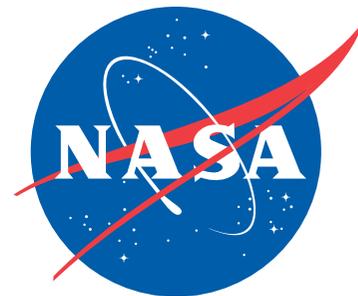


Spaceport News

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



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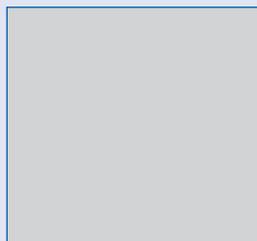
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Many Variables Dictate Launch Windows



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NuSTAR to open high-energy window in space

By *Steven Sicheloff*
Spaceport News

NASA's next observatory is about the size of a refrigerator, but it is expected to uncover some of the most powerful structures in the universe.

The Nuclear Spectroscopic Telescope Array, called NuSTAR, is to launch later this month aboard an Orbital Sciences Pegasus rocket from the Reagan Test Site at Kwajalein Atoll in the Pacific Ocean.

It will be the first spacecraft able to focus high-energy X-rays, the same kind of X-rays dentists use to penetrate teeth. Researchers say the instrument represents a huge advance in what they will be able to see in space.

"We are going to open up the high-energy window on the universe," said Daniel Stern, project scientist for NuSTAR. "It's going to teach us a lot about the universe from what heats the atmosphere of the sun to understanding black holes."

Some of the highest energy objects in the universe have been invisible to astronomers because they didn't have an instrument that could focus high-energy X-rays from black holes and stars that recently exploded. NuSTAR is expected to allow a complete count of the black holes in the universe and measure how fast black holes rotate.

"We think two out of every three black holes in the universe are hidden," Stern said.

NuSTAR will not leave Earth orbit as it looks out



CLICK ON PHOTO

NASA/Randy Beaudoin, VAFB

Orbital Science technicians ensure the Pegasus payload fairing is properly installed around NASA's Nuclear Spectroscopic Telescope Array, or NuSTAR inside the Orbital Sciences processing facility at Vandenberg Air Force Base in California, on March 3. For more on the NuSTAR mission, click on the photo.

on the universe. It will ride aboard a winged Pegasus rocket to an orbit close to the equator and extend a solar array for power.

"Compared to a Juno or an MSL (Mars Science Laboratory), it's not very big, it's about 775 pounds, about the size of a refrigerator" said Garrett Skrobot, NuSTAR's mission manager for NASA's Launch Services Program (LSP). "But it only has one basic instrument on the spacecraft itself, whereas the other spacecraft have multiple instruments on them."

After about a week in space, it will extend a

33-foot-long span with sensors at one end that will focus the X-rays the spacecraft sees.

The span is similar to the one extended during space shuttle mission STS-99 for the Shuttle Radar Topography Mission.

Part of NASA's Small Explorers program, the NuSTAR mission takes advantage of numerous technological advances of the past decade, said Yunjin Kim, NuSTAR's project manager.

NASA opted to launch the spacecraft from Kwajalein because the horseshoe-

shaped island is close to the equator. A launch team from LSP will head to the Pacific atoll about a week ahead of launch and return after NuSTAR is in orbit.

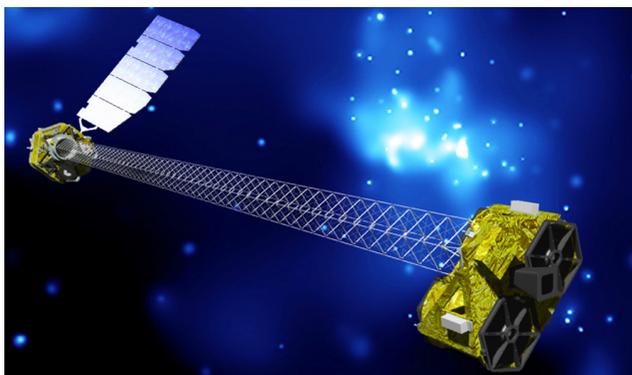
The Pegasus is NASA's only rocket that launches from an airplane, a modified L-1011 aircraft called Starchaser.

"Pegasus is our most unique rocket, period," said Omar Baez, launch director for LSP. "First off, it has a wing. The way we launch it is we drop it like a weapon or a bomb and a few seconds later this thing lights off and scoots in front of the L-1011. It's unique in all kinds of aspects."

Kwajalein is one of five launch sites LSP uses. Cape Canaveral Air Force Station in Florida, Vandenberg Air Force Base in California, Kodiak Launch Complex in Alaska, and Wallops Flight Facility in Virginia are the others. LSP is based at Kennedy Space Center.

After NuSTAR is orbiting and returning data, astronomers expect to team it with other observatories already in orbit, such as NASA's Chandra X-ray Observatory. That can mean anything from the two spacecraft looking at an object at the same time and comparing the results to having Chandra confirm theories sprouting from NuSTAR observations.

"We have planned observations of things we're safely sure we're going to see," Stern said, "but the big excitement is we might see things that are unexpected."



NASA image

NASA's Nuclear Spectroscopic Telescope Array (NuSTAR) will allow astronomers to study the universe in X-rays. It is the first satellite focused on high-energy X-rays and will complement astrophysics missions that explore the cosmos in other regions of the electromagnetic spectrum.



'Good challenges' ahead for new S&MA leaders

By Linda Herridge
Spaceport News

Kennedy Space Center's new Safety and Mission Assurance (S&MA) Director Russell Romanella and Deputy Director Russ DeLoach say there are challenges ahead, but they are good challenges, as the center transforms to a multiuser launch center.

"I'm very happy to take on this challenge," Romanella said. "The time was right."

With previous director Mike Wetmore's and deputy director's Humberto (Bert) Gambaro's retirements late last year, Romanella and DeLoach officially moved into their positions in January.

Romanella leads about 200 NASA civil servants and 60 support contractors in safety and mission assurance efforts that support all of Kennedy's programs and directorates.

"The S&MA workers are top-notch folks," Romanella



Director Russell Romanella
Safety & Mission Assurance

said. "In a time when there's a different way of thinking, I feel like we can make a difference."

According to Romanella, there are a number of transformative changes in work including reviewing and rewriting S&MA documentation to support Kennedy's future environment. The spaceport envisioned in NASA's future includes facilities shared with commercial partners, facilities turned over to NASA partners en-



Deputy Director Russ DeLoach
Safety & Mission Assurance

tirely and facilities in which Kennedy organizations are the sole tenants.

"It is vital to maintain an atmosphere of safety," DeLoach said. "In the world of safety, we're trying to be more risk-based and less rule-based."

DeLoach said the directorate will look at the center's safety requirements, processes and procedures to maintain safety and allow commercial ventures to be able to prosper and flourish.

The recent Space Act Agreement with Space Florida to lease Orbiter Processing Facility-3 to The Boeing Company is an example of paving the way for facility use by another company.

"This supports NASA's overall exploration vision including commercial space," Romanella said.

"The commercial partners have their requirements and Kennedy has its safety culture. The key is to meld the two without sacrificing safety."

DeLoach said there's a growing understanding that Kennedy needs to help commercial spaceflight succeed.

"The kinds of things we're doing require us to be flexible while developing appropriate safety controls," DeLoach said. "Some rules may need to be more or less stringent."

At his first All Hands meeting last month, Ro-

manella set the directorate's goals and objectives.

He acknowledged Kennedy's safety record which he said was better in 2011 than in other years and credits the center's safety culture for that.

"The shuttle's retirement changed the center significantly," Romanella said. "How do we maintain the safety culture and keep the excitement going? That's the challenge."

He said the directorate needs to maintain a level of independence with checks and balances between S&MA, engineering, and programs and projects.

"It's important that S&MA is recognized as an organization that will help solve problems," Romanella said. "Find the problem and then find the solution."

DeLoach added, "It's going to be a very busy time for S&MA."

Safety requirements shaping commercial crew designs

By Rebecca Regan
Spaceport News

NASA's plans for a new generation of commercially owned and operated spacecraft and launches involve meeting a number of goals, none higher than keeping to the agency's high standards for crew safety.

The agency's Commercial Crew Program (CCP) outlined hundreds of human safety and performance requirements for the companies it is working with to carry astronauts to low Earth orbit. NASA's engineers won't directly tell the companies how to meet the requirements, though. Instead, they'll rely on their partners' innovations to meet their safety objectives.

"The success of this program is really dependent on all of us working together to design, develop and verify that we have a sound crew transportation system," said Ed Mango, CCP program man-

ager. "Safety is our No. 1 priority. That's why, in our list of goals as a program, it's safe first, then reliable, then cost-effective access to low Earth orbit."

In 2011, CCP developed and released a set of requirements and standards, called the 1100 series, which outlines about 300 requirements for NASA missions to the International Space Station.

"We wrote the 1100 series to be independent of our acquisition strategy. So, it's a set of documents that can stand alone whether we're in a Space Act Agreement (SAA) or contract with our commercial providers," said Chris Gerace, deputy chief of CCP's Systems Engineering and Requirements Office.

Gerace said that throughout CCP's second round of development, known as CCDev2, NASA's industry partners are either meeting those requirements specifically or attempting to meet their intent. The

program anticipates the same level of enthusiasm in meeting requirements during the next round of development, called Commercial Crew Integrated Capability (CCi-Cap).

"It really behooves our industry partners to meet our requirements now so that it doesn't become costly to the partnership to fix later on down the road," Mango said.

The standards cover every aspect of safety, from ground processing and providing a crew with optimal breathing air and life support systems to ensuring the reliability of a spacecraft's windows and computer circuit boards.

"When you look at everything that goes into designing both a launch vehicle and a spacecraft that has to dock with the space station, stay in orbit for months, and re-enter the Earth's atmosphere, every safety requirement is important," Gerace said. "Our partners can be as

creative as they want when it comes to their designs, but they've got to meet the intent of these standards before they can fly a NASA crew."

Gerace noted that his team relied heavily on the successes and hard lessons learned from NASA's Space Shuttle Program to develop CCP's requirements.

"Our goal has always been to be safer than the programs that came before us," said Mango, who spent the majority of his NASA career supporting the shuttle program. "As engineers, as designers, as test conductors, as assistant launch directors or as project management for the shuttle program, we have the scars in order to make this program even better."

When NASA launched its first space shuttle, Columbia, from Kennedy Space Center on April 12, 1981, its mission was to prove a number of cutting-edge

See CCP, Page 4



Three themes guiding Kennedy's next 20 years

Spaceport News Report

Kennedy Space Center currently is creating a new Master Plan that describes how the center will transform itself from a single user federal entity to one that supports a multitude of users and operations. This agency mandated plan, spans a twenty year horizon and will detail the land uses, business policies and infrastructure that the center will require to remain the launch site of choice for all providers.

During the past year, Kennedy's Center Planning and Development Office (CPDO) has led the effort while preparing the Future Development Concept, the precursor to the Master Plan. Guided by the Master Planning Steering Group -- chaired by the Kennedy Deputy Center Director Janet Petro -- CPDO has interviewed officials from: Kennedy, NASA HQ, Florida Department of Transportation, Space Florida, Cape Canaveral Air Force Station, Merritt Island National Wildlife Refuge and various operating and emerging commercial space launch customers; to determine Kennedy's position in the space industry. These interviews and the resulting two-day planning meeting last September formed the framework of the Future Development Concept.

Trey Carlson, Master Planner for Kennedy, describes the Future Development Concept with three succinct themes that will guide activity during the next 20 years:

- to adopt new business practices allowing companies and outside organizations to make investments in the center to operate their enterprises,

- to transfer or otherwise dispose of facilities that are not being used enough and won't be needed by future NASA programs,

- to build new facilities that are economically and environmentally sustainable and can be used by a variety of people, organizations and programs.

"It is very challenging making the transition from a government program focused primarily on a single crewed spacecraft to a multiuser program," Carlson said, adding "at the



NASA image

An artist image of the proposed new headquarters of Kennedy Space Center. According to Trey Carlson, master planner for Kennedy, modern construction technology will allow the new headquarters to operate far more efficiently.

same time, we must be careful not to preclude any future uses with decisions that are being made today."

Overall, the aim is to keep Kennedy's identity as a premier launch site while adding the capability to host researchers in some fields and adapting the landscape to the needs of a variety of horizontal and vertically launched spaceflight systems and aircraft.

After all, Kennedy has some of the most unique infrastructure in the world, ranging from the 3-mile-long Shuttle Landing Facility runway big enough for any aircraft or spacecraft currently envisioned, to the Vehicle Assembly Building, which has stacked the largest rockets NASA has ever flown.

There are about 700 facilities in different areas of the center's 144,000 acres. Figuring out their roles in the center's future was a large part of the master planning effort.

Many structures, including the orbiter processing facilities, have garnered intense interest from organizations and companies outside NASA. Already, one of the three has been leased to Space Florida, which in turn made a deal with The Boeing

Company to process its new human spaceflight capsule.

"A multiuser spaceport, by definition, has facilities with different users," Carlson said.

The shuttle runway is already hosting divergent users, including Starfighters Inc. and auto racing teams testing their designs on one of the flattest surfaces on Earth, not to mention transport flights carrying rockets, such as United Launch Alliance's Atlas V.

While some buildings will be taken down or turned over to new tenants, others will be rebuilt or heavily modified. The north wing of the Operations and Checkout Building is undergoing a remodeling that will eventually remake the facility from the inside. The building, one of the first built at Kennedy, is tapped to host Lockheed Martin's Orion final assembly in the high bay.

Kennedy's Headquarters Building and the Central Instrumentation Facility, which are approaching their 50th birthday and showing signs of their age, are to be taken down the next several years and replaced by a new headquarters that will consolidate all shared services and most administrative func-

tions across the Industrial Area.

The new headquarters building is the cornerstone for the Central Campus consolidation. It will be built in two phases and all shared services and administrative office functions south and west of the current HQ building except for the Occupational Health Facility" (which is scheduled for Phase 4). A third follow-on phase will build a modern engineering and science laboratory building. The new laboratory building will enable a complete gut and renovate project for the South Wing of the Operations and Checkout (O&C) building similar to the current one on the north wing of the O&C. Central Campus will enable demolition of approximately 900,000 square feet of physical plant in the Industrial Area while rebuilding only about 450,000 square feet. Between the 50 percent reduction in foot print and the considerably lower costs associated with the operation and maintenance of the new energy efficient facilities, KSC will save in the order of \$400 million during the next 40 years.

Carlson said the modern construction technology will allow the new headquarters to operate far more efficiently.

"We're going to see a dramatic return on investment with new facilities," Carlson said. Planners have begun discussions with Florida's Department of Transportation exploring partnering arrangements for upkeep and perhaps the eventual improvements of some of Kennedy's roads, particularly the four bridges currently under the center's care. That could free up NASA's resources for other infrastructure upgrades at the center.

"With a constrained budget forecast we owe it to ourselves to look at options of how to operate the Center in a more sustainable manner," Carlson said."

Although the changes are expected to touch most aspects of the center, Carlson said planners anticipate keeping the area's identity as a NASA launch site and aerospace research hub.

Carlson added, "You will always be driving by a sign at the gate that says, 'Welcome to Kennedy Space Center.'"



Variables dictate launch window opportunities

By Anna Heiney
Spaceport News

Why does NASA sometimes schedule a rocket launch for the middle of the night or aim for a liftoff time when weather is notoriously unlikely to cooperate?

The simplicity of the question belies the complexity of the answer. The best time to start a mission is based on a blend of factors: the flight's target and goals, the needs of the spacecraft, the type of rocket, and the desired trajectory, which refers to the path the vehicle and spacecraft must take to successfully start the mission. Not only do these variables influence the preferred launch time -- the ideal time of departure -- but the overall length of the launch window, which can vary from one second to several hours.

The dynamics change from mission to mission, and determining the launch window is an important part of the overall flight design.

"The interesting thing about our job is each mission is almost completely different from any other mission," said Eric Haddox, the lead flight design engineer in NASA's Launch Services Program (LSP), based at Kennedy Space Center.

Haddox leads the team of agency and contractor personnel overseeing and integrating the trajectory design efforts of the spacecraft team and launch service contractor for each



NASA/Bill Ingalls

A Delta II arcs across the sky carrying NASA's Suomi NPP spacecraft.

LSP mission. Once the spacecraft team identifies its needs, a rocket is selected, and the work of hammering out the best launch window and trajectory begins. Ultimately, the launch window and preferred liftoff time are set by the launch service contractor.

"We help everybody understand the requirements of the spacecraft and what the capabilities are of the launch vehicle, and try to mesh the two," Haddox explained.

The most significant deciding factors in when to launch are where the spacecraft is headed and what its solar needs are. Earth-observing spacecraft, for example, may be sent into low Earth orbit. Some payloads must arrive at a specific point at a precise time, perhaps to rendezvous with another object or join a constellation of satellites already in place. Missions to the moon or a planet involve aiming for a moving object a

long distance away.

Additionally, spacecraft often have solar requirements: they may need sunlight to perform the science necessary to meet the mission's objectives or they may need to avoid the sun's light in order to look deeper into the dark, distant reaches of space.

All of these variables influence a flight's trajectory and launch time. A low Earth mission with specific timing needs must lift off at the right time to slip into the same orbit as its target; a planetary mission typically has to launch when the trajectory will take it away from Earth and out on the correct course.

According to Haddox, aiming for a specific target -- another planet, a rendezvous point, or even a specific location in Earth orbit where the solar conditions will be just right -- is a bit like skeet shooting.

"You've got this object that's going to go flying out into the air and you've got to shoot it," said Haddox. "You have to be able to judge how far away your target is and how fast it's moving and make sure you reach the same point at the same time."

But Haddox also emphasized that Earth is rotating on its axis while it orbits the sun, making the launch pad a moving platform. With so many moving players, launch windows and trajectories must be carefully choreographed.

Of course, weather or technical problems can interfere with the team's best plans. Launch windows are intended to absorb small delays while still offering plenty of chances to lift off on a given day. However, launching at a time other than the preferred time could reduce the rocket's performance, potentially limiting the payload mass.

Likewise, if a spacecraft has to use any of its onboard propellant to make up for any difference in the trajectory, that could impact the entire mission.

"The navigation system on the rocket is going to do what it needs to do to get the spacecraft where it needs to be, but it's not going to be the same trajectory you looked at before," said Haddox. "When you've got things that are moving seven to eight kilometers a second, half a second can result in a big distance."

Haddox added, "So it just makes things a lot harder to predict."

From CCP, Page 2

technologies, from the innovative main engines that provided enough thrust to accelerate the shuttle to 17,000 mph in eight-and-a-half minutes to the ceramic tiles that protected the shuttle from the searing heat of re-entry. Never before had the agency put astronauts on board a spacecraft that hadn't been tested without a crew first.

"The first four shuttle flights were considered test flights," Mango said. "It wasn't until the fifth flight that shuttle missions were considered operational."

Mango said he envisions CCP verifying systems and subsystems in a somewhat similar fashion, whether it's with demonstrations, such as test flights without a crew, or through analyses, inspections or testing, and then, finally, test flights with a crew.

"What we want is innovation," Mango said.

"So, if we're meeting the intent of our requirements, we are more than willing to talk about different verification methods with our partner. As long as the intent has not changed and the risk that that requirement is trying to negate is being accounted for."

There are several reasons CCP is handling safety and mission requirements a little differently than its shuttle predecessor. One is that shuttles had a lot more mission capabilities than what CCP is requesting, which is to transport up to four crew members and a few lockers full of supplies and experiments to the International Space Station. Shuttles had the unique capability to house satellites in their payload bays or act as research laboratories all on their own in space. And, second, because each design is so different, CCP couldn't develop a set of requirements that detailed every nut and bolt like the thousands of requirements levied for the shuttle.

"Our goal from the beginning has been to have a NASA-certified system before NASA crews use the capability," Mango said. "I have 100 percent confidence that our partners will succeed with our knowledge base and our help."

Mango said that CCP's acquisition approach is sound because overall verification and certification of a crew transportation system will take place once NASA enters into a contract with a commercial provider. The first crew members of a test flight would likely be employed by the commercial providers themselves, but that doesn't change the importance of NASA's safety goals.

"The value of a human life is priceless," Mango said. "It's the same whether it's a NASA employee or a company employee. The people who will sit in these rockets and spacecraft are our partners, our friends, our neighbors, our spouses, so we will only fly when we are ready."



Scenes Around Kennedy Space Center



CLICK ON PHOTO

NASA/Frankie Martin

Representatives from NASA's Kennedy Space Center in Florida talk to visitors attending the NBA All-Star Jam Session at the Orange County Convention Center in Orlando, Fla., on Feb. 23. The NASA exhibit offers hands-on educational activities highlighting some of the contributions the space agency has made to sports, transportation and everyday life. One of the events leading up to the NBA All-Star game in Orlando on Feb. 26, the jam session is a basketball experience intended for all ages, allowing fans to compete against their friends in skills challenges and collect autographs from players and legends. To find out more about how space exploration adds to your daily life, click on the photo.



Photo courtesy of United Launch Alliance

An Atlas V, carrying a Mobile User Objective System-1 (MUOS-1) satellite lifts off at 5:15 p.m. EST, Feb. 24, from Launch Complex 41 at Cape Canaveral Air Force Station, Fla. At nearly 15,000 pounds, MUOS-1 is the heaviest payload launched to date by an Atlas V launch vehicle.

Play Ball! NASA celebrates Space Day at Space Coast Stadium

NASA and the Space Coast Stadium in Viera, Fla., celebrate Space Day during Major League Baseball's Washington Nationals spring training game with the Houston Astros on March 8. Kennedy Space Center Director Bob Cabana threw the first pitch (bottom right).

Kennedy hosted a booth at the stadium where representatives highlighted some of the contributions the space agency has made to sports, transportation and everyday life. Spaceperson greeted and took photos with baseball fans (bottom left). Attendees had the opportunity to sign the full-scale test version of NASA's Orion Multi-Purpose Crew Vehicle outside the stadium (top left).

Photos by NASA/Kim Shifflett



Shuttle team reflects on permanent power-downs

By Anna Heiney
Spaceport News

Space shuttles Discovery and Atlantis are on the move today between different facilities at Kennedy Space Center's Launch Complex 39. Discovery is rolling out of Orbiter Processing Facility-1 and into the Vehicle Assembly Building while Atlantis takes its place in OPF-1. The moves come after the vehicles were powered down for the final time: Discovery on Dec. 16, 2011, and Atlantis on Dec. 22.

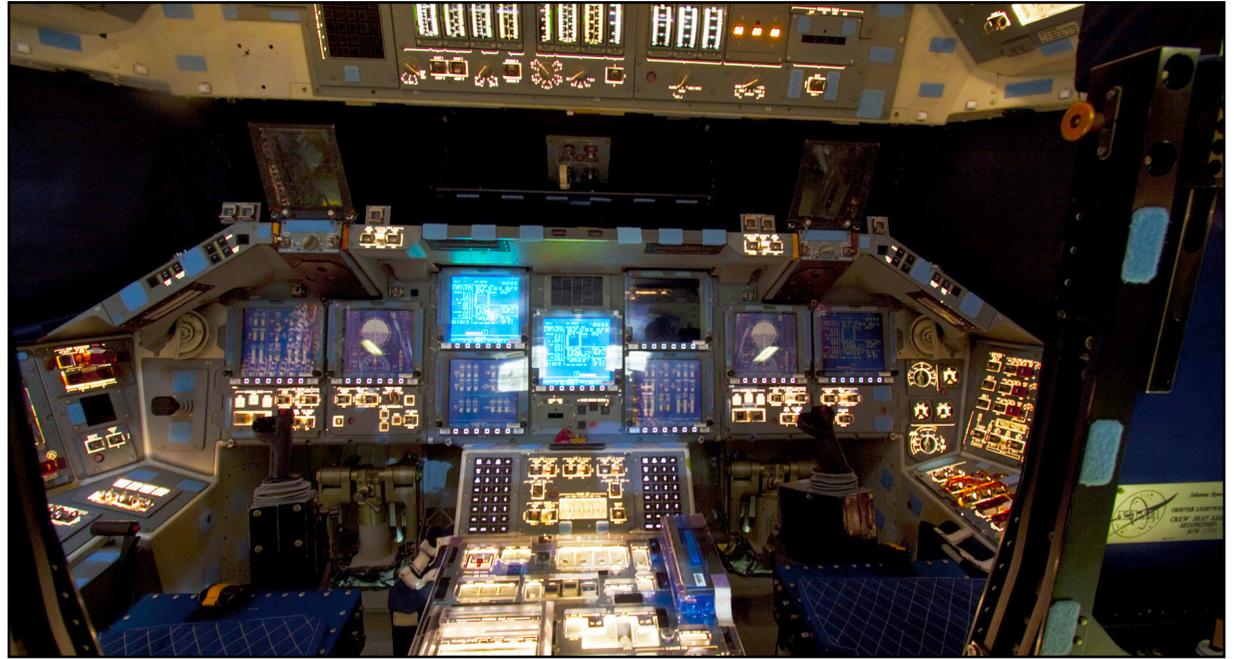
Endeavour is targeted to be powered-down in May.

"After working so many years -- since 1988 -- on these vehicles, it's a little hard to say, 'I'm taking my best car and I'm going to not drive it anymore. In fact, I'm going to go ahead and fix it so it can't ever crank anymore,'" said United Space Alliance's Walter "Buddy" McKenzie. After overseeing preparations of several space shuttles during his career and witnessing the power-downs, he reflected, "The realization really hits you when you're powering down a vehicle for the last time."

One by one, flight deck switches and displays were turned off by spacecraft operators inside the crew module, while in the firing room inside the nearby Launch Control Center, test conductors gave direction as system engineers monitored the process. Finally, the lights on the flight deck went out for good.

These are important milestones in the shuttle's transition and retirement activities. Discovery, Atlantis and Endeavour all are being prepared for their retirement roles as museum attractions, and the team still has plenty of work to do before the vehicles are safe and ready for public display. But that doesn't make the transition easier for those who cared for these spacecraft, sometimes for decades, and were there to see the two shuttles put into permanent sleep.

"My gut's tied up in knots, because I know I won't be doing it again," said Gene Dixon of United Space Alliance. A spacecraft operator for the past 27 years, he was one of three technicians working through the checklist for the last time inside



CLICK ON PHOTO

NASA/Jim Grossmann

In Orbiter Processing Facility-2 at NASA's Kennedy Space Center in Florida, the flight deck of space shuttle Atlantis is illuminated one last time Dec. 22 during preparations to power down the shuttle during Space Shuttle Program transition and retirement activities. Atlantis is being prepared for public display in 2013 at the Kennedy Space Center Visitor Complex. For more information, click on the photo.

Discovery's flight deck.

The world knows NASA's most-flown orbiter as space shuttle Discovery, but to the shuttle team, it's OV-103, short for Orbiter Vehicle-103. After landing at Kennedy for the final time on March 9, 2011, preparations began for its public display at the Smithsonian's National Air and Space Museum Steven F. Udvar-Hazy Center in Chantilly, Va.

Shuttle processing activities typically required that the vehicle be powered. But the team reached a point in mid-December when all of those tasks were complete, and vehicle power would no longer be needed. So Discovery was powered up, the payload bay doors were closed, and the spacecraft then was powered down.

"Everyone that's used to working in the midbody or seeing those (payload bay) doors open, all of a sudden were watching them close, and knowing that that was the final time that we here at Kennedy would ever see inside that midbody," said Stephanie Stilson, the NASA flow director overseeing all the orbiters' transition and retirement activities.

"Even at the Smithsonian, there are no plans to open the payload bay doors on Discovery, so as far as we know right now, those doors will never open again."

When the power-down check-

list was complete, Center Director Bob Cabana pulled the plug on the "Vehicle Powered" sign near the operations desk.

"I just want to thank everybody on the loop for an outstanding job you guys have done over the years," Cabana said, referring to the communications channel used by the shuttle team during processing activities. "It's kind of a momentous day, and I just appreciate everybody's hard work, and the team's doing absolutely outstanding. It is special to see you power down the vehicle for the last time."

Atlantis, or OV-104, touched down before dawn on July 21, 2011, wrapping up the STS-135 mission and completing the last flight of 30 years of Space Shuttle Program missions. Destined for display at the Kennedy Space Center Visitor Complex, it's temporarily moving to the Vehicle Assembly Building to make room in the orbiter processing facility for Endeavour.

"We basically laid out the work so we could get what we had to get done to be able to power down," Stilson explained. "We got all that work taken care of right away, so we could continue with the safing efforts over in the Vehicle Assembly Building. We can't do everything over there, but it will allow us to continue and keep our schedule if

we can continue that work."

With the shuttle's robotic arm and Ku-band antenna stowed and the payload bay doors closed, Atlantis' power was shut down.

"And, 10:28," says spacecraft operator Bill Powers, pausing to glance around Atlantis' flight deck, "OV-104 final power-down's complete."

Stilson compares the shuttles' pending departures to sending your children off to college.

"You don't want to see them go, you're going to miss not having your hands on them every day, and knowing that you can really look out for them, but you're happy for this progression of their career," Stilson said. "And you just trust that there will be other people there to take care of them and look out for them."

In addition to those participating in the work to power the vehicles down, several other shuttle team members gathered to observe and honor the spacecraft they know so well.

"You're with them more than you are with your family. They actually become part of you," McKenzie said of the shuttle fleet. "You work on them so much, you know where their weaknesses are and you know where their strengths are. You get familiar with them. At some point, they leave the machine stage, and they become part of your soul."



Remembering Our Heritage - Celebrating Women's History Month

Women are 'bright spots' in solar research program

By Kay Grinter
Reference Librarian

Women scientists have been at the forefront in space exploration and discovery, managing NASA's solar research missions "with flare" over the past 50 years.

Nancy Roman was chief of astronomy in the Office of Space Science at NASA Headquarters in 1962 when the first of NASA's eight Orbiting Solar Observatory (OSO) satellites launched from Cape Canaveral on March 7. Roman, who "reached for the stars" in more ways than one, is distinguished as the first woman to hold an executive position in the agency.

Roman's astronomy credentials included a bachelor's degree from Swarthmore College and a doctorate from the University of Chicago.

Women often encountered resistance in their pursuit of scientific careers during that era and Roman was no exception.

"At Swarthmore, the Dean of Women was very opposed to women going into science or engineering," Roman recalled during an interview in 2000 for an oral history project, "so opposed that if she couldn't talk a girl out of it, she just never had



CLICK ON PHOTO

Solar Dynamics Observatory (SDO) Program Executive Dana Brewer is shown with an image of the SDO satellite in 2010. For more on the SDO Program, click on the photo.

NASA file/2010

anything more to do with her for the four years she was there."

The OSO-1 spacecraft made Roman proud, transmitting 1,000 hours of real-time data on solar phenomena, including measurements of 75 solar flares, until May 1964.

Before Roman retired in 1979, she had oversight for the planning and development of several other

astronomical satellite programs, including the Cosmic Background Explorer and the Hubble Space Telescope.

NASA's solar research continues today, 50 years later, with NASA's Solar Dynamics Observatory (SDO), managed by a bevy of women scientists including SDO Program Executive Dana Brewer.

Brewer's experience with career advice was not unlike that received by Roman.

"I accepted the challenge of succeeding in science when a chemistry professor told me that women should not get science degrees, because it's a man's field," Brewer reported in an interview for the SDO Team website.

Brewer was not deterred and earned a bachelor's degree in general science from Penn State and a doctorate in quantum chemistry from Virginia Tech.

When the sun erupted March 6, 2012, with one of the largest solar flares of this solar cycle, SDO, launched from Cape Canaveral in February 2010, captured the event, categorized as an X5.4, from its orbit 22,300 miles above Earth.

One of the most dramatic features apparent in a video of the event is

the way the entire surface of the sun seems to ripple with the force of the eruption. This movement comes from something called EIT waves because they were first discovered with the Extreme Ultraviolet Imaging Telescope (EIT) on the Solar Heliospheric Observatory.

Since SDO captures images every 12 seconds, it can map the full evolution of these waves and confirm that they can travel across the full breadth of the sun. The waves move at over a million miles per hour, zipping from one side of the sun to the other in about an hour.

The video, available online at www.nasa.gov/mission_pages/sunearth/news/News030712-X1.5.html, shows two distinct waves. The first seems to spread in all directions; the second is narrower, moving toward the southeast. Such waves are associated with, and perhaps trigger, fast coronal mass ejections, so it is likely that each is connected to one of the two ejections that erupted on March 6.

The journeys of the OSO and SDO spacecraft have been successful but how do these two women scientists feel about their career paths?

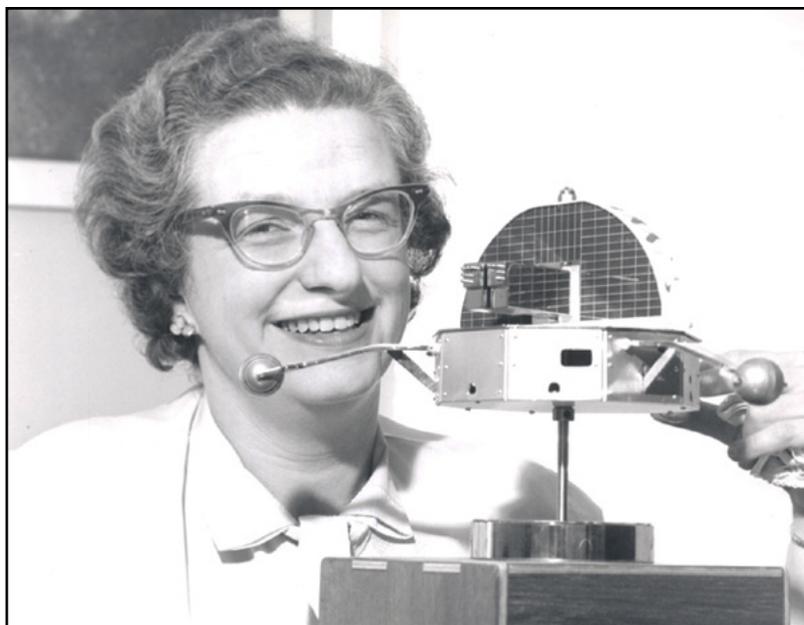
"Well, when I joined NASA," Roman said, "...because the women's pages (of the newspapers) were so very anxious to get material, I got a great deal of publicity, much more, I think, than I deserved, but in a way, it was fun. As a result, of course, I had a lot of opportunities that I probably would not have had as a man in the same job."

Brewer concurred, "Society's acceptance of female engineers has caught up with my activities."

More information

For additional information on the "Women of SDO," visit www.nasa.gov/mission_pages/sdo/team/women-of-sdo.html.

For information on NASA's commitment to attract and retain students in the science, technology, engineering and mathematics, or STEM, disciplines, visit www.nasa.gov/education.



CLICK ON PHOTO

Dr. Nancy Roman, one of the nation's top scientists in the space program, is shown with a model of the Orbiting Solar Observatory (OSO) in 1963. For more on the OSO Program, click on the photo.

A transcript of Roman's interview is available online in its entirety at www.jsc.nasa.gov/history/oral_histories/NASA_HQ/Herstory/RomanNG/romanng.pdf.

NASA file/1969



NASA Employees of the Month: March



NASA/Rick Wetherington

Employees for the month of March are, from left, Richard Knochelmann (VA), Jennifer Stahre (CC), Chris Zuber (OP), Katherine Renneisen (GP), and James Smith (NE). Not pictured are William Simmonds (LX), Kathleen Ellis (NE), Crystal Jones (SA) and Ramon Mejias (TA).



NASA/Brittney Longley

Softball game inspires team building

After a grueling seven innings, Kennedy Space Center's senior management defeated the center's co-op students 30-14 in the Senior Management/Co-op softball game at KARS Park I on March 2.

Many of the players said they were pleased with the way each team worked together.

"More important than the score, was that we had fun and it was a great team building exercise," Kennedy Center Director Bob Cabana said. "We really are a family at KSC and the positive relationships that we build with one another on and off the field of play here at the center are important in helping us excel in all we do."

The co-ops took an early lead, but an injury seemed to turn the game around as senior management pulled out the win.

"To be a successful team, you have to work together," said co-op Kevin Ricksecker. "This is a helpful way for us to get to know each other and strategize toward the common goal of beating the management team."

Senior managers also won last year's contest after rain shortened the game.

Some of the players from the management team included Cabana, Jerry Stubbs, Pepper Phillips, Mike Bolger, Mark Ruether, Tom Engler and Cheryl Hurst. Co-ops included James Wood, Dennis Bayon, Quentin Hibbs and Eric Meier. Among the supporters were Nancy Bray, Jennifer Kunz, Susan Kroskey and Sandy Massey. The co-ops wore red while management donned blue.

"The softball game was a fantastic way for co-ops to interact with upper-level management and get to know each other. We were able to socialize with each other while playing a competitive game," co-op Jesse Berdis said.

Already, many of the co-ops are excited about next years' match-up. Berdis added, "The rivalry still continues."

Brittney Longley
Spaceport News

Looking up and ahead . . .

* All times are Eastern

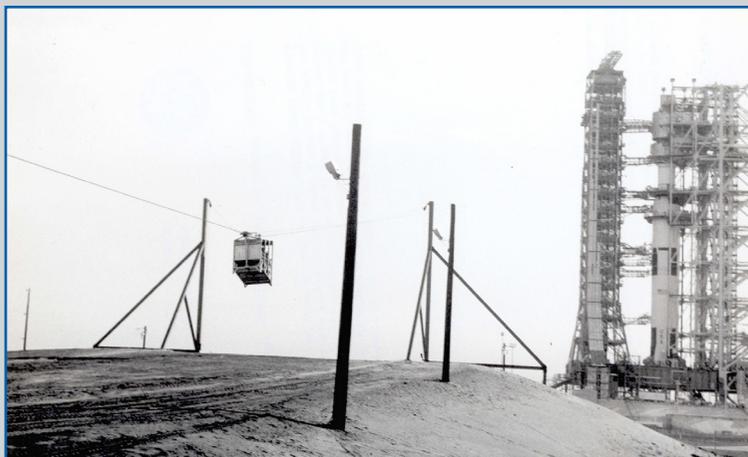
No earlier than March 22 Launch/Reagan Test Site Kwajalein Atoll:
Pegasus XL, NuSTAR
Launch window: 11:30 a.m. to 3:30 p.m.

No earlier than late April Launch/CCAFS (SLC-40): SpaceX Falcon 9,
Dragon C2/C3
Launch window: TBD

No earlier than April 27 Launch/CCAFS (SLC-41): Atlas V, AEHF 2
Launch window: TBD

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

FROM THE VAULT



NASA file/1969

The cab used for emergency egress from the Apollo/Saturn V rocket hits a reverse pull arrestor cable system which slowed it to a stop during the first manned run of the system from Launch Complex 39's Pad A on Jan. 25, 1969. Riding in the nine-person-capacity cab were astronaut Stuart Roosa, a member of the Apollo 9 support crew; Chuck Billings, KSC Safety Office; and Art Porcher, Design Engineering. In the background is the Saturn V launch vehicle for the Apollo 9 mission. It is surrounded by the mobile service structure and Launcher Umbilical Tower.



John F. Kennedy Space Center

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