Endeavour payloads to put final touches on space station

BY JUSTIN RAY
SPACEFLIGHT NOW
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The cosmic experiment headed for the International Space Station to probe the mysteries of physics and more spare parts to keep the outpost flying after the space shuttles are retired have arrived at the pad for launch aboard Endeavour four weeks from today.

Credit: Justin Ray/Spaceflight Now
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A special transport canister shaped like the shuttle's 60-foot-long payload bay was hoisted into pad 39A's gantry overnight to unload the mission's critical cargos into the cleanroom.

The Alpha Magnetic Spectrometer and the Express Logistics Carrier No. 3, both destined for attachment onto the space station's truss backbone, will be inserted into the shuttle's bay Friday to await the April 19 blastoff.

"It's almost like each of the payloads is a separate mission, but the two come together," said Joe Delai, Kennedy Space Center's payload mission manager.

Endeavour's diverse passengers represent nearly 30,000 pounds of hardware and are the last additions that the shuttle program will give to the space station's million-pound structure after 12 years of assembly work.

The two-sided ELC-3 holds a pair communications antennas, a high-pressure oxygen tank, an extra ammonia coolant reservoir, a new arm for the Dextre robot and some assorted

electronics. It is the final batch of large replacement items that NASA has been stockpiling in orbit for future use once the heavy-lifting shuttles go out of service.

"The objective is to get all the spares, the larger parts that need to fly on the shuttle, up on the station," said Bob Hart, the Boeing payload flow manager.

Some suggest the Alpha Magnetic Spectrometer, valued at about $2 billion, will write the lasting scientific legacy for the International Space Station. But the instrument's leader, Nobel Prize-winning physicist Samuel Ting, bristles at such predictions now.

"I don't want to say these kinds of things. It's not productive. In 10-15 years if we see something truly important, the community will judge itself. It's best not to claim things in the beginning," he says.

Nonetheless, AMS aims to answer some of the grand questions about how the universe was created, the invisible matter and energy that make up most of the cosmos and the existence of antimatter.

"The issues of antimatter in the universe and the origin of dark matter probe the foundations of modern physics. But the most exciting objective of AMS is to probe the unknown; to search for phenomena which exist in nature that we have not yet imagined nor had the tools to discover," said Ting.

AMS is a state-of-the-art cosmic ray detector using a permanent magnet that will be operated around-the-clock from its space-pointed post atop the station. The 15,250-pound device rides aboard Endeavour, then gets removed from the shuttle by the robot arm and latched to the station's truss to begin its observations that last as long as the outpost remains aloft.

"It's a gradual learning process. The longer you stay, the longer you learn how to analyze the data with more data," says Ting.

While always running, the experiment won't call upon the station residents for involvement. "The astronauts on the space station have many things to do. We'll not dare to bother them," Ting says.

Using the space station to support AMS was the obvious choice, he says, adding that launching the instrument as a free-flying satellite would be far too costly. The station has the room and the extensive power required.

But just getting AMS into space has been a daunting challenge for the multi-national collaboration between 16 countries, 60 institutes and 600 physicists.

Originally designed for a three-year temporary stay aboard the station, AMS was supposed to go up and come back on shuttle missions. But after the Columbia accident and the Bush Administration's decision in 2004 to retire the shuttle program by 2010, the remaining flights were devoted to finishing station construction in the least-possible number of launches. AMS fell off the manifest completely.

Outrage in scientific circles and the dogged determination by Ting won support in Congress, and NASA was ordered to fly an extra shuttle flight to get AMS delivered to the station. That's STS-134, the 25th and final voyage of Endeavour.

However, the planned launching last summer was postponed so AMS could under a major change. Its helium-cooled superconducting magnet designed to last just three years was replaced with a permanent device that would work as long as the space station stays in use. The magnet switch moved Endeavour's flight to this year and breathed an extension into the shuttle program beyond the 2010 retirement deadline.

Now, AMS is atop the launch pad and ready to fly. Its mission will unveil a new realm of the universe by detecting and characterizing charged cosmic rays that hit the instrument.

"All of our knowledge about space is from the measurement of light rays. All of our understanding about the cosmos comes from the measurement of light rays. But in space beside light rays there are charged cosmic rays...a nearly unexplored region in science. A magnetic spectrometer on the space station is the only way to provide long-duration -- 20 years -- of high-precision measurements of charged cosmic rays," said Ting.

"In other words, you don't need to know anything else about physics. In space there are two types of particles -- one has been measured and the second is just beginning to be measured."

Attempting to prove or disprove the presence of antimatter is one achievement AMS will strive to reach.

"The universe began with the Big Bang. Before the Big Bang there was a vacuum. Nothing exists in vacuum. After the Big Bang there must be equal amounts of matter and antimatter, otherwise we would not have come from vacuum. AMS on the space station for 20 years will search for the existence of antimatter to the edge of the observable universe," said Ting.

"No matter how elegant it is a theory, if it cannot be proven by experiment it is completely meaningless...What we want to do is look whether it's really there or not. Nobody has done a very sensitive search. We want to increase the sensitivity by a factor of a thousand to a million. When you change the sensitivity by a factor a million, you enter into a totally different domain," said Ting.

And there's the question about what comprises nearly 90 percent the universe -- the invisible dark matter and dark energy.

"How do you look for the origin of dark matter? You cannot see the dark matter. But the collision of dark matter will produce additional positrons with certain characteristics. These characteristic additional positrons can be measured very accurately by AMS, so will give us for the first time a chance to understand where is the other 90 percent," Ting said.

What gets Ting the most excited, however, are the unknowns and potential discoveries awaiting AMS.

"When you build a new instrument you ask the best scientists to review and see what you can do. When you make a discovery with a precision instrument, most of the time it has nothing to do with the original purpose. If you think about it, it is very obvious because the experts' opinion is based on existing knowledge. Discovering something new is to destroy the existing knowledge."