

High-tech analysis of Orion heat shield underway at NASA's Marshall Center

May 13 2015, by Katherine Hambleton



Engineers from NASA's Ames Research Center in Moffett Field, California, and NASA's Marshall Space Flight Center in Huntsville, Alabama, remove segments of a heat-resistant material called Avcoat from the surface of the Orion heat shield, the protective shell designed to help the next-generation crew module and its future occupants withstand the heat of atmospheric reentry. The work is being conducted in the seven-axis milling machine facility at Marshall. Credit: NASA/MSFC/Emmett Given

Engineers from three NASA field centers are partnering this month at NASA's Marshall Space Flight Center in Huntsville, Alabama, to remove and analyze some 180 small squares of an ablative material called Avcoat—the outer coating of the heat shield that protected the Orion crew module during its 2014 flight test. NASA is developing the spacecraft to carry future astronauts on new missions of discovery to an asteroid and on to Mars.

Charred during the successful test flight known as Exploration Flight Test 1, or EFT-1, the 16.5-foot-diameter [heat shield](#) arrived at Marshall March 9. It was installed in the center's state-of-the-art, seven-axis milling machine, which uses precision, computer-aided tools able to fluidly maneuver in a variety of ways to manufacture parts and cut large metal or composite materials or structures. Built for NASA by Lockheed Martin of Huntsville, the machine is the largest of its kind in the world except its twin, now in use at NASA's Michoud Assembly Facility in New Orleans.

The milling machine boasts a fixed, rotating structure that enables researchers to easily inspect the 5,000-pound heat shield and remove samples of the ablated, or slowly incinerated, material from its surface. A heavy piece of Lockheed Martin Ground Support Equipment also is employed, enabling workers to suspend massive structures such as the heat shield at any angle for ease of access.

The Orion heat shield analysis work is led by researchers from NASA's Ames Research Center in Moffett Field, California, while Marshall Center engineers lead the physical machining effort. Personnel from NASA's Johnson Space Center in Houston, where the Orion Program is managed for the agency, also are on hand to provide inputs during the process.

The team will spend the rest of May removing the final scorched squares

of ablative material—and the sophisticated data-gathering sensors embedded in many of them—by hand. The sensors, designed and fabricated at Ames, collected critical entry environment and thermal protection performance data during the EFT-1 flight.



From left, John Kowal, manager of Orion's thermal protection system at NASA's Johnson Space Center in Houston; Nicholas Crowley, engineering technician at NASA's Ames Research Center in Moffett Field, California; and Rob Kornienko, Ames engineering branch chief, discuss removal of thermal protection system material from the Orion heat shield in the seven-axis milling machine facility at NASA's Marshall Space Flight Center in Huntsville, Alabama. Credit: NASA/MSFC/Emmett Given

Once those final pieces are removed for analysis, the milling machine will be used for a final pass. It will smooth the denuded heat shield—actually a series of 320,000 honeycomb-like cells covering the entire shield, each hand-filled with the Avcoat material—leaving a uniform layer one-tenth of 1 inch above the shield's composite inner surface.

The charred blocks, sensors and other materials then will be shipped to research teams at Ames and other NASA facilities. Ames teams who tested and qualified the materials prior to flight, using the nation's premiere arc jet facilities, will analyze the thermal performance of the material. Data gleaned from the material and from the heat shield's behavior during reentry will help researchers refine predictive computer models and assist technologists in developing safer, more cost-effective ways to design and build these critical protection systems.

The heat shield will be shipped in June to NASA's Langley Research Center in Hampton, Virginia, for water impact testing intended to prepare the spacecraft for water-landing certification.

The Orion spacecraft will launch atop the Space Launch System, the nation's next flagship in space.

More information: For more information about Orion, its flight test and NASA's journey to Mars, visit: www.nasa.gov/orion

Provided by NASA

Citation: High-tech analysis of Orion heat shield underway at NASA's Marshall Center (2015, May 13) retrieved 26 April 2024 from <https://phys.org/news/2015-05-high-tech-analysis-orion-shield-underway.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.