy's employees."

NASA/Dimitri Gerondidakis

NASA Emergency Response Team (ERT) members toss a flash-bang diversionary device during specialized training simulations at the Protective Services Training Academy at Kennedy Space Center as a helicopter hovers above. The ERT members are wearing full protective gear and carrying nonlethal firearms for the training exercises in order to keep their skills current. To watch the group in action, click on the photo.

ML strengthened for next generation

By Anna Heiney
Spaceport News

The mobile launcher that will support NASA's next heavy-lift launch vehicle, the powerful Space Launch System (SLS), is being bulked up in preparation for the forces of liftoff.

The steel mobile launcher towers 405 feet above its construction site in the heart of Launch Complex 39 at NASA's Kennedy Space Center in Florida. While the structure itself is undergoing significant modifications to fit the new vehicle, additional work is bringing new capabilities to the construction site.

The SLS rocket will be capable of sending humans to near-Earth asteroids, Mars or other destinations. Its first flight test is slated for 2017, and efforts to prepare launch facilities and support equipment are in full swing at Kennedy. The Ground Systems Development and Operations Program (GSDO), based at Kennedy, manages the project.

Although the SLS vehicle still is in development, there is enough information already available that the team could begin the time-consuming work of updating the launcher's structure. The primary goal is to reconfigure and strengthen it to accommodate the weight, size and thrust of the new rocket.

NASA/Ben Smegelsky

Fog envelopes the top of the 405-foot-tall Mobile Launcher at Kennedy Space Center on Feb. 7.

"Ultimately, we're modifying the mobile launcher to expand the exhaust opening from about 22 by 22 feet to approximately 64 by 32 feet," said Mike Canicatti, mobile launcher construction manager. That means rearranging one of the massive steel support beams within the launcher's platform, installing five newly fabricated pieces and relocating and modifying another piece.

"We broke the job into logical stages," Canicatti said, explaining that much of the structural work could be completed with basic information about the rocket. "We just needed to know about how much the vehicle is going to weigh, its physical size and where the launcher will mount to it."

Prime contractor J.P. Donovan of Rockledge, Fla., is handling the work for this part of the project with support from Midwest Steel of Detroit. Work under the current contract began in June 2013 with completion scheduled for December 2014. Nearly all of the necessary demolition work around the original exhaust opening already is complete, clearing the way for structural changes.

The first piece was delivered to Kennedy on Tuesday, Jan. 28, on the back of a flatbed truck. Measuring 25 by 65 feet, it spanned two traffic lanes during its move from Rockledge, through Titusville, and finally to the spaceport.

Large pipes and related hardware for the launcher's sound suppression water system also will be installed. A larger version of the one used during the Space Shuttle Program, the system will spray water across the surface of the platform and underneath the vehicle to minimize the acoustic energy generated during liftoff. Work also is in progress on the power, air conditioning, sprinkler and fire alarm systems.

In addition to the structural work on the launcher, its construction zone north of the iconic Vehicle Assembly Building (VAB) is being upgraded to allow more on-site testing capabilities.

Contractor URS Federal Technical Services Inc. is increasing the capacity of the pipelines that deliver gaseous nitrogen and helium to the area. Nitrogen gas helps keep the interior panels of the mobile launcher dry and prevents build-up of toxic vapors, while helium, an inert gas, allows the team to safely check the integrity of liquid-hydrogen propellant lines and tanks.

NASA/Dimitri Gerondidakis

Modifications continue on the Mobile Launcher (ML) at the Mobile Launcher Park Site at Kennedy Space Center on Feb. 12. The ML will carry the SLS rocket and Orion spacecraft to Launch Pad 39B for its first mission, Exploration Mission-1, in 2017.

The construction site currently lacks any data connectivity with the Launch Control Center. Rather than wait until the launcher is moved to the VAB or the launch pad to begin verification and validation, technicians with Kennedy's Information Management and Communications Support contract are working to bring this capability to the construction site, allowing for much more testing before the launcher ever leaves the area.

The flight test in 2017 will send an uncrewed Orion spacecraft into lunar orbit. NASA's asteroid initiative, which is part of the agency's proposed budget request for fiscal year 2014, will use SLS and Orion to send astronauts to study a small asteroid that will have been redirected robotically to a stable orbit near the moon.

Although the launcher and its components are large and heavy, the project requires precision.

"We have to make sure everything fits perfectly," Canicatti said. "There are a lot of tight tolerances on this particular project, so if things shift just half an inch or a quarter of an inch, we'll say, 'OK, what do we need to do?'

"But everything has gone smoothly," he added. "Everything is on schedule, just moving right along."

Scenes Around Kennedy Space Center

NASA/Kim Shiflett

Barbara Harrison, retired vice president of Lakeland, Fla., Regional Medical Cancer Center, was the keynote speaker for Kennedy Space Center's annual African-American History Month celebration on Feb. 21. She spoke of her philosophy of lifelong learning with priories that focused on advancement in education and excellence associated with a strong work ethic. The event was hosted by the spaceport's Black Employee Strategy Team (BEST) and included presentation of four college scholarships.

NASA/Kim Shiflett

One of four new emergency egress vehicles, called Mine-Resistant Ambush-Protection (MRAP) vehicles, left, sits near a space shuttle-era M-113 vehicle at the Maintenance and Operations Facility at Kennedy Space Center on Feb. 13. The new vehicles replace the M-113 vehicles that were used during the Space Shuttle Program.

Health & Safety Days inspire workers to take the next step

While the 2014 Health & Safety Days official program events and activities end Feb. 28, there's still time to take part in the many activities offered.

This month, Kennedy directorates and contractor organizations are conducting 52 separate events consisting of more than 110 hours of health- and wellness-related activities and classes/training for the entire workforce (civil service and contractor).

The Health & Wellness Fair on Feb. 19 was a great success with more than 1,200 employees attending and more than 25 vendors and organizations providing information. More than 500 Kennedy employees are participating in the eight-week President's Active Lifestyle Award (PALA+) Challenge. The participation level this year is five times the participation level of prior years.

Telemetry fix preserves TDRS-L launch

By Anna Heiney
Spaceport News

Liftoff of NASA's latest Tracking and Data Relay Satellite aboard a United Launch Alliance Atlas V rocket was delayed unexpectedly with only minutes remaining before the launch window opened on Jan. 23.

Engineers with the agency's Launch Services Program (LSP) and QinetiQ North America kept the liftoff on track with quick troubleshooting when a problem with periodic dropouts in telemetry from the vehicle threatened to stop the launch.

"Telemetry is basically another word for telemetrics. It's measuring things at a distance," explained QinetiQ lead telemetry engineer Tim Clinger. "Much in the same way a doctor would measure the vitals of a patient, we measure the vitals of a rocket during the launch countdown."

While a rocket is on the launch pad, the vehicle itself and its spacecraft payload send information to the Telemetry Lab, located inside historic Hangar AE on Florida's Cape Canaveral Air Force Station. Engineers monitor the data coming in and ensure it is sent immediately to the vehicle and spacecraft teams so they can monitor their systems' health.

"The telemetry data comes in from the launch vehicle either through a hard line, which is called an umbilical, or RF radio signal," said Alex Biamonte, a telemetry engineer with NASA's Launch Services Program.

"A few minutes before launch, we want to switch to RF, or the radio signal telemetry, because that's what's going to be used when it lifts off the pad," Biamonte explained, "but with RF, we do encounter data drops, or interference on the radio signal."

This posed a problem during the TDRS-L countdown because telemetry from the spacecraft was embedded in the rocket's telemetry stream. As the information flowed from Launch Complex 41 into Hangar AE, data from the satellite was extracted from it and sent to the spacecraft community. Periodic drops in the rocket telemetry meant the spacecraft data would stop briefly, too.

The countdown had gone smoothly throughout the evening, and clocks were holding at the T-4 minute mark. The rocket was fueled and ready to fly at 9:05 p.m. EST, the opening of a 40-minute launch window. With seconds remaining until the countdown was set to resume, the hold was extended so the team could work on the telemetry issue.

"A first order response, when we heard of the dropouts, was we wanted to correlate the spacecraft dropouts to the dropouts we saw on the launch vehicle, to prove that they were real and that we were talking about the same exact anomaly," Clinger said.

Clinger proposed a solution: Go back to the hard line through the remainder of the countdown, and then manually switch to RF at T-0. The LSP team, relying on experience gathered through years of successful launches, had the flexibility to make this real-time call. James Wood, NASA chief engineer for LSP, agreed to the plan, preserving the launch opportunity.

Tuan Doan, a NASA communications engineer for Launch Services, was serving as the mission operations director in Hangar AE's Mission Directors Center during the TDRS-L countdown and joined the discussion on one of the launch team's communications channels.

"There was a call to hold at T-4 minutes, and all the team -- launch team members from United Launch Alliance, spacecraft personnel, as well as NASA -- got on the Anomaly Net to come up with a resolution to avoid a delay or even a scrub of the launch," Doan said.

NASA and ULA managers quickly agreed to the plan, and the spacecraft community polled its members to ensure they were willing to go forward with the proposed solution. The new launch time was 9:33 p.m., 12 minutes before the launch window would close.

When countdown clocks reached T-0 and the Atlas V began its climb into space, Clinger performed the switch to RF telemetry with the click of a mouse.

"We made the switch, it was flawless, on time, and no data was lost to either party," he said.

NASA

The United Launch Alliance Atlas V rocket lifts off Jan. 23 carrying NASA's Tracking and Data Relay Satellite (TDRS-L) spacecraft. To watch a video of the telemetry solution, click on the photo.

NASA/Dimitri Gerondidakis

Tuan Doan is a communications engineer for NASA's Launch Services Program.

NASA/Dimitri Gerondidakis

Tim Clinger, who made the proposed solution, is the lead telemetry engineer for QinetiQ.

NASA/Dimitri Gerondidakis

Alex Biamonte is a telemetry engineer for NASA's Launch Services Program.

Beyond Earth: Pioneer 4 marks 55 years

By Bob Granath
Spaceport News

NASA's commitment to exploration beyond low-Earth orbit is continuing with plans to launch the Orion spacecraft on Exploration Flight Test-1 (EFT-1) in September 2014. Since its formation in 1958, one of the agency's core missions has been to discover what lies beyond. The fledgling space agency's first successful mission past Earth orbit was Pioneer 4, 55 years ago.

Just two months after its inception, NASA planned two attempts to fly by the moon and return data about cosmic radiation in the Earth and lunar environments. Developed at the Jet Propulsion Laboratory in Pasadena, Calif., the conical-shaped Pioneer 3 and 4 spacecraft were small by today's standards, weighing just 13.2 pounds, and measuring 1.67 feet in length and 9 inches in diameter at the base.

Pioneer 3 lifted off on Dec. 6, 1958, atop an Army Ballistic Missile Agency Juno II rocket from Cape Canaveral Air Force Station's Launch Complex 5. However, depletion of propellant caused the first stage engine to shut down 3.7 seconds prematurely, preventing the spacecraft from reaching the speed necessary to break free of the Earth's gravity.

Although Pioneer 3 did not achieve escape velocity, it reached an altitude of 63 miles and discovered a second radiation belt around Earth. America's first satellite, Explorer 1, was launched Jan. 31, 1958, and made the initial discovery of what became known as the Van Allen Radiation Belts. University of Iowa Physics and Astronomy professor Dr. James Van Allen, for whom the energetic charged particle layers are named, developed the instruments for the satellite.

NASA file/1959

Dr. Wernher von Braun, director of the U.S. Army Ballistic Missile Agency's Development Operations Division at the Redstone Arsenal, left, John Casani of the Jet Propulsion Laboratory, center, and Dr. James Van Allen, professor of Physics and Astronomy at the University of Iowa, inspect components of the Pioneer 4 spacecraft March 1, 1959.

NASA/Jet Propulsion Laboratory-Caltech

Technicians wearing clean-room attire inspect the Pioneer 3 probe before shipping it to Cape Canaveral in late 1958. Like its sister spacecraft, Pioneer 4, was designed to measure the intensity of the Earth's and moon's radiation and test long-range communication systems.

On the second attempt, on March 3, 1959, Pioneer 4 successfully lifted off from Launch Complex 5 and became the first American spacecraft to escape Earth's gravity.

The Soviet Union's Luna 1 was the first probe to do so on Jan. 2, 1959. It was designed to impact the moon, but due to an incorrectly timed upper-stage burn during launch, Luna 1 missed the moon but became the first spacecraft to enter orbit around the sun.

Pioneer 4 made its closest approach to the moon on the second day of the mission, passing within 37,000 miles of the lunar surface. The payload included two Geiger counters, similar to those developed by Van Allen for Explorer 1, and a camera trigger mechanism as a test for future photographic missions. While the spacecraft did fly past the moon, the camera sensor failed to trigger because its fly-by was at a greater distance than originally planned due to a trajectory error.

Pioneer 4 did provide extensive and valuable data on radiation and the tracking of space objects. Contact was lost from Pioneer 4's tiny radio on March 6, 1959, after 82 hours of transmissions and 655,000 miles of travel. It was the farthest tracking distance for a human-made object at the time.

Learning more about travel beyond Earth also is the objective of the upcoming first flight of Orion as NASA continues plans to explore.

The spacecraft is designed to take astronauts beyond low-Earth orbit to deep space. When boosted by NASA's Space Launch System (SLS), an advanced heavy-lift launch vehicle under development, Orion will provide the capability to transport astronauts to destinations such as an asteroid and Mars.

For EFT-1, plans call for the Lockheed Martin-built Orion to launch atop a United Launch Alliance Delta IV Heavy rocket from Space Launch Complex 37-B at Cape Canaveral. The planned two-orbit mission will send Orion farther into space than any human spaceflight vehicle since the Apollo 17 mission in December 1972.

The test will feature a 3,671-mile-high apogee on the second orbit and a high-energy re-entry at 20,000 mph. This will simulate the conditions that are expected as Orion returns from deep space destinations.

After splashdown in the Pacific Ocean, U.S. Navy crews will recover the Orion spacecraft. Data gathered from EFT-1 will be analyzed in the agency's Critical Design Review in April 2015.

NASA file/1959

The Juno II rocket lifts off March 3, 1959, successfully boosting the Pioneer 4 spacecraft. It was America's first spacecraft to escape Earth's gravity and passed within 37,000 miles of the lunar surface.

Looking up and ahead . . .

All times are Eastern

Feb. 27
Mission: Global Precipitation Measurement (GPM) Core Observatory
Launch Vehicle: H-IIA
Launch Site: Japan Aerospace Exploration Agency (JAXA) Tanegashima Space Center, Tanegashima Island, Japan
Launch Time: 1:07 to 3:07 p.m.
Description: GPM is an international satellite mission led by NASA and JAXA to provide next-generation observations of rain and snow worldwide.

March 16
Mission: SpaceX 3 Commercial Resupply Services Flight
Launch Vehicle: Falcon 9
Launch Site: Cape Canaveral Air Force Station
Launch Pad: Space Launch Complex 40
Launch Time: 4:42 a.m.
Description: SpaceX 3 will be the third commercial resupply mission to the ISS by Space Exploration Technologies (SpaceX).

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

NASA Employees of the Month: February

NASA/Kevin O'Connell

Employees of the Month for February are, from left, Jose R. Camacho, ISS and Spacecraft Processing (Employee of the Quarter); Mecca D. Murphy, Office of the Chief Financial Officer; Wade T. Graves, Launch Services Program; David R. Wallace, Center Operations; and Peter A. Taddie, Safety and Mission Assurance. Not pictured are Dawn A. Feick, Chief Counsel; Kenneth L. Harding, Ground Processing; Lowell I. Spaulding, Engineering and Technology; and William C. Manley, Engineering and Technology.

NuSTAR reveals how stars explode

NASA News Report

One of the biggest mysteries in astronomy, how stars blow up in supernova explosions, finally is being unraveled with the help of NASA's Nuclear Spectroscopic Telescope Array (NuSTAR).

The high-energy X-ray observatory has created the first map of radioactive material in a supernova remnant. The results, from a remnant named Cassiopeia A (Cas A), reveal how shock waves likely rip apart massive dying stars.

"Stars are spherical balls of gas, and so you might think that when they end their lives and explode, that explosion would look like a uniform ball expanding out with great power," said Fiona Harrison, the principal investigator of NuSTAR at the California Institute of Technology (Caltech) in Pasadena. "Our new results show how the explosion's heart, or engine, is distorted, possibly because the inner regions literally slosh around before detonating."

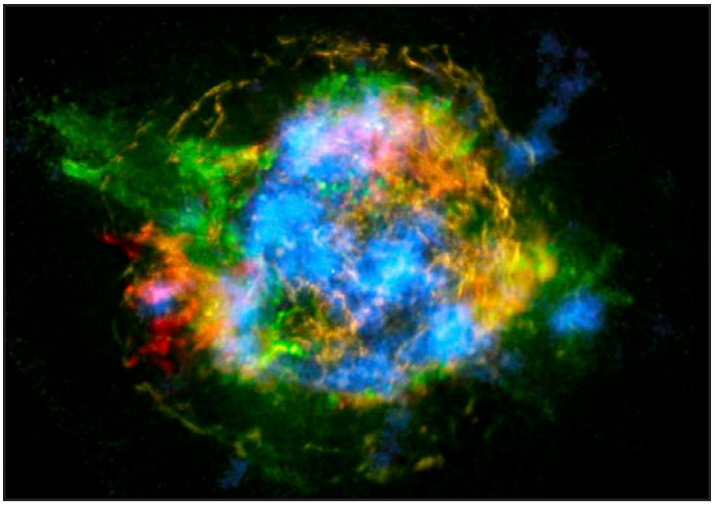
Harrison is a co-author of a paper about the results appearing in the Feb. 20 issue of Nature.

Some 55 members of the KSC-based Launch Services Program, or LSP, joined the Orbital launch team on a June 13, 2012, flight to Kwajalein Atoll in the Marshall Islands in the western Pacific Ocean to oversee the Pegasus/NuSTAR flight. A team at Kennedy also played a part in the operation.

NuSTAR is the first telescope capable of producing maps of radioactive elements in supernova remnants. In this case, the element is titanium-44, which has an unstable nucleus produced at the heart of the exploding star.

The latest findings strongly suggest the exploding star literally sloshed around, re-energizing the stalled shock wave and allowing the star to finally blast off its outer layers.

"This is why we built NuSTAR," said Paul Hertz, director of NASA's astrophysics division in Washington, "to discover things we never knew -- and did not expect -- about the high-energy universe."



NASA/JPL-Caltech/CXC/SAO

This is the first map of radioactivity in a supernova remnant, the blown-out bits and pieces of a massive star that exploded. The blue color shows radioactive material mapped in high-energy X-rays using NuSTAR.

John F. Kennedy Space Center

Spaceport News

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