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Space Station Sets New Records as Expedition 38 Crew Visits Marshall Space Flight Center

By Bill Hubscher

As new scientific discoveries are made on the [International Space Station](#), it can be hard to believe it has been orbiting the planet for more than 15 years.

The station passed a major milestone on July 12 when it finished 5,000 consecutive days of human presence on board the orbiting laboratory. The current crew on the space station set

another record the week of July 21 by performing 82 hours worth of scientific investigations in one week. The previous record was 72 hours. In addition to station maintenance and experiments operated by the crew, many experiments operated continuously from the ground.

“The Expedition 40 payload operations team is proud and excited to be part of the record-

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Marshall Engineers Build and Test Inflatable Solar Array Technology

By Tracy McMahan

Space is about power -- the energy to leave Earth and soar to new places. From rockets carrying humans, to small, inexpensive satellites, to robotic explorers -- all need power to achieve mission success. But often power sources are large, costly and difficult to maintain.

Marshall Space Flight Center engineers, working with industry partners, recently built and tested

a large, inflatable solar array with the potential to provide affordable, lightweight power for both large and small spacecraft. This technology could be combined with others such as advanced solar electric propulsion to enable deep space exploration missions.

“We’ve analyzed hundreds of space vehicle concepts, and it is obvious that almost all spacecraft

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breaking week of science on the space station,” said Pat Patterson, payload operations manager at the Marshall Space Flight Center’s [Payload Operations Integration Center](#), or POIC. “It is mind boggling to realize the hard work and planning we do day in and day out at the POIC to execute science operations could be an integral part of new discoveries.”

One of the station’s payload operations directors, Stephanie Dudley, talked about the activities in the POIC, including the record-setting week of science, during the [July 23 episode of Space Station Live](#) on NASA-TV.

NASA astronauts [Michael Hopkins](#) and [Richard Mastracchio](#) -- who worked closely with the POIC team to perform experiments on the station from September 2013 through May 2014 -- visited the Marshall Center July 29 to thank the ground crew who assisted in their scientific efforts and share their experiences with the workforce.

The two astronauts each lived and worked for six months as flight engineers during Expeditions 37, 38 and 39. Hopkins and Mastracchio performed several hundred experiments that crossed the fields of biology and biotechnology, physical science and earth science. They also performed spacewalks that were vital to maintaining the space station,



NASA astronauts Richard Mastracchio, left, and Michael Hopkins flank Ed Litkenhous, a payload activity requirements coordinator in the Payload Operations and Integration Center (POIC), as he hangs the astronauts’ mission plaque on the wall of the POIC in the Marshall Center’s Building 4663. The plaque joined the logos from previous missions hanging around the room, recognizing the collaboration between the orbiting astronauts and the Huntsville-based team. (NASA/MSFC/Emmett Given)

and participated in multiple educational outreach events.

“Our relationship with the POIC here in Huntsville is fantastic,” Hopkins said. “Having access to the principal investigators while we’re in orbit with our hands on the experiment is very useful. We can get clarification on any part of the investigations or answers to our questions very quickly. Marshall has a great group of professionals and we appreciate all their help and hard work.”

For more information on the space station, visit [here](#).

Follow space station research on Twitter [here](#).

Hubscher, an ASRC Federal/Analytical Services employee, supports the Office of Strategic Analysis & Communications.



From left, Alba Romero, a NASA intern and a graduate student in mathematics at California State University at Channel Island, takes a “selfie” photograph with NASA astronauts Michael Hopkins and Richard Mastracchio during an autograph session after the astronauts’ presentation of mission highlights in Marshall’s Morris Auditorium. (NASA/MSFC/Emmett Given)

Solar Array *Continued from page 1*

would benefit from lighter, more affordable power sources,” said Les Johnson, the technical assistant for the Advanced Concepts Office at the Marshall Center. “We’re developing a lightweight solar array that inflates once a craft is launched.”

The Marshall Center funded the project through the center’s Technology Investment Program. The team included two Huntsville companies, Jacobs Engineering and ManTech International, that helped with the test article design and fabrication. The sample solar array was mounted on an inflatable structure, packaged into a small volume similar to what might be experienced on a small spacecraft, and then deployed. Engineers measured the energy production of solar cells before and after deployment in Marshall’s labs. Folding and deployment did not damage the cells and performance remained constant.

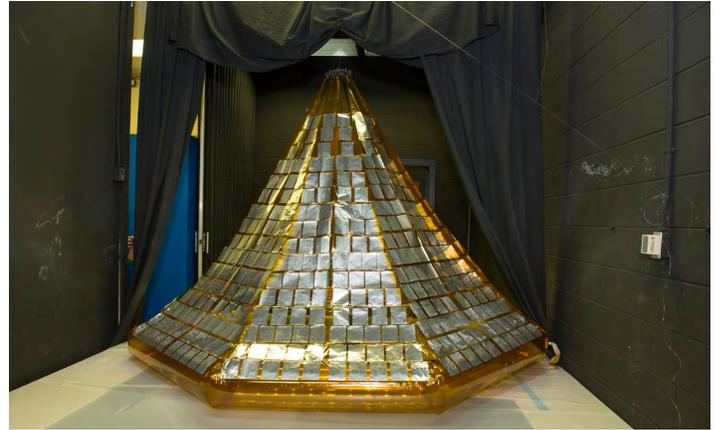
The test article could have provided average power of 1 kilowatt to a spacecraft in Earth orbit and was packaged into a volume that would allow a conventional space solar array system to produce only a few tens of watts. One kilowatt is roughly one-third of the power provided to the Hubble Space Telescope by its much larger solar arrays. The typical U.S. home consumes about 1.3 kilowatts of power on average throughout the day.

“This system packed a lot of power in a small structure,” said Karen Cunningham, an engineer in Marshall’s Space Systems Department, where testing was completed. “There’s a new emphasis on small satellites and spacecraft, which only increases the demand for lighter weight, more efficient power systems.”

The Advanced Concepts Office examined three classes of missions and determined that each would benefit from an inflatable solar array power source: Earth-orbiting small spacecraft; a three-unit cubesat mission; and a larger probe designed to fly to the outer planets.

“Our studies showed that thin film, printable yet flexible solar arrays paired with inflatable structures can change our thinking about space power systems,” Johnson said.

The system could be scaled up for larger satellite



Inflatable solar arrays like this one tested at the Marshall Center have the potential to drastically reduce the weight and size of power systems for spacecraft. A small canister held the folded system. During testing, the doors and structure inflated to form a rigid framework filled with solar cells. Sensors measured the performance of the deployment mechanism and the solar array before, during and after testing. (NASA/MSFC)

missions and down for smaller cubesat missions. Engineers designed the system with no pointing mechanisms and few other parts that could break in orbit. Features included thin photovoltaics/diodes for the solar arrays, a deployment mechanism and an inflatable structure.

Testing the system validated that it worked in a laboratory environment, which is considered a test readiness level of four and proved the feasibility of the concept. The team’s next step is to advance the technology to provide the most power in the most efficient packaging possible for a variety of Earth and space-based uses and eventually to build a prototype suitable for flight testing.

To watch a video of the inflatable solar array being tested at Marshall Center, visit [here](#).

McMahan is a public affairs officer in the Office of Strategic Analysis & Communications.

NASA's Chandra X-ray Observatory Celebrates 15th Anniversary

Fifteen years ago, NASA's Chandra X-ray Observatory was launched into space aboard the Space Shuttle Columbia. Since its deployment on July 23, 1999, Chandra has helped revolutionize our understanding of the universe through its unrivaled X-ray vision.

Chandra, one of NASA's current "Great Observatories," along with the Hubble Space Telescope and Spitzer Space Telescope, is specially designed to detect X-ray emissions from hot and energetic regions of the universe.

Chandra has observed objects ranging from the closest planets and comets to the most distant known quasars. It has imaged the remains of exploded stars, or supernova remnants, observed the region around the supermassive black hole at the center of the Milky Way, and discovered black holes across the universe. Chandra also has made a major advance in the study of dark matter by tracing the separation of dark matter from normal matter in collisions between galaxy clusters. It is also contributing to research on the nature of dark energy.

"Chandra changed the way we do astronomy. It showed that precision observation of the X-rays from cosmic sources is critical to understanding what is going on," said Paul Hertz, NASA's Astrophysics Division director in Washington. "We're fortunate we've had 15 years – so far – to use Chandra to advance our understanding of stars, galaxies, black holes, dark energy and the origin of the elements necessary for life."

Chandra orbits far above Earth's X-ray absorbing atmosphere at an altitude up to 139,000 kilometers (86,500 miles), allowing for long observations unobscured by Earth's shadow. When it was carried into space in 1999, it was the largest satellite ever launched by the shuttle.

"We are thrilled at how well Chandra continues to perform," said Belinda Wilkes, director of the Chandra X-ray Center (CXC) in Cambridge, Massachusetts. "The science and operations teams work very hard to ensure that Chandra delivers its astounding results, just as it has for the past decade and a half. We are looking forward to more ground-breaking science over the next decade and beyond."

Originally called the Advanced X-ray Astrophysics Facility (AXAF), the telescope was first proposed to NASA in 1976. Prior to its launch aboard the shuttle, the observatory was renamed in honor of the late



Among the events held to celebrate the 15th anniversary of the Chandra X-ray Observatory was a panel discussion July 24 -- part of the Pass the Torch lecture series at the U.S. Space & Rocket Center. From left, Chandra Project Scientist Dr. Martin Weisskopf, former Chandra Program Manager Fred Wojtalik and former Chandra Deputy Program Manager Jean Olivier described the development and testing of the telescope, some of the observatory's discoveries and the telescope's current status and future. The panel was moderated by Keith Hefner, who was Chandra Program manager from 2002-12 and is now associate program manager of the Space Launch System. (NASA/MSFC/Emmett Given)

Indian-American Nobel laureate, Subrahmanyan Chandrasekhar. Known to the world as Chandra (which means "moon" or "luminous" in Sanskrit), he was widely regarded as one of the foremost astrophysicists of the 20th century.

"Chandra continues to be one of the most successful missions that NASA has ever flown as measured against any metric – cost, schedule, technical success and, most of all, scientific discoveries," said Martin Weisskopf, Chandra Project Scientist at NASA's Marshall Space Flight Center. "It has been a privilege to work on developing and maintaining this scientific powerhouse, and we look forward to many years to come."

The Marshall Center manages the Chandra program for NASA's Science Mission Directorate. The Smithsonian Astrophysical Observatory in Cambridge controls Chandra's science and flight operations.

For Chandra images, multimedia and related materials, visit [here](#).

Additional information on Chandra and the 15th anniversary can be found [here](#).

Marshall Team Members 'Cool Off' at Exchange's Ice Cream Social



Sherry Hopper, of the Marshall Space Flight Center's Protective Services Office, creates her own sundae at an ice cream social hosted by the Marshall Exchange on July 29. In commemoration of the 45th anniversary of the lunar landing, the Exchange served ice cream, toppings and ice cream sandwiches to all employees and contractors at Marshall. (NASA/MSFC/Ray Downward)

Obituaries

Dorothy "Dottie" Eakes Osborn, 76, of Madison, died July 6. She retired from the Marshall Center in 1981 as a secretary. She is survived by her husband, Lamar Osborn.

Alfred "Al" Gregory Orillion, 85, of Crowley, Louisiana, died July 3. He retired from the Marshall Center in 1984 as an aerospace engineer.

Ewell Marvin Scott Jr., 87, of Huntsville, died July 21. He retired from the Marshall Center in 1994 as an aerospace engineer. He is survived by his wife, Clara Jo Scott.

Kenneth LeRoy Rossman, 84, of Athens, died July 22. He retired from the Marshall Center in 1979 as an aerospace engineer. He is survived by his wife, Jean Rossman.