February 2015 Vol. 2 No. 2

National Aeronautics and
Space Administration

KENNEDY SPACE CENTER'S

SPACEPORT magazine

EARTH *RIGHT* NOW

Your planet is changing. We're on it.

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PANORAMIC VIEW OF ANDROMEDA
This sweeping bird's-eye view of a portion of the Andromeda galaxy (M31) is the sharpest image ever taken of our galactic next-door neighbor. Though the galaxy is more than 2 million light-years away, The Hubble Space Telescope is powerful enough to resolve individual stars in a 61,000-light-year-long stretch of the galaxy's pancake-shaped disk. Image credit: NASA, ESA, J. Dalcanton, B.F. Williams, and L.C. Johnson (University of Washington), the PHAT team, and R. Gendler

Experience virtual reality and learn about NASA's #JourneytoMars

3DV
NASA 3-D VIEW

Smartphone and tablet users can experience the excitement of standing on the launch pad beneath NASA's massive new rocket, the Space Launch System, or SLS, with a new interactive app from NASA that previews the starting point for the nation's journey to Mars. Point the device up to see to the top of the rocket, or hold level to see the details of the solid rocket boosters and engines.

Called NASA 3DV, for 3-D view, the inventive app shows viewers 3-D models of the Orion spacecraft and Space Launch System, the fixtures of NASA's push to send astronauts on deep space exploration missions to an asteroid and eventually Mars. The app also shows virtual models of the crawler transporter that carried the Saturn V moon rockets and space shuttles to the launch pad and is on tap to take the SLS and Orion on the same trip.

DOWNLOAD NOW

Download on the App Store

To watch a video demonstration of the app, go to http://go.nasa.gov/1yZdGOv

ORION | Technology | History | Earth | International Space Station (ISS)

KENNEDY SPACE CENTER'S

SPACEPORT MAGAZINE

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Cover: Just one year ago, we waited eagerly, wide-eyed and almost breathlessly as NASA prepared to launch five Earth science missions within a single year's span. And now, just one short year later, we're here again, celebrating the opening of the new and improved remote eyes to monitor our changing planet.

Back: A worker prepares the launch gantry to be rolled back from the United Launch Alliance Delta II rocket with the Soil Moisture Active Passive (SMAP) observatory onboard, at the Space Launch Complex 2, Jan. 28 at Vandenberg Air Force Base, California. SMAP is NASA's first Earth-observing satellite designed to collect global observations of surface soil moisture and its freeze/thaw state.
Photo credit: NASA/Bill Ingalls

NASA'S LAUNCH SCHEDULE

No Earlier Than: Feb. 8 -- 6:10 p.m. EST
Mission: NOAA's Deep Space Climate Observatory (DSCOVR)
Description: DSCOVR will maintain the nation's real-time solar wind monitoring capabilities which are critical to the accuracy and lead time of space weather alerts and forecasts issued by the National Oceanic and Atmospheric Administration (NOAA). It will launch on a SpaceX Falcon 9 rocket from Space Launch Complex 40 at Cape Canaveral Air Force Station, Florida.

Targeted Date: March 12
Mission: Magnetospheric Multiscale (MMS)
Description: Launching from Cape Canaveral Air Force Station on an Atlas V 421 launch vehicle, the MMS mission will study the mystery of how magnetic fields around Earth connect and disconnect, explosively releasing energy via a process known a magnetic reconnection.

Date: March 27
Mission: One Year Crew Launch to Space Station Aboard Soyuz
Description: Scott Kelly, Mikhail Kornienko and Gennady Padalka launch to the International Space Station aboard a Soyuz TMA-16M spacecraft from the Baikonur Cosmodrome, Kazakhstan. Kelly and Kornienko will spend a year on the station, returning in March 2016.

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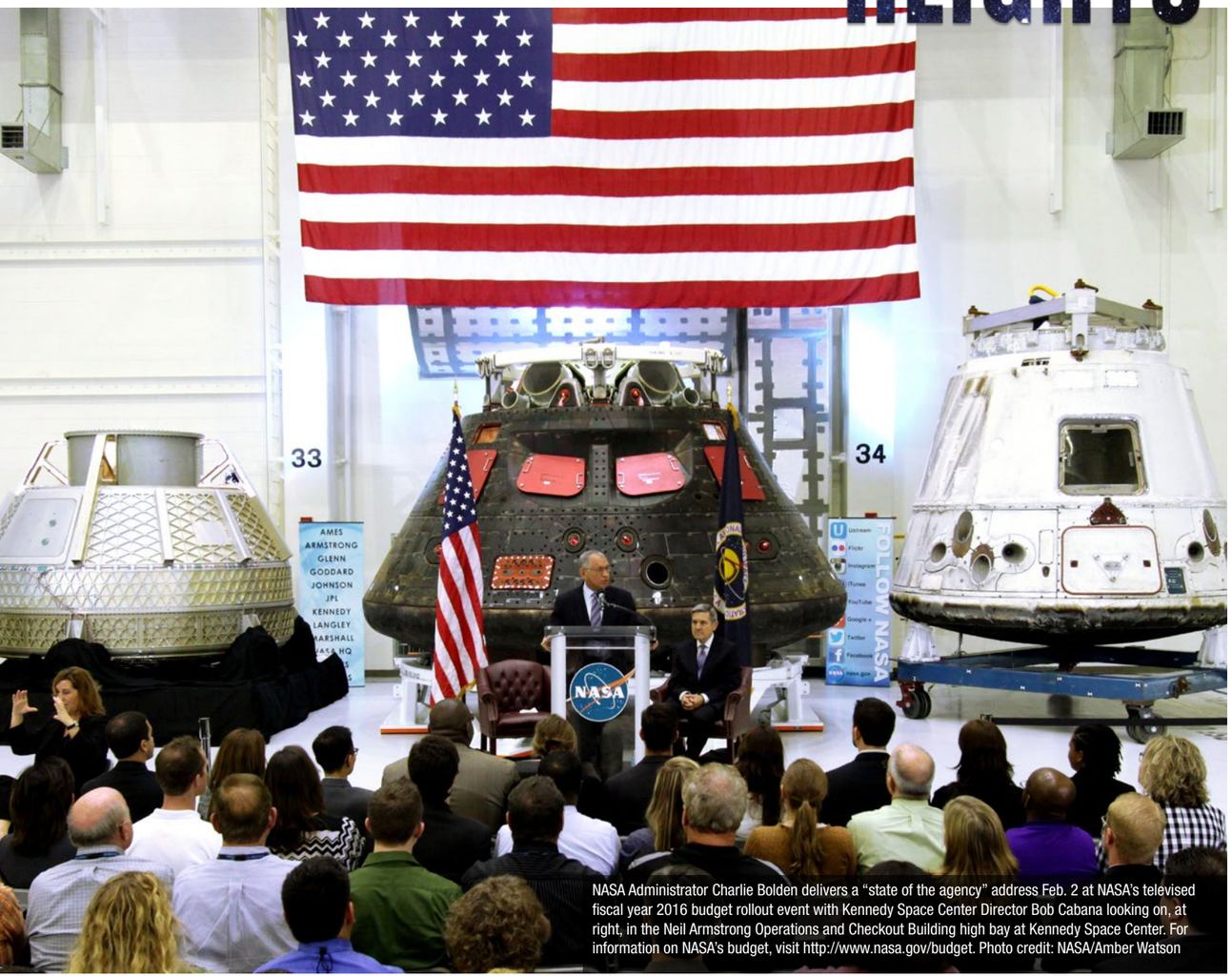
REACHING NEW HEIGHTS

NASA unveils budget for fiscal year 2016



NASA Administrator Charlie Bolden delivers a "state of the agency" address Feb. 2 at NASA's televised fiscal year 2016 budget rollout event with Kennedy Space Center Director Bob Cabana looking on, at right, in the Neil Armstrong Operations and Checkout Building high bay at Kennedy Space Center. For information on NASA's budget, visit http://www.nasa.gov/budget. Photo credit: NASA/Amber Watson

BY BOB GRANATH

In a presentation at Kennedy Space Center, NASA Administrator Charlie Bolden announced details of the Obama administration's fiscal year 2016 agency budget proposal recently submitted to Congress. Bolden emphasized that the recommended increase of about a half-billion dollars over last year's enacted budget would provide the necessary resources to continue advancing America's bipartisan space exploration plans. The ongoing programs will ensure that the United States remains the world's leader in space exploration and discoveries benefiting all humankind.

Speaking on Feb. 2 in the high bay of Kennedy's Neil Armstrong Operations and Checkout Building, Bolden's remarks served as a "State of NASA" address. He focused on recent progress and the work ahead. The 2016 budget year begins Oct. 1, 2015.

"Today, President Obama is proposing an additional $18.5 billion for NASA, building on the significant investments the administration has made in America's space program over the past six years," Bolden said. "NASA is firmly on a journey to Mars. Make no mistake, this journey will help guide and define our generation."

With about 200 space center employees as well as members of the news and social media present, Bolden was joined by Kennedy's director, Bob Cabana. Also attending were representatives from Congress and NASA industry partners. The backdrop for the presentation was the recently returned Orion spacecraft, flanked by Boeing's CST-100 and the SpaceX Dragon capsules being designed for the agency's Commercial Crew Program.

Bolden noted that the budget allows NASA to continue development of the Orion crew vehicle, Space Launch System and Exploration Ground Systems that will one day send astronauts beyond low-Earth orbit.

The Space Launch System (SLS) is a new heavy-lift rocket, more powerful than any previously built. SLS will be capable of sending humans aboard Orion to deep-space destinations such as an asteroid and Mars.

During 2014, NASA continued several highly successful missions highlighted by the maiden flight of Orion. The spacecraft completed its first voyage to space, traveling farther than any spacecraft designed for astronauts in more than 40 years.

As referenced by President Obama in his Jan. 20, State of the Union address, the Dec. 5, 2014, milestone was not only part of his goal to eventually send humans to the Red Planet, but one that supports research with far-reaching benefits.

"I want Americans to win the race for the kinds of discoveries that unleash new jobs . . . pushing out into the solar system not just to visit, but to stay," the president said. "Last month, we launched a new spacecraft as part of a re-energized space program that will send American astronauts to Mars."

Bolden noted that the Orion flight test was a crucial initial step.

"The Orion spacecraft that recently performed a near flawless flight test on its first journey to space is being dismantled right now so it can reveal its secrets about that amazing flight," he said. "What we learn will prepare us for its next launch aboard our Space Launch System rocket, and its future with astronauts aboard exploring farther into our solar system than ever before."

The journey to Mars remains a primary NASA goal, designed to answer some of humanity's fundamental questions about life beyond Earth and what it can teach us about Earth's past, present and future.

Highlights of the past year included the Mars Atmosphere and Volatile Evolution, or MAVEN, spacecraft arriving in orbit around the Red Planet, The Boeing Company and SpaceX were selected as partners to provide transportation from U.S. soil to the International Space Station as part of the Commercial Crew Program and groundbreaking research continued aboard the ISS.

Obama also noted that the space station will continue to advance plans for exploration beyond Earth, expanding scientific knowledge in space, along with physical and biological sciences.

"In two months, to prepare us for those missions (to Mars and the solar system), Scott Kelly will begin a year-long stay in space. Good luck, Captain -- and make sure to Instagram it," the president said.

This March, Kelly, an American astronaut and a retired U.S. Navy captain, along with Russian cosmonaut Mikhail Kornienko, will launch to the ISS and become the first crewmembers to live and work aboard the orbiting laboratory for a 12-month flight.

Since November of 2000, space station crews have worked off the Earth, for the Earth. The ISS is a platform allowing scientists to identify and quantify risks to human health and performance, develop countermeasures, and test technologies that protect astronauts during extended missions.

Bolden noted that the budget proposal

supports the administration's commitment to serve as a catalyst for the growth of a vibrant American commercial space industry, including development of commercial crew transportation.

"American companies are developing the new systems in which astronauts soon will travel from the United States to low-Earth orbit," Bolden said. "That journey, indeed our entire path to the future, starts right here on Earth. Our commercial crew work, for example, is headquartered here at Kennedy, but encompasses efforts in 37 states."

Kennedy Space Center Director Bob Cabana introduces NASA Administrator Charlie Bolden, at left, who will deliver a "state of the agency" address at NASA's televised fiscal year 2016 budget rollout event in the Neil Armstrong Operations and Checkout Building high bay at Kennedy Space Center. Photo credit: NASA/Amber Watson

Cabana also explained some of the specifics in the spending plan for the Florida spaceport, including initiatives such as the Commercial Crew Program.

"The $2.6 billion budget proposal for Kennedy Space Center further cements our path forward in place and confirms that Kennedy is headed in the right direction in support of NASA's exploration, science, and human spaceflight missions," Cabana said. "It also is enabling further commercial space operations from the Cape."

The U.S. Commercial Crew transportation Capability (CCtCap) contracts are being developed at the Florida spaceport with the goal of certifying safe, reliable and cost-effective access to and from low-Earth orbit and the International Space Station by the end of 2017.

During fiscal year 2016, Kennedy's Launch Services Program will support three planned NASA payloads, as well as design services and integration support to over 40 NASA sponsored missions in various stages of spacecraft development.

Funding will continue plans for 21st century space launch complex modernization and infrastructure upgrades for more cost-effective operations, serving multiple users.

The improvements also will support Ground Systems Development and Operations modernization of facilities such as the Vehicle Assembly Building, mobile launcher and crawler–transporter in support of Orion, the SLS and Advanced Exploration Systems.

Under Advanced Exploration Systems, Kennedy provides engineering services and support to the agency's efforts, contributing to advanced technology for future robotic and human spaceflight missions beyond Earth.

Bolden noted that the 2016 budget will allow NASA to continue developing and testing transformative capabilities and cutting-edge technologies crucial to future exploration initiatives. This includes accelerating development of a high-powered solar electric propulsion capability to drive the robotic segment of an asteroid retrieval mission and future exploration systems in deep space.

Looking further into the solar system and beyond, the NASA budget also funds continued work toward a 2018 launch of the James Webb Space Telescope.

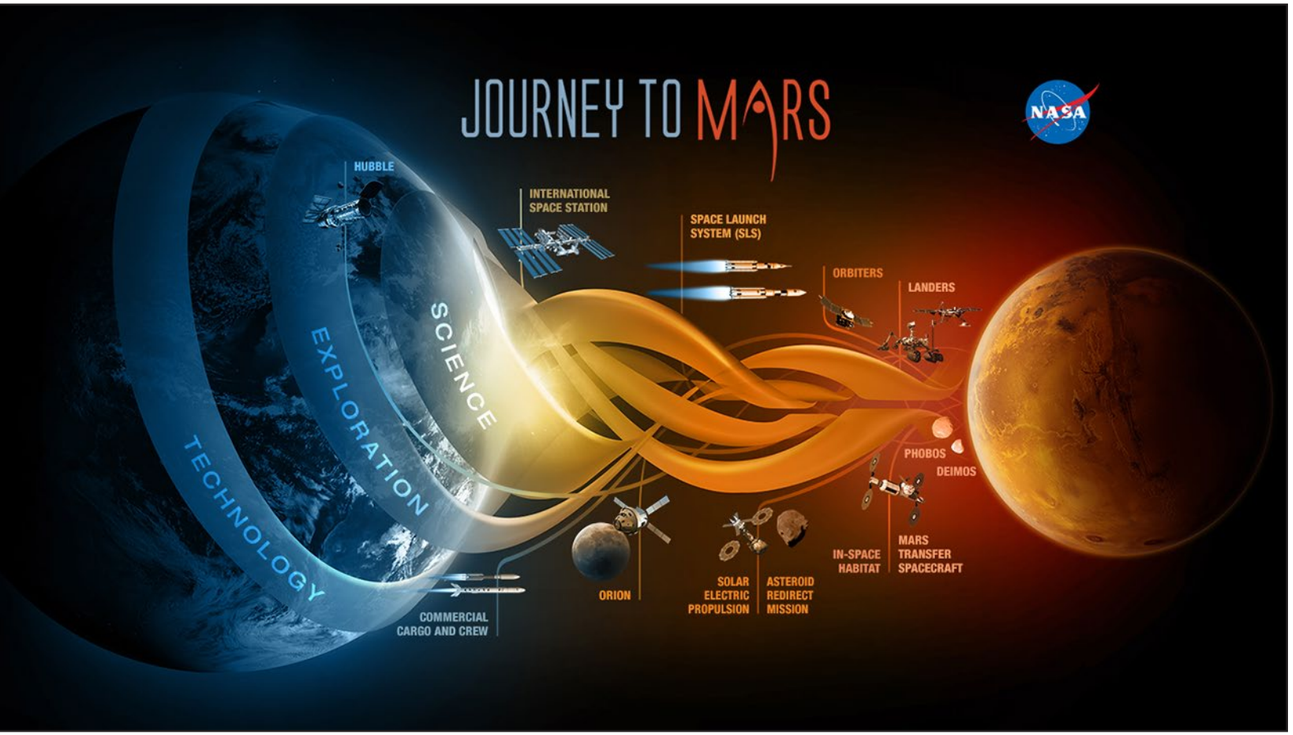
The United Launch Alliance Delta IV Heavy rocket with NASA's Orion spacecraft mounted atop, lifts off from Cape Canaveral Air Force Station's Space Launch Complex 37 at at 7:05 a.m. EST, Friday, Dec. 5, 2014, in Florida. The Orion spacecraft will orbit Earth twice, reaching an altitude of approximately 3,600 miles above Earth before landing in the Pacific Ocean. No one is aboard Orion for this flight test, but the spacecraft is designed to allow us to journey to destinations never before visited by humans, including an asteroid and Mars. Photo credit: (NASA/Bill Ingalls)

Named for NASA's second administrator, it will be the largest observatory ever put in space. A successor to the Hubble Space Telescope, the new platform is designed to help answer questions such as how the solar system originated and changed over time.

NASA science funding supports research in a wide variety of areas, facilitating collaboration with more than 10,000 U.S. scientists in universities, industry and government laboratories through over 3,000 openly competed research awards.

Bolden pointed out that some of the agency's aeronautics research is applied in every U.S. aircraft and air traffic control tower. Each has NASA-developed technology on board. NASA scientists and engineers are working on new composite materials that will make future air and spacecraft lighter and more durable.

"We're with you when you fly, and we're committed to transforming aviation by



dramatically reducing its environmental impact, maintaining safety in more crowded skies, and paving the way toward revolutionary aircraft shapes and propulsion," he said.

Bolden emphasized that the progress made and the exciting work ahead is made possible by the NASA team of dedicated professionals in the agency, industry and academia, securing America's leadership in space.

"Our journey of discovery has only just begun," he said. "Together, humans and robots will pioneer Mars and the solar system. In fact, they already work closely together aboard the space station."

Each of NASA's 10 field centers were connected to Bolden's presentation via a multi-center television simulcast. Following his address, social media and news reporters at each location, including Kennedy, then were taken on a tour of facilities highlighting the work of testing cutting-edge technologies, making scientific discoveries, studying a changing Earth and developing the tools for the agency's journey to Mars.

Bolden emphasized his belief that NASA is an incredible investment for our nation and for the world.

"NASA is an incredible investment for our nation because what we do not only uncover new knowledge, it helps raise the bar of human achievement," he said. "People everywhere are attracted to what we do, because exploration embodies our values as a nation -- resilience, hope, and overcoming the challenges faced." SpM

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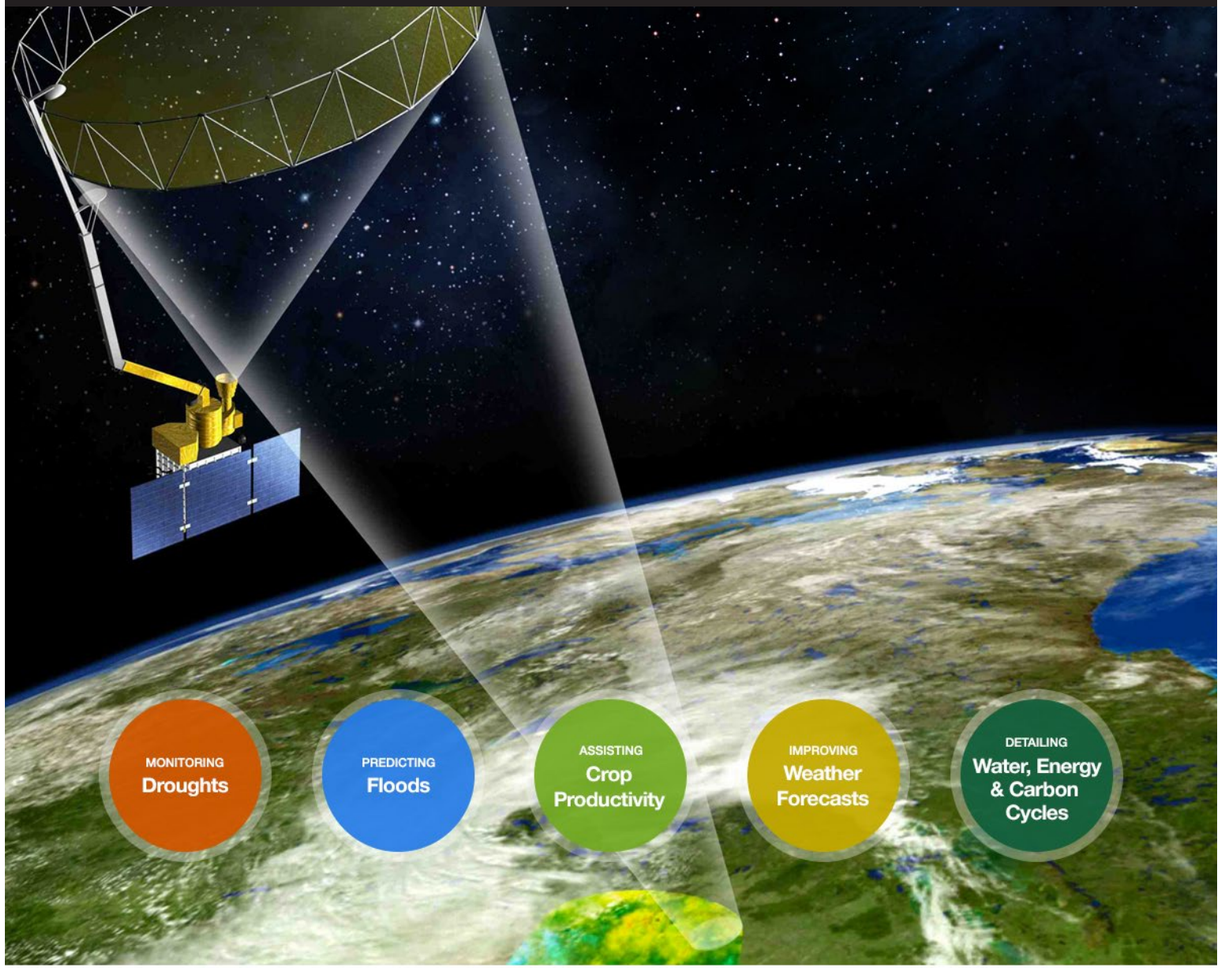
PREPARATIONS TO LAUNCH

NOAA's Deep Space Climate Observatory spacecraft, or DSCOVR, nears completion in the Building 1 high bay of the Astrotech payload processing facility in Titusville, Florida, near Kennedy Space Center. DSCOVR is a partnership between NOAA, NASA and the U.S. Air Force. DSCOVR will maintain the nation's real-time solar wind monitoring capabilities which are critical to the accuracy and lead time of NOAA's space weather alerts and forecasts. Launch is targeted for no earlier than Feb. 8 aboard a SpaceX Falcon 9 from Cape Canaveral Air Force Station, Florida. Photo credit: NASA/Kim Shiflett

SMAP

SOIL MOISTURE ACTIVE PASSIVE

SMAP will produce detailed global maps of soil moisture, enabling insights on the way Earth's water, energy, and carbon link and work together. In addition, SMAP enables a new era in global drought monitoring, flood forecasting, crop-yield forecasts, and other important water-related applications.



SMAP has the potential to touch every human life. How will it touch you?

SMAP will map soil moisture beneath Earth's surface

BY LINDA HERRIDGE

NASA's first U.S. Earth-observing satellite designed to map global soil moisture, the Soil Moisture Active Passive (SMAP) satellite, launched aboard a United Launch Alliance Delta II rocket Jan. 31 at 9:22 a.m. EST from Space Launch Complex 2 at Vandenberg Air Force Base in California.

"SMAP will be the first mission to measure the soil moisture in the top two inches of the Earth's surface," said Chuong Nguyen, the SMAP mission manager for the Launch Services Program (LSP) at the agency's Kennedy Space Center.

The intricate satellite will provide high-resolution, space-based measurements of the soil moisture, whether frozen or thawed, to better predict natural hazards of extreme weather, climate change, floods and droughts. The satellite will map the entire land mass of the Earth every two to three days for at least three years.

The SMAP satellite has two instruments. The "active" is a radar that will provide high-resolution measurements of the moisture in the soil, though not as accurate as radiometer observations. The "passive" is a radiometer that has higher accuracy but lower resolution than the radar. Both instruments working together will provide greater accuracy and spatial resolution in measuring soil moisture than is possible using either instrument alone.

"Soil moisture is an important part of the Earth's climate. As it evaporates, it condenses into the clouds and atmosphere, and that in turn becomes rain later in the weather cycle," Nguyen said. "SMAP will help with climate forecasting and help predict a good growing season. That's an important part of agriculture, in the U.S. and around the world."

Prior to launch, Nguyen and his team monitored launch activity about four hours

A United Launch Alliance Delta II rocket with the Soil Moisture Active Passive (SMAP) observatory onboard launches from Space Launch Complex 2, Jan. 31 at Vandenberg Air Force Base, California. SMAP is NASA's first Earth-observing satellite designed to collect global observations of surface soil moisture and its freeze/thaw state. SMAP will provide high resolution global measurements of soil moisture from space. The data will be used to enhance scientists' understanding of the processes that link Earth's water, energy and carbon cycles. Photo credit: NASA/Bill Ingalls

before liftoff. They checked the health and status of the rocket and made sure everything was nominal before it flew.

"After the launch, we monitored the performance of the rocket though its various stages of flight, and the separation of SMAP from the Delta II," Nguyen said. "We were looking for an indication that the satellite is healthy. We were all literally holding our breath."

Once in orbit, the SMAP satellite slowly deployed its very extensive boom assembly that has an almost 20-foot-diameter antenna at the end of it. During processing, the antenna assembly and boom were folded up and neatly loaded inside the payload fairing of the rocket.

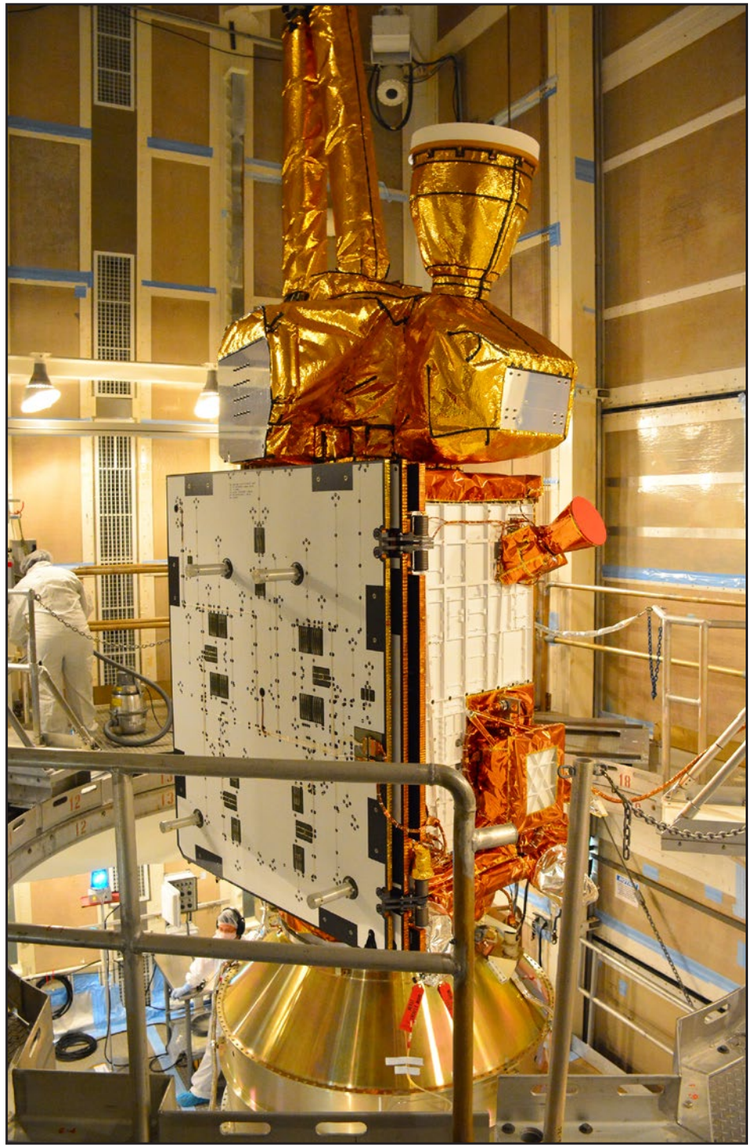
Tim Dunn, the NASA LSP launch director, said the Delta II rocket is perfectly sized for the mass requirement for SMAP. The physical size of SMAP fit within the payload fairing volume of the rocket.

"Delta II has the nickname 'the workhorse' for NASA for a reason," Dunn said. "It has an incredible track record."

To date, including SMAP, there have been 153 launches of the Delta II since 1989, with 52 of those for NASA. Dunn said the Delta II is significant in NASA's history because of the importance of all the science and exploration missions that it has launched.

"Our team worked very hard for the launch processing phase of the SMAP launch campaign. We were all excited for countdown and launch," Dunn said. "I can't say enough about the team that we have." SpM

For more information about the SMAP mission, visit **http://www.nasa.gov/smap.**

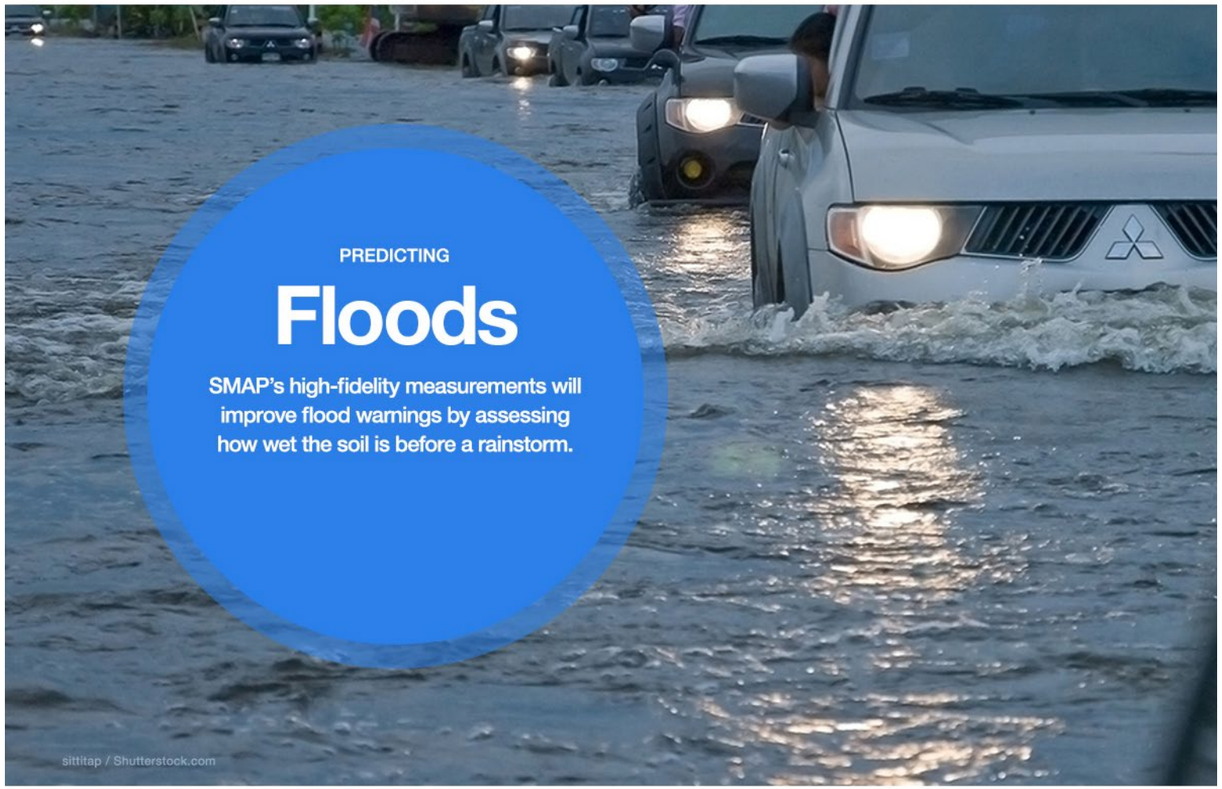


NASA's Soil Moisture Active Passive mission, or SMAP, satellite is mated to its Delta II rocket at Space Launch Complex 2 at Vandenberg Air Force Base in California on Jan. 13. SMAP will provide global measurements of soil moisture and its freeze/thaw state. These measurements will be used to enhance understanding of processes that link the water, energy and carbon cycles, and to extend the capabilities of weather and climate prediction models. SMAP data also will be used to quantify net carbon flux in boreal landscapes and to develop improved flood prediction and drought monitoring capabilities. To learn more about SMAP, visit http://smap.jpl.nasa.gov
Photo credit: NASA/Randy Beaudoin

Climate projections of global warming indicate the possibility of three times more frequent drought by the end of the 21st century.

A sustained drought can result in crop failure, deaths of livestock, increasing likelihood of wildfires and, ultimately, deaths of people.

The economic cost to the state of California of the 2014 drought is $2.2 billion, with a total loss of 17,100 seasonal and part-time jobs.



Floods are the No.1 natural disaster in the U.S. and account for 40 percent of all natural disasters worldwide.

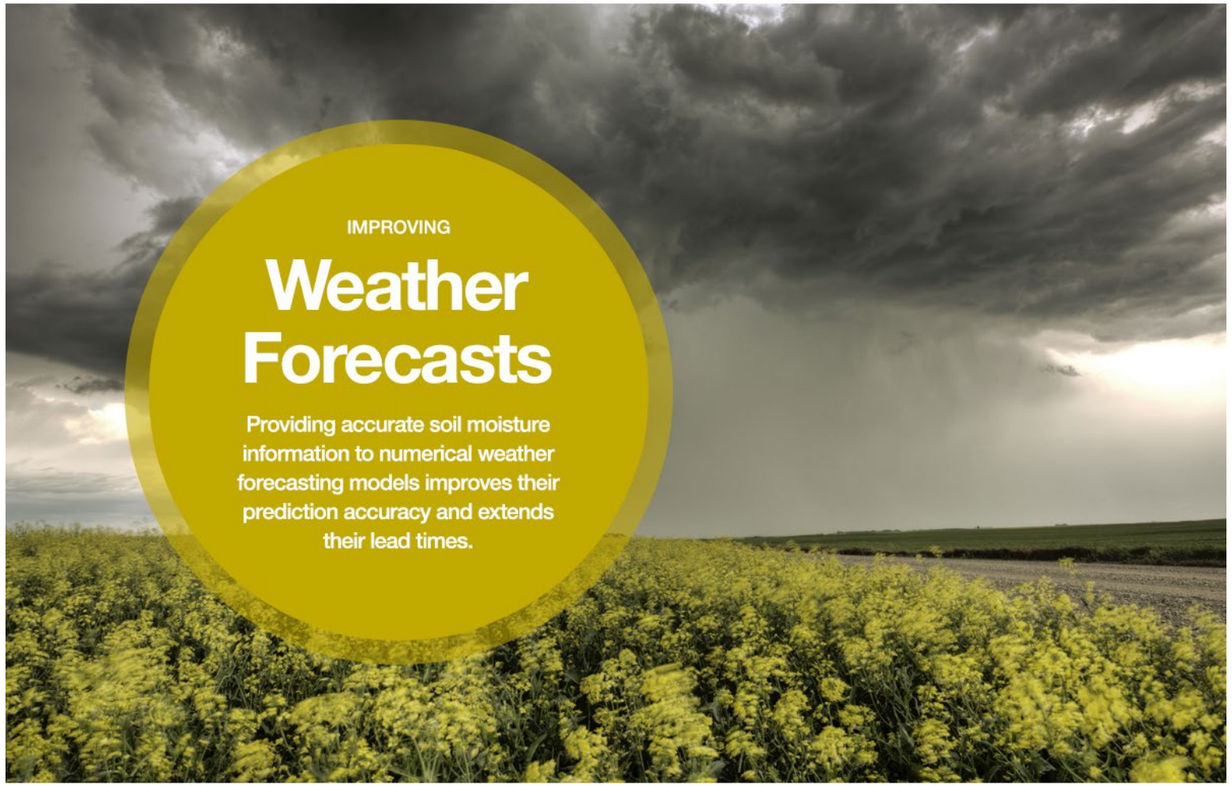
Flash flooding is the leading cause of weather-related deaths in the U.S. and accounts for approximately 89 deaths per year.

Flood loss averages $8.2 billion per year in the U.S. Coastal flood damage will rise greatly in the 21st century as sea levels rise.

Monitoring global food production will improve targeting of humanitarian food assistance.

Studies estimate that climate change will increase the number of undernourished people worldwide by 5 percent to 26 percent by 2080.

Monitoring global food production will improve targeting of humanitarian food assistance.



IMPROVING

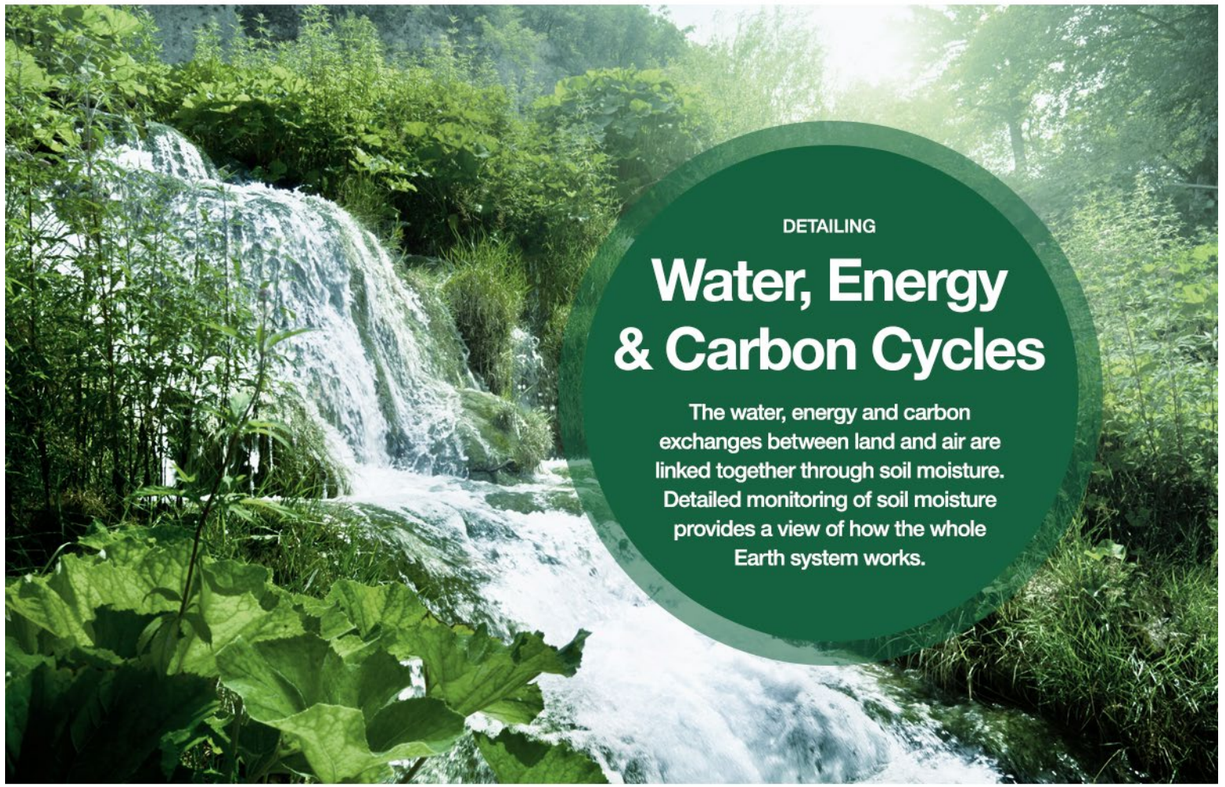
Weather Forecasts

Providing accurate soil moisture information to numerical weather forecasting models improves their prediction accuracy and extends their lead times.

Weather forecasting requires continuously observing the atmosphere, soil moisture and water sources on the ground.

Weather forecasts are used extensively to ensure personal safety and economic well-being.

Nearly 90 percent of the emergencies declared by FEMA and approximately 70 percent of air traffic delays are caused by weather.



DETAILING

Water, Energy & Carbon Cycles

The water, energy and carbon exchanges between land and air are linked together through soil moisture. Detailed monitoring of soil moisture provides a view of how the whole Earth system works.

The health of our environment is dependent on the flow and storage of water, energy, and carbon.

Changes in the global climate are dependent on these major Earth cycles. Impacts on climate change may cause major shifts in how our societies will function in the future.

Agriculture, energy, transportation, infrastructure, and ecosystems will be impacted economically by climate change.

To Station, From America

NASA, Boeing, SpaceX outline objectives to station flights

BY STEVEN SICELOFF

American spacecraft systems testing followed by increasingly complex flight tests and ultimately astronauts flying orbital flights will pave the way to operational missions during the next few years to the International Space Station. Those were the plans laid out Jan. 26 by NASA's Commercial Crew Program officials and partners as they focus on developing safe, reliable and cost-effective spacecraft and systems that will take astronauts to the station from American launch complexes.

According to Boeing, the company's schedule calls for a pad abort test in February 2017, followed by an uncrewed flight test in April 2017, then a flight with a Boeing test pilot and a NASA astronaut in July 2017.

SpaceX said they anticipate a pad abort test in about a month, then an in-flight abort test later this year as part of its previous development phase. An uncrewed flight test is planned for late 2016 and a crewed flight test in early 2017.

Speaking for the first time together since the awarding of the final development and certification contracts, officials from NASA's Commercial Crew Program, Boeing and SpaceX revealed some of the details of their plans to cross the chasm from spacecraft and launch system design to flight tests, certification and operational missions to the station.

"It's an incredible testament to American ingenuity and know-how, and an extraordinary validation of the vision we laid out just a few years ago as we prepared for the long-planned retirement of the space shuttle," said Charlie Bolden, NASA administrator, during the briefing at the agency's Johnson Space Center in Houston. "This work is part of a vital strategy to equip our nation with the technologies for the future and inspire a new generation of explorers to take the next giant leap for America."

Boeing and SpaceX were selected in September 2014 to finalize their respective CST-100 and Crew Dragon spacecraft along with the rockets that will lift them into orbit and all of the ground and mission operations networks essential for safe flights. Both companies have worked with NASA's Commercial Crew Program throughout multiple development phases, continuing to advance their designs before being chosen to complete their systems, reach certification and then fly astronauts to the station.

The goal of NASA's effort is to provide an American launch vehicle and spacecraft capable of safely carrying astronauts to the station. Unlike other NASA spacecraft, though, this new generation of human-rated vehicles will be designed, built, operated and owned by the companies themselves, not NASA. NASA will buy space transportation services from the companies for astronauts and powered cargo. It will be an arrangement like the one the agency uses already with the Commercial Resupply Services initiative that uses privately developed and operated rockets and spacecraft to deliver critical cargo to the station.

"There are launch pads out there already being upgraded and there is hardware already being delivered," said Kathy Lueders, manager of the Kennedy Space Center-based Commercial Crew Program. "Both companies have already accomplished their first milestones."

The new spacecraft will allow the station's crew to expand to seven astronauts and cosmonauts, which means twice as much time for research aboard the one-of-a-kind scientific platform – 80 hours a week instead of the current 40. Also, the handoff of flight to low-Earth orbit will permit NASA to pursue the challenges of deep space exploration and the journey to Mars with the Space Launch System rocket and Orion spacecraft.

Boeing and SpaceX each proposed a set of objectives

NASA's Stephanie Schierholz opens a presentation about the agency's Commercial Crew Program highlighting key development activities, test plans and objectives for achieving certification of two American crew transportation systems with Dr. Ellen Ochoa, director of NASA's Johnson Space Center in Houston, NASA Administrator Charlie Bolden, Commercial Crew Program Manager Kathy Lueders, Boeing Space Exploration Vice President and General Manager John Elbon, SpaceX President and Chief Operating Officer Gwynne Shotwell and NASA Astronaut Mike Fincke. Photo credit: NASA/Robert Markowitz

and milestones that suits their development, testing and flight plans. NASA's role is to evaluate progress and make sure it meets stringent safety requirements, including a safe launch abort system built in to provide astronauts a means of escaping a potentially catastrophic situation. The agency placed a premium on giving providers the freedom to come up with innovations in design, manufacturing and testing.

Ultimately, NASA expects to have two separate spacecraft and launch systems it can turn to for flights of crew to the station and low-Earth orbit. The companies also can provide space transportation services to private citizens, companies and institutions in what could become a new industry for the American aerospace sector. The STS-135 mission, the final flight of the space shuttle, delivered an American flag to the station as a prize for the first Commercial Crew astronauts to visit the orbiting laboratory. A second flag will be taken to the station and brought back as a symbol of success as well.

"When we have both of these flags on the ground with their crews safely returned, we'll all be winners," Lueders said.

Boeing and SpaceX anticipate using facilities at Kennedy and the adjacent Cape Canaveral Air Force Station for aspects of processing and launch.

Boeing's CST-100 program will be based at Kennedy with the spacecraft being assembled inside one of the hangars formerly used to process space shuttles. Riding atop a United Launch Alliance Atlas V rocket, the CST-100 will launch from Cape Canaveral's Space Launch Complex 41. A tower designed for the needs of astronauts and support staff is already under construction at SLC-41.

The work comes at a time when NASA is marking significant progress in a number of areas. For instance, the space station has housed crew members for 14 straight years and a NASA astronaut and Russian cosmonaut are getting ready for a yearlong residency there. There also is a NASA spacecraft already in development to carry astronauts on deep space missions along with a massive new rocket for it in manufacturing. Not to mention the New Horizons probe closing in on Pluto.

"Never before in the history of human spaceflight has there been so much going on all at once," said John Elbon, vice president and general manager of Boeing's Space Exploration division. "NASA's exploring places we didn't even know existed 100 years ago."

SpaceX leased Launch Complex 39A at Kennedy and will build a facility at the base of the pad that will be used for processing its Falcon 9 rockets and Crew Dragon spacecraft for launch. The company launches cargo-carrying Dragons and other uncrewed spacecraft from Space Launch Complex 40 at Cape Canaveral.

"We understand the incredible responsibility we've been given to carry crew," said Gwynne Shotwell, president of SpaceX.

Speaking in front of the agency's astronaut corps, the panelists offered an appealing vision of space travel including long-term spaceflight research and deep space missions.

"It's a great time to be a part of the American space program, which is on its way to Mars," said astronaut Mike Finke, who commanded the International Space Station and flew aboard the space shuttle. "There's not another group on this planet, or off this planet, that wants the success of the Commercial Crew Program more than we do."

The flights to the station are vital to NASA's goals, Bolden reiterated, and as the agency sets its eyes firmly on the Red Planet.

"It takes a lot of stuff to get off this planet and a whole lot more to get to Mars," Bolden said. "But that is the ultimate destination." SpM

KSC Scenes

NESTLING FLEDGLINGS
A bald eagle stands watch over two fledglings in a nest at Kennedy Space Center recently. The sprawling space center averages about 14 to 15 eagle nests at any given time. About three times a year, NASA Aircraft Operations teams up with environmental ecologists from InoMedic Health Applications for "Eagle Flights" to keep tabs on the nests of these majestic birds as seen in the video at this link: **http://go.nasa.gov/1JAOKzW**. Photo credit: InoMedic Health Applications/Russ Lowers

DRAGON DELIVERS

Commercial resupply mission totes 3,700 pounds to space station

BY STEVEN SICELOFF

More than two tons of experiments, equipment and supplies was sent to the International Space Station early Jan. 10 when a SpaceX Falcon 9 roared off the pad at Space Launch Complex 40 to place a Dragon cargo capsule on a path to the orbiting laboratory.

The rocket lifted off on time at 4:47 a.m. EST from the Florida launch site adjacent to Kennedy Space Center following a quiet countdown that played out to the second.

NASA flight controllers in Houston and SpaceX controllers at the company's Hawthorne, California, headquarters reported the spacecraft reached its preliminary orbit as planned and the flight was going extremely well. Dragon extended its two power-producing solar array wings moments after separating from the second stage to begin its independent flight.

Dragon, which was carrying only cargo and no crew, took two days to catch up to the station. Station commander Butch Wilmore grabbed the spacecraft with the station's 57-foot-long robotic arm and latched it to the station.

This was the fifth operational cargo delivery mission for SpaceX to the station. The company's contract with NASA calls for at least a dozen cargo delivery flights in all.

The cargo that Dragon carried is important to NASA's scientific goals for the station in several areas. For instance, the mission delivered the Cloud Aerosol Transport System instrument known as CATS that will be connected to the outside of the station. Riding along with the station on its 261-mile-high orbit, the CATS laser sensors can evaluate the clouds and tiny particles in Earth's atmosphere to potentially decipher important clues for climate change and aid in weather forecasting on Earth.

"Clouds are one of the largest uncertainties in predicting climate change," said Matt McGill, principal investigator and payload developer for CATS at NASA's Goddard Space Flight Center in Maryland. "For scientists to create more accurate models of Earth's current and future climate, they'll have to include more accurate representations of clouds."

The spacecraft also was loaded with several biological experiments that take advantage of the microgravity environment unavailable on Earth to advance medical knowledge.

One of the projects will grow proteins inside a 4-inch cube in weightlessness to research a suspected cause of Alzheimer's and similar brain ailments in people. The research is preliminary, but a successful test could set up more detailed studies in the future.

The spacecraft also carried equipment and supplies for the station and its crew of six astronauts and cosmonauts.

Dragon will be connected to the station for more than four weeks while the astronauts unload it, then repack it with equipment and supplies that are no longer needed along with experiments that have been completed and are ready to be returned to their researchers.

Dragon will re-enter Earth's atmosphere within a few hours of disconnecting from the station. It will descend under parachutes to the Pacific Ocean where a ship will retrieve the craft and bring it back to shore. SpM

A SpaceX rocket lifts off from Space Launch Complex 40 at Cape Canaveral Air Force Station carrying the Dragon resupply spacecraft to the International Space Station. Liftoff was at 4:47 a.m. EST on Jan. 10. The commercial resupply mission delivered 3,700 pounds of scientific experiments, technology demonstrations and supplies, including critical materials to support 256 science and research investigations that will take place on the space station. Photo credit: NASA

ROOM WITH A VIEW
This image of the interior view from the International Space Station's Cupola module was taken on Jan. 4, 2015. The large bay windows allows the Expedition 42 crew to see outside. The Cupola houses one of the space station's two robotic work stations used by astronauts to manipulate the large robotic arm seen through the right window. The robotic arm, or Canadarm2, was used throughout the construction of the station and is still used to grapple visiting cargo vehicles and assist astronauts during space.walks. The Cupola is attached to the nadir side of the space station and also gives a full panoramic view of the Earth.
Image Credit: NASA

HOT STUFF

A new exhibit featuring a full-scale mockup of NASA's Orion spacecraft heat shield recently opened at the agency's Kennedy Space Center Visitor Complex. Depicted as it will appear during the peak of re-entry heating, the display is in the "Exploration Space: Explorers Wanted" area of the visitor complex. Photo credit: NASA/Kim Shiflett

Visitor complex unveils Orion heat shield exhibit

BY BOB GRANATH

The Kennedy Space Center Visitor Complex recently opened a new exhibit featuring a full-scale mock-up of the agency's Orion spacecraft heat shield. The new capsule is designed to take humans farther than ever before and made its first uncrewed flight test Dec. 5.

Early last year, engineers and technicians with Orion's prime contractor, Lockheed Martin, installed the largest and most advanced heat shield ever constructed on the crew module of the spacecraft. Testing this crucial component was one of the primary goals of the successful flight test.

According to Sarah Hansen, communications coordinator for the Kennedy Space Center Visitor Complex, the new display was designed to give guests a perspective on the size of the heat shield.

"The exhibit does a good job of showing how Orion's heat shield is so much larger than the ones used for Mercury, Gemini and Apollo," Hansen said.

The heat shield of the Apollo command module was 12 feet, 10 inches in diameter across the base. By comparison, Orion's heat shield has a 16.5-foot diameter.

The display is in the "Exploration Space: Explorers Wanted" area of the visitor complex with information on how the heat shield will protect the spacecraft during the heat of re-entry.

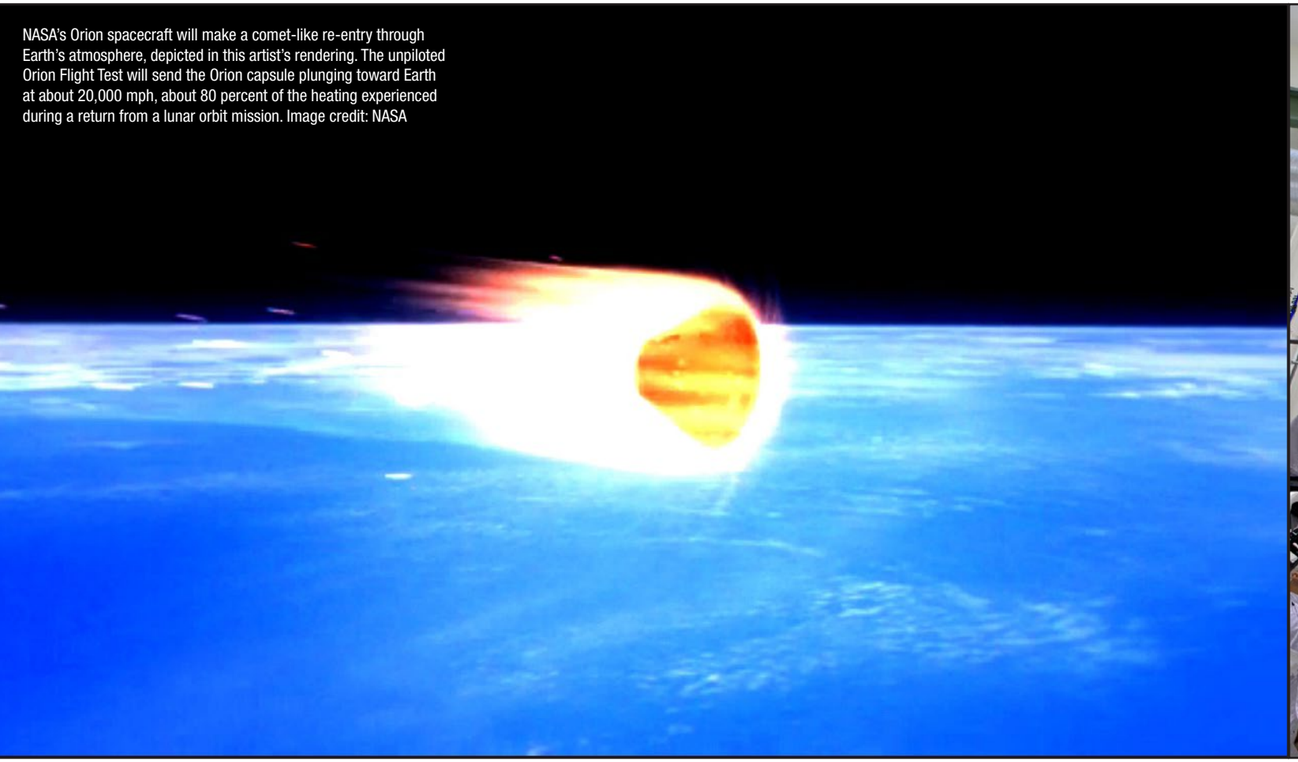
"The exhibit was built by Lockheed Martin with support from Textron,

which manufactured the ablative material on the heat shield; Delaware North; Ivey's Construction; and Britts Air Conditioning," said Hansen.

The result is an exhibit that includes videos depicting Orion's assembly and simulations of its fiery re-entry into the Earth's atmosphere.

"The exhibit has a real 'wow' factor to it," Hansen said. "Our guests are coming away excited about Orion."

NASA's Orion was mounted atop a United Launch Alliance Delta IV Heavy rocket at Space Launch Complex 37B at Cape Canaveral Air Force Station. It lifted off at 7:05 a.m. EST on Dec. 5 for a 4.5-hour, two-orbit flight. In addition



NASA's Orion spacecraft will make a comet-like re-entry through Earth's atmosphere, depicted in this artist's rendering. The unpiloted Orion Flight Test will send the Orion capsule plunging toward Earth at about 20,000 mph, about 80 percent of the heating experienced during a return from a lunar orbit mission. Image credit: NASA

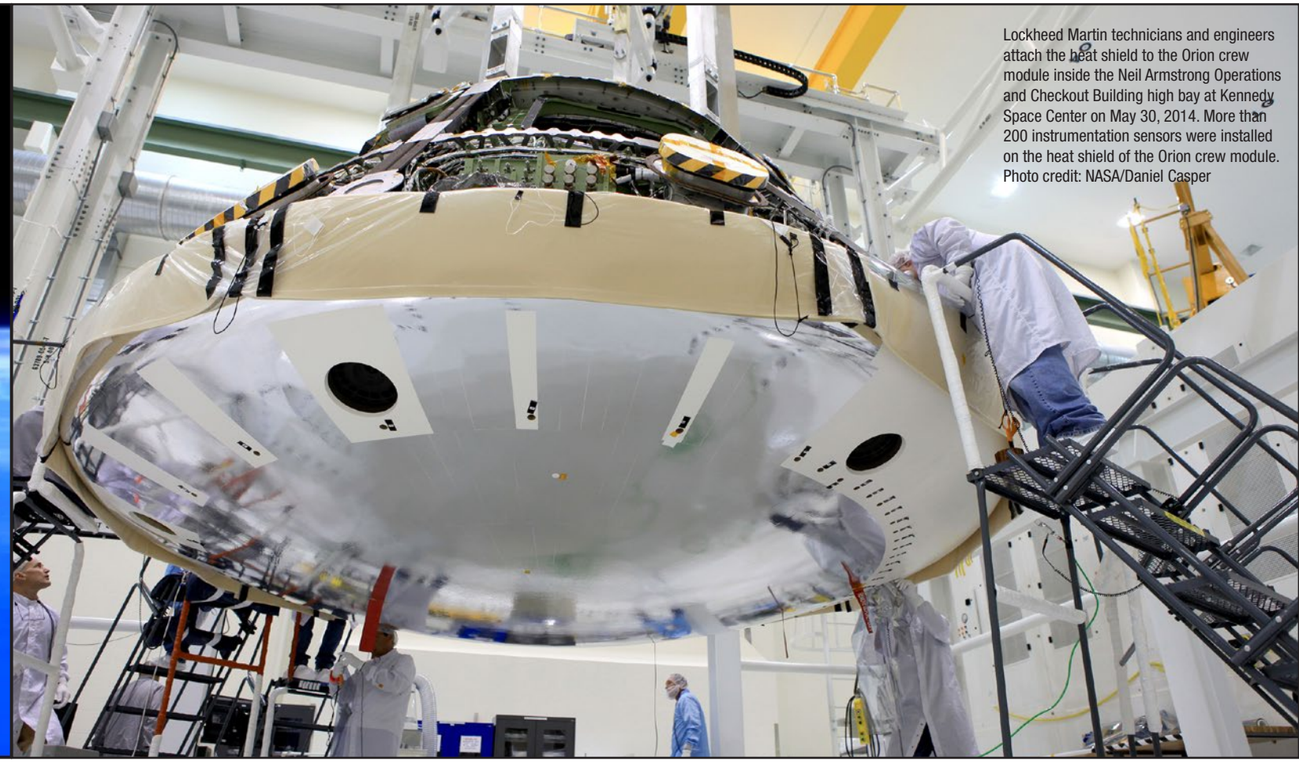
to the heat shield, the test evaluated critical systems such as avionics, attitude control and the parachutes.

During the second orbit, the Delta IV Heavy's second stage boosted Orion more than 3,600 miles above the Earth, allowing the spacecraft to return though the atmosphere with a high-energy re-entry at about 20,000 mph.

The Orion crew module is the only portion of the spacecraft that returns to Earth. Its primary structure is made of aluminum and aluminum-lithium, with additional heat protection in the form of 970 tiles covering Orion's back shell. The back shell tiles are almost identical to the ones that protected the bellies of the space shuttles as they returned from space.

Temperatures climbed highest at the bottom of the Orion capsule, which was pointed into the heat as it returned to Earth. The heat shield is built around a titanium skeleton and carbon-fiber skin that gives the shield its shape and provides structural support for the crew module during descent and splashdown.

A fiberglass-phenolic honeycomb structure fits over the skin, and each of its 320,000 cells are filled with a material called Avcoat. That surface is designed to burn away, or ablate, as the material heats up, rather than transfer the heat back into the crew module. At its thickest, the heat shield is 1.6 inches thick, and about



Lockheed Martin technicians and engineers attach the heat shield to the Orion crew module inside the Neil Armstrong Operations and Checkout Building high bay at Kennedy Space Center on May 30, 2014. More than 200 instrumentation sensors were installed on the heat shield of the Orion crew module. Photo credit: NASA/Daniel Casper

20 percent of the Avcoat will erode as Orion travels through Earth's atmosphere.

On this first flight, Orion faced temperatures near 4,000 degrees Fahrenheit during its return to Earth. That's about 80 percent of the peak heating it would see during a return from lunar orbit in which temperatures could reach 5,000 degrees Fahrenheit. That was hot enough to give engineers on the ground confidence in the heat shield design for future missions.

Orion will eventually be boosted on missions beyond low-Earth orbit by NASA's Space Launch System to destinations such as an asteroid and on the journey to Mars. SpM

TECHNOLOGY CATALYST

Moon Express will develop, test compact lunar lander at Kennedy Space Center

BY LINDA HERRIDGE

NASA is working with U.S. industry to develop the capabilities and cutting-edge technologies that will help send astronauts beyond low-Earth orbit. To achieve this goal, space travelers will need the resources to survive during long-duration missions to an asteroid, Mars and other outer planets.

Moon Express Inc., of Moffett Field, California, is one of three companies selected for the agency's new Lunar Cargo Transportation and Landing by Soft Touchdown (CATALYST) initiative to advance lander capabilities that will enable delivery of payloads to the surface of the moon.

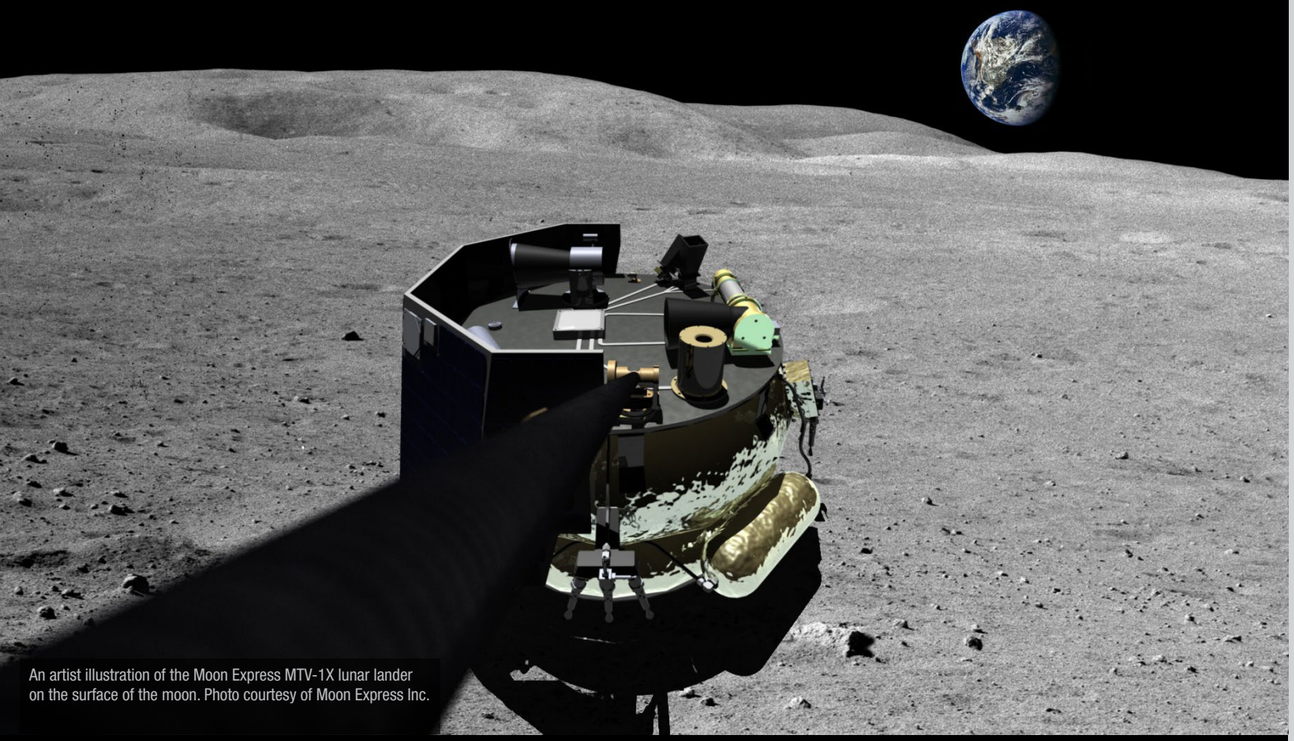
Moon Express will base its operations at Kennedy Space Center in Florida, and is using facilities and the automated landing and hazard avoidance technology, or ALHAT, field at the Shuttle Landing Facility to perform its initial lander test development.

"Having Moon Express at Kennedy is yet another cornerstone moment in the transformation of the center to becoming a multi-user spaceport," said Tom Engler, deputy director of Center Planning and Development. "A facility used by NASA's Morpheus prototype lander will now be used by a commercial company."

An artist illustration of the Moon Express MTV-1X lunar lander on its mission to the moon. Photo courtesy of Moon Express Inc.

“We want to unlock not just the mysteries, but the resources of the moon to benefit all humanity.”

– Bob Richards
Moon Express Founder and CEO



An artist illustration of the Moon Express MTV-1X lunar lander on the surface of the moon. Photo courtesy of Moon Express Inc.

The Moon Express team has been busy since October preparing the test vehicle, called MTV-1X, for a series of tests. The compact vehicle is the size of a large coffee table. The version of this vehicle that will fly in space is a single-stage spacecraft that uses hydrogen peroxide as a primary fuel in a bi-propellant propulsion system bolstered by kerosene for its Earth departure and moon arrival burns. It’s also powered by solar energy, which makes it a very green vehicle.

Activity at the ALHAT field began in December. The team transported the spacecraft out to the ALHAT pad and was able to pressurize the tanks up to 110 percent of maximum expected operating pressure (MEOP). This critical milestone checked out the control systems and cleared the way for future testing at MEOP.

“NASA has been a wonderful partner,” said Bob Richards, Moon Express founder and CEO. “We’re working beside the Morpheus team to build and test our own vehicle at Kennedy.”

Richards said they will use entrepreneurial and innovative ways to become the first private company to reach the moon within two years. The plan is to launch the lunar lander spacecraft, called MX-1, as a secondary payload on a maiden technology demonstration flight in 2016 on a mission to the moon.

“We want to unlock not just the mysteries, but the resources of the moon to benefit all humanity,” Richards said. “We’re preparing to live off the land on the moon, because there’s water there.”

The Moon Express lunar lander could be used to deliver commercial and government payloads to the moon.

This year, the vehicle’s guidance, navigation, control and operation will be checked during initial testing. According to Moon Express president Andy Aldrin, the team will use a crane to hover the vehicle and move it around at the ALHAT field to capture the vehicle milestone process. A series of tethered landing tests will be performed until enough confidence is established in vehicle control to do a free flight.

Early next year, another set of tests will occur. The same test vehicle will be used, with added hydrogen peroxide thrusters, a star tracker and some of the navigation controls that will be used on the actual flight vehicle.

Later in the year, more flight-like versions of the test vehicle will be built. MTV-2 and MTV-3 will utilize a unique fuel tank, called a toroidal tank, shaped like a doughnut, which will be installed on the vehicle and tested to determine how the fuel behaves as it swirls around in the tank. Aldrin said the advantage of a tank shaped like this is that the vehicle can be packaged into a very compact spacecraft that holds a lot of propellant.

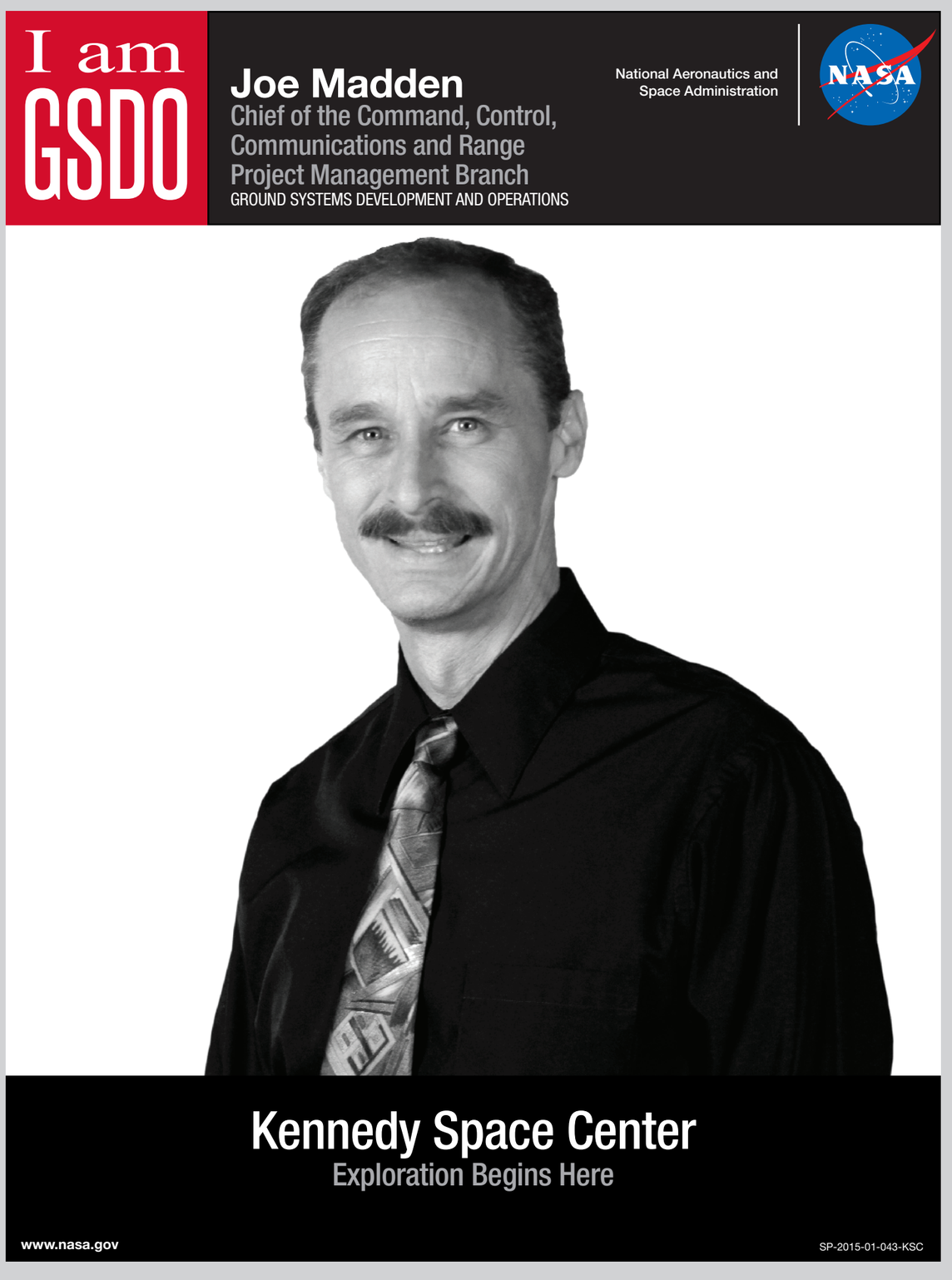
If testing goes well, the actual composite fuel tank will be added to the vehicle for further testing at the ALHAT field. At the hangar, the GNC software and some of the flight avionics are being prepared for flight vehicle testing.

“We want to support the exciting commercial innovations that come from partnerships like this one with Moon Express,” Engler said.

“One day we’ll learn how to use water on the moon to make the rocket fuel we need, to make the economics of all the resources on the moon viable,” Richards said.

The Advanced Exploration Systems Division of NASA’s Human Exploration and Operations Mission Directorate manages the Lunar CATALYST initiative as part of its Lander Technologies Project. The project is led by Marshall Space Flight Center in Huntsville, Alabama, but includes all of the NASA centers to support the partnership. SpM

DAY OF REMEMBERANCE
Kennedy Space Center paid tribute to the crews of Apollo 1 and space shuttles Challenger and Columbia, as well as other NASA astronauts who lost their lives while furthering the cause of exploration and discovery, during the agency's Day of Remembrance, Jan. 28. Kennedy workers and guests left roses at the Space Mirror Memorial in the Kennedy Space Center Visitor Complex. Photo credit: NASA/Jim Grossmann



TECH TREK

NASA chief technologist visits Kennedy labs

BY LINDA HERRIDGE

NASA Chief Technologist David Miller visited some of the laboratories and talked to engineers and researchers about the innovative technology projects currently in progress at Kennedy Space Center on Jan. 6. It was Miller's first official visit to Kennedy since his appointment by NASA Administrator Charlie Bolden.

"We always think of Kennedy as the launch infrastructure," Miller said. "But, seeing the wealth of research that's happening here to support so many elements of NASA's mission, it's not just about the start of the journey, it's about every aspect of the journey."

Miller visited the Cryogenic Test Laboratory, Swamp Works, and the Polymer Material Sciences Laboratory in the Neil Armstrong Operations and Checkout Building. The labs visited are in the center's Engineering and Technology Directorate.

In the Swamp Works Facility, Dr. Carlos Calle, lead of the Electrostatics and Surface Physics Lab, demonstrated an electric field wave that can move simulated moon dust away from a surface.

Dr. Michael Hogue, a physicist in the same lab, demonstrated a regolith-derived heat shield for a planetary body entry and descent system. Working in partnership with Ames Research Center in Moffett Field, California, the technology was tested in the Arc Jet Facility in 2012 using baseline space shuttle re-entry conditions.

Dr. Ray Wheeler, NASA plant physiologist and lead for the Advanced Life Support Lab, demonstrated a wastewater treatment cylinder and a biofuel concept. Dr. Gioia Massa, NASA plant physiologist, used a prototype of the Veggie plant growth system developed by ORBITEC in Madison, Wisconsin, to demonstrate how plant pillows and LED lights were used to grow red romaine lettuce on the International Space Station. Massa said the Veggie system could be adapted to grow other fresh foods for astronaut consumption.

Using LED lighting to securely transmit data is a technology development project that Dr. Eirik Holbert, lead in Advanced Lighting Technologies, is working on with LVX Systems in St. Cloud, Minnesota, and Bigelow Aerospace in North Las Vegas, Nevada.

Also on display was a prototype version of the Regolith Advanced Surface Systems Operation Robot (RASSOR) that has been tested in the large regolith bin inside the lab, and at the rocky, uneven terrain of the autonomous landing and hazard avoidance technology (ALHAT) field at the north end of the Shuttle Landing Facility.

A.J. Nick, a mechanical engineer with an engineering services contractor, explained that RASSOR version 2.0 is in production and will have reduced mass and triple the capacity for digging and collecting regolith.

"Throughout the tour, Dr. Miller saw that almost all of Kennedy's research and technology work is performed in collaboration with other NASA centers, other government agencies, industry and academia," said Karen Thompson, Kennedy's chief technologist.

Thompson said it is important for NASA's chief technologist to be familiar with the work at all of the agency's centers in order to ensure that technologies critical to NASA's future missions are being developed.

"Kennedy works with the Office of the Chief Technologist and NASA mission directorates to identify and prioritize key technology areas that are essential to the center's success in its lines of business and its ability to meet the needs of future exploration and science missions," Thompson said.

One of Miller's goals is to help grow the dialogue and collaboration that exists between technology, engineering and science. Reaching the external community also is important.

"I also would like to help establish or further strengthen relationships with the external technology and development community, engaging technologists outside of NASA, because they do technology that is very relevant to NASA's mission," Miller said.

As chief technologist, Miller said his role is to take an up-and-out view of technology, to look across and see all of the technology investments and how they relate to investments being made in other government agencies, national labs, academia, industry and international partners.

Jack Fox, chief of the Surface Systems Office in the Engineering and Technology Directorate, said "Miller's visit was important because it demonstrates that NASA recognizes Kennedy as being a key provider of technologies to meet mission needs,". SpM

Photos from top: NASA Chief Technologist David Miller looks at plant experiments on display in the Swamp Works lab during a visit to Kennedy Space Center on Jan. 6. Photo credit: NASA/Kim Shiflett

NASA Chief Technologist David Miller, right, watches as Dr. Carlos Calle demonstrates an experiment involving electric field waves that can move simulated moon dust away from a surface, in the Electrostatics and Surface Physics Lab inside the Swamp Works Lab. Photo credit: NASA/Kim Shiflett

NASA Chief Technologist David Miller, center, talks with Dr. Michael Hogue, a physicist in the Swamp Works lab during a visit to Kennedy Space Center on Jan. 6. At right is Kennedy's Chief Technologist Karen Thompson. Photo credit: NASA/Kim Shiflett

Dr. Ray Wheeler, right, a plant physiologist in the Engineering and Technology Directorate, discusses a wastewater treatment experiment with NASA Chief Technologist David Miller in the Swamp Works Laboratory on Jan. 6 at Kennedy Space Center. Photo credit: NASA/Kim Shiflett

WINTER WONDERLAND
NOAA's GOES-East satellite provided a look at the frigid eastern two-thirds of the U.S. on Jan. 7, 2015, that shows a blanket of northern snow, lake-effect snow from the Great Lakes and clouds behind the Arctic cold front.

A visible picture captured at 11 a.m. EST showed the effects of the. latest Arctic outbreak. The cold front that brought the Arctic air moved as far south as Florida, and stretched back over the Gulf of Mexico and just west of Texas. The image shows clouds behind the frontal boundary stretching from the Carolinas west over the Heartland. Farther north, a wide band of fallen snow covers the ground from New England west to Montana, with rivers appearing like veins. The GOES-East satellite image also shows wind-whipped lake-effect snows off the Great Lakes, blowing to the southeast. Meanwhile, Florida, the nation's warm spot appeared almost cloud-free.
Image Credit:
NASA/NOAA GOES Project

Moving On

Iconic space shuttle era facility demolished

BY BOB GRANATH

Kennedy Space Center is well on its way to establishing a multi-user spaceport to help meet America's spacefaring needs for the 21st century. The Mate-Demate Device, or MDD, that stood for more than 35 years as a key facility supporting the Space Shuttle Program recently was demolished, helping make way for current and future space program needs.

A Shuttle Carrier Aircraft is positioned beneath space shuttle Discovery in the Mate-Demate Device at the Shuttle Landing Facility at Kennedy Space Center on April 15, 2012. Discovery will be lowered and mated to the aircraft for a ferry flight to the Washington Dulles International Airport in Virginia, after which the shuttle will be on display in the Smithsonian's National Air and Space Museum Steven F. Udvar-Hazy Center. Photo credit: NASA/Kim Shiflett

Facilities no longer used by NASA are being transferred to industry partners, and the agency is disposing of those that are no longer needed.

When a space shuttle landed anywhere other than Kennedy, it was ferried back to Florida riding piggyback-style atop one of two modified Boeing 747 jetliners known as the Shuttle Carrier Aircraft (SCA). Following the touchdown at the Shuttle Landing Facility (SLF), the Mate-Demate Device enabled crews to hoist the orbiter off the SCA and place it on the runway for towing to the Orbiter Processing Facility.

"The MDD was a solid, well-built structure," said Ismael Otero, project manager of NASA's Construction of Facilities Division in Center Operations. "We started the demolition project in October, and it was completed on Nov. 26."

A hydraulic excavator picks up broken steel beams for loading in a truck. About 844,700 pounds of steel, tin and aluminum were recycled from Kennedy's no longer needed Mate-Demate Device. Photo credit: NASA

V&R/Sunrise Systems of Brevard Inc. was the prime contractor for the MDD demolition project with Frank-Lin Services Inc. of Melbourne, Florida, as the subcontractor. According to Otero, their work began with electrical systems being disconnected, then dismantling of movable access platforms and the cranes that lifted the space shuttles.

"Welders used cutting torches to begin the process of weakening the primary load-bearing steel beams of the MDD structure, creating wedge-shaped sections," said Otero. "A Komatsu hydraulic excavator later pulled the sections from a safe distance."

The hydraulic excavator has an arm with a powerful cutting tool, called a shears attachment, on the end to slice the steel beams.

"Two material handlers simply pulled on the weakened support beams," Otero said. "The first one broke quickly, but as more weight was placed on the others, the process slowed. The fourth and final one took three hours of pulling before giving way as planned."

The MDD assembly then toppled forward, starting the breakup of the facility. Crews spent the next month slowly cutting the structure apart into sections that could be recycled.

"Altogether, we recycled about 844,700 pounds of steel, tin and aluminum from the MDD," Otero said.

The spaceport's MDD was a large gantry-like steel structure that stood at the northeast corner of the ramp to the Shuttle Landing Facility. Kennedy's SLF first opened for flights in 1976 and was specially designed for returning space shuttles. The three-mile-long runway is located northwest of the huge Vehicle Assembly Building, with the launch pads only an additional three to four miles to the east.

The device was 150 feet long, 93 feet wide and 105 feet high. It could lift up to 230,000 pounds and withstand hurricane-force winds of up to 125 miles per hour. A large lift beam was mounted at the 80-foot level, between two towers and was attached to a shuttle orbiter to raise and lower it.

A similar MDD was built at NASA's Armstrong (then Dryden) Flight Research Center at Edwards Air Force Base, California. It, too, has been dismantled after 38 years of use. Work there began last August.

The California MDD was first put into service in 1977, supporting the shuttle approach and landing tests using the prototype shuttle orbiter Enterprise. It was last used for turnaround operations of the shuttle Discovery following its STS-128 mission that landed at Edwards in 2009.

Construction of the Kennedy MDD was completed two years after Kennedy's SLF runway, and the MDD was first tested on Oct. 19, 1978, when a space shuttle mock-up, dubbed Pathfinder, was attached to the MDD for a fit-check.

The MDD continued in constant use throughout the 30-year history of the space shuttle, removing the orbiters from the backs of the SCAs after ferry flights from the shuttle assembly plant and from the California alternate landing site at Edwards Air Force Base. On one occasion in 1982, the STS-3 mission concluded with a landing at the White Sands Space Harbor when rain at Edwards prevented a landing there. On that occasion, cranes were used to mount the shuttle Columbia atop the SCA.

The first time an MDD was not needed after a shuttle's return to Earth was with the inaugural landing at the Florida spaceport as Challenger touched down on Feb. 11, 1984, following STS-41B.

The Kennedy MDD's final use was to mate the space shuttle Endeavour to an SCA on Sept. 14, 2012. Five days later, the shuttle-747 jetliner combination took off for Los Angeles where Endeavour is now on public display at the California Science Center.

"The demolition project went well," said Otero. "It was completed safely and on schedule." SpM

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