NASA’s Space Launch System Marks Progress as Core Stage Passes Critical Design Review

By Megan Davidson

NASA continues to make progress toward its next giant leap to send humans farther into the solar system than ever before, including to an asteroid and eventually to Mars.

The core stage for NASA’s Space Launch System (SLS) recently passed its Critical Design Review -- a major milestone for the program, proving the first new design for America’s next great rocket is mature enough for production.

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Mysterious X-ray Signal Intrigues Astronomers

A mysterious X-ray signal has been found in a detailed study of galaxy clusters using NASA’s Chandra X-ray Observatory and the European Space Agency’s XMM-Newton. One intriguing possibility is that the X-rays are produced by the decay of sterile neutrinos, a type of particle that has been proposed as a candidate for dark matter.

While holding exciting potential, these results must be confirmed with additional data to rule out other explanations and determine whether it is plausible that dark matter has been observed.

Astronomers think dark matter constitutes 85 percent of the matter in the universe, but does not emit or absorb light like “normal” matter such as protons, neutrons and electrons that make up the familiar elements observed in planets, stars and galaxies. Because of this, scientists must use indirect methods to search for clues about dark matter.

The latest results from Chandra and XMM-Newton consist of an...
Frederick Ordway, Von Braun Associate and ’2001: A Space Odyssey” Adviser, Dies at 87

By Kenneth Kesner

Space and rocket scientist, author and space enthusiast Frederick I. Ordway III, who worked with Dr. Wernher von Braun during the early years of the Apollo program at NASA’s Marshall Space Flight Center and was later an adviser to famed director Stanley Kubrick on the movie “2001: A Space Odyssey,” died July 1 at his home in Huntsville. He was 87.

Ordway was born in New York City and raised in Maine. He studied geosciences at Harvard University and performed graduate work at the Sorbonne University in Paris and other institutions.

Before coming to Huntsville, he worked for Reaction Motors Inc. of New Jersey, an early maker of liquid-fueled rocket engines; in the Guided Missile division of Republic Aviation in Farmingdale, New York; and for other companies and organizations.

Ordway was later a consultant to Hollywood, industry and academia on space and science issues; served as special assistant to Robert Seamans, the first director of what would become the U.S. Department of Energy, where Ordway had a long career; received an honorary doctorate from the University of Alabama in Huntsville in 1992; and continued writing, among many other activities.

He was a good friend of noted science fiction writer Arthur C. Clarke, whose story “The Sentinel” was the basis for Kubrick’s “2001” film. In 1965, Clarke introduced Kubrick to Ordway, who spent three years as a technical advisor to the director.

Ordway was noted for his lifelong interest in space exploration. He was the longest-serving member of the American Rocket Society, which later merged with the Institute of Aerospace Sciences to become the American Institute of Aeronautics and Astronautics. He was the author of many books on space travel -- some co-written with von Braun -- and more than 350 articles.

Marshall Center historian Mike Wright said Ordway’s role in space history and his longtime association with von Braun are well known. Von

In 1967, then-Marshall Space Flight Center Director Dr. Wernher von Braun, right, and Frederick Ordway examine one of the books they co-authored. Ordway, who was an adviser to director Stanley Kubrick on “2001: A Space Odyssey,” died July 1 at his home in Huntsville. (Photo courtesy U.S. Space & Rocket Center)

Braun, who recommended Ordway as the possible author of a biography on Army missile pioneer Maj. Gen. Holger Toftoy, said Ordway would be perfect for the task because he was utterly familiar with the rocket and missile business.

Kesner, an ASRC Federal/Analytical Services employee, supports the Office of Strategic Analysis & Communications.
unidentified X-ray emission line -- a spike of intensity at a very specific wavelength of X-ray light -- detected in the Perseus galaxy cluster. They also found the line in a combined study of 73 other galaxy clusters with XMM-Newton.

“We know that the dark matter explanation is a long shot, but the pay-off would be huge if we’re right,” said Esra Bulbul of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, who led the study. “So we’re going to keep testing this interpretation and see where it takes us.”

The authors suggest this emission line could be a signature from the decay of a “sterile neutrino.” Sterile neutrinos are a hypothetical type of neutrino that is predicted to interact with normal matter only via gravity. Some scientists have proposed that sterile neutrinos may at least partially explain dark matter.

“We have a lot of work to do before we can claim, with any confidence, that we’ve found sterile neutrinos,” said Maxim Markevitch, a co-author from NASA’s Goddard Space Flight Center. “But just the possibility of finding them has us very excited.”

One source of uncertainty is that the detection of this emission line is pushing the capabilities of the two observatories in terms of sensitivity. Also, there may be explanations other than sterile neutrinos if this X-ray emission line is deemed to be real. There are ways that normal matter in the cluster could have produced the line, although the team’s analysis suggested that all of these would involve unlikely changes to our understanding of physical conditions in the galaxy cluster or the details of the atomic physics of extremely hot gases.

The authors note that even if the sterile neutrino interpretation is correct, their detection does not necessarily imply that all of dark matter is composed of these particles.

“Our next step is to combine data from Chandra and the Japan Aerospace Exploration Agency’s Suzaku mission for a large number of galaxy clusters to see if we find the same X-ray signal,” said co-author Adam Foster, also of the Harvard-Smithsonian Center for Astrophysics. “There are lots of ideas out there about what these data could represent. We may not know for certain until Astro-H launches, with a new type of X-ray detector that will be able to measure the line with more precision than currently possible.”

Because of the tantalizing potential of these results, after submitting to The Astrophysical Journal the authors posted a copy of the paper to a publicly accessible database. This forum allows scientists to examine a paper prior to its acceptance into a peer-reviewed journal. The paper ignited a flurry of activity, with 55 new papers having already cited this work, mostly involving theories discussing the emission line as possible evidence for dark matter. Some of the papers explore the sterile neutrino interpretation, but others suggest different types of candidate dark matter particles, such as the axion, may have been detected.


For an additional interactive image, podcast, and video on the finding, visit here.

For Chandra images, multimedia and related materials, visit here.
SLS, Mars Vehicle Braking Tests Featured on ’This Week@NASA’

Scale-model testing of NASA’s Space Launch System and full-scale flight testing of an innovative, saucer-shaped supersonic decelerator -- both part of programs managed at the Marshall Space Flight Center -- are featured in the latest edition of "This Week@NASA."

Heavily instrumented, scale-model versions of the Space Launch System -- some as small as 5 percent -- have been undergoing a variety of wind tunnel and acoustic tests at the Marshall Center and, as seen in the video segment, at NASA's Langley Research Center. The Scale Model Acoustic Test (SMAT) program paves the way for full-scale construction of America's next flagship in space, set to carry human crews on new missions of exploration at Mars and other solar-system destinations.

The video also showcases the initial test flight of NASA's Low-Density Supersonic Decelerator (LDSD), which on June 28 was lifted via balloon and rocket booster over the U.S. Navy’s Pacific Missile Range Facility in Kauai, Hawaii. Researchers studied the craft’s behavior in flight, seeking to refine vehicle braking and landing technologies for future Mars missions. Two more test flights are planned for the LDSD project, which is part of NASA's Technology Demonstration Missions Program (TDM). The TDM program, managed by the Marshall Center for NASA's Space Technology Mission Directorate, includes projects at NASA field centers and partner facilities around the country -- all capable of dramatically transforming the way we live and work in space.

View “This Week@NASA” on the NASA-TV YouTube channel.

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Representatives from various NASA centers and The Boeing Co. -- prime contractor for the core stage, including its avionics -- met June 30 and July 1 for the Critical Design Review (CDR) board at NASA's Marshall Space Flight Center. More than 3,000 core stage artifacts were reviewed by 11 individual technical discipline teams. Marshall manages the SLS Program for the agency.

“The SLS program team completed the core stage critical design review ahead of schedule and continues to make excellent progress toward delivering the rocket to the launch pad,” said SLS Program Manager Todd May. “Our entire prime contractor and government team has been working full-steam on this program since its inception.”

Manufacturing of components of the core stage test article and actual flight hardware is underway at NASA's Michoud Assembly Facility, while development and integration of flight computers and software continues at Marshall.

“Completing the CDR is a huge accomplishment, as this is the first time a stage of a major NASA launch vehicle has passed a critical design review since the 1970s,” said Tony Lavoie, manager of the Stages Office at Marshall. “In just 18 months since the Preliminary Design Review, we are ready to go forward from design to qualification production of flight hardware.”

Program officials also completed modification of the remaining major SLS contract with Boeing Aerospace of Huntsville, a division of the Boeing Co. of St. Louis. Under the contract, Boeing will develop the 200-foot core stage, including the avionics system for SLS. The core stage will store cryogenic liquid hydrogen and liquid oxygen that will feed the RS-25 engines at the base of the core stage. Boeing has also been tasked to study the Exploration Upper Stage, which will be needed for the 130-metric-ton version of SLS that will further expand mission range and payload capabilities.

Three prime contractors support SLS in addition to Boeing: ATK of Brigham City, Utah; Aerojet Rocketdyne of Sacramento, California; and Teledyne Brown Engineering of Huntsville.

The first configuration of the SLS launch vehicle will have a 70-metric-ton (77-ton) lift capacity and carry an uncrewed Orion spacecraft beyond low-Earth orbit to test the performance of the integrated system. As the SLS is evolved, it will be the most powerful rocket ever built and provide an unprecedented lift capability of 130 metric tons (143 tons) to enable missions even farther into our solar system.

For more information on SLS, visit here.

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