The Mission

Orbiter: Endeavour
Mission: STS-134
Payload: AMS
Launch: Feb. 26, 2011
Time: 4:04 p.m. EST
Site: Pad 39A, Kennedy Space Center
Landing: March 10
Site: KSC's Shuttle Landing Facility

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Astrophysics experiment touches down in Florida

BY STEPHEN CLARK
SPACEFLIGHT NOW
Posted: August 26, 2010

An international particle physics experiment flew into the Kennedy Space Center on a U.S. Air Force cargo plane Thursday, reaching the mission's last stop on Earth before launching in February on a hunt for an anti-universe and dark matter.

Shuttle commander Mark Kelly, AMS principal investigator Samuel Ting, and ESA's director of human spaceflight Simonetta Di Pippo welcome the C-5 cargo plane to the United States. Credit: Justin Ray/Spaceflight Now

The more than $2 billion Alpha Magnetic Spectrometer touched down on the shuttle landing strip on a chartered heavy-lifting C-5 Galaxy aircraft at 11:18 a.m. EDT (1518 GMT).

The Air Force cargo plane ferried the experiment to Florida from Geneva, the home base of the European Organization for Nuclear Research, or CERN, where scientists spent the spring and summer feverishly replacing its magnets.

AMS was joined on the trip by crates of support and test equipment and dozens of Air Force and mission personnel.

"We have finished all the tests," said Samuel Ting, a Nobel laureate from the Massachusetts Institute of Technology. "Now, it's in the hands of NASA."

Later Thursday, workers moved the hardware to KSC's Space Station Processing Facility to begin several months of final assembly, testing and packaging for its Feb. 26 launch aboard the shuttle Endeavour.

About the size of a truck, the spectrometer will be robotically mounted on the station's starboard truss on the final scheduled shuttle flight, which was added to the manifest by an act of Congress.

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Scientists say the experiment has the mind-boggling mission of collecting high-energy cosmic rays from the edge of the universe to seek evidence of antimatter and dark matter, exotic material not yet observed in the universe.

Antimatter particles are structured the same way as normal matter. A hydrogen particle, made of one proton and electron, has a counterpart called antihydrogen with a negatively-charged antiproton and a positively-charged positron taking the place the orbiting electron.

Researchers believe there were equal amounts of matter and antimatter at the moment of the Big Bang, the unimaginably violent birth of the universe 13.7 billion years ago.

"At the moment of the Big Bang, there must have been an equal amount of matter and antimatter. Otherwise, we would have never come from vacuum," Ting said. "So if you have a positive-charged electron, you must have negative-charged electron. So if you have matter, you must have antimatter."

Credit: NASA/Jack Pfaller

But antimatter has disappeared from view, raising questions that there it collected somewhere else -- perhaps an anti-universe that is comprised almost entirely of antimatter.

Energetic collision experiments have created antimatter particles on Earth, but physicists are still looking for the missing antimatter elsewhere in the universe.

"The question is if there is a universe far, far away that is made out of antimatter," Ting said.

The spectrometer will analyze cosmic rays for slight spectral aberrations formed by the annihilation, or collision, of weakly-interacting particles. Annihilation destroys dark matter and antimatter, but the events produce tiny bursts of radiation that should be observable with ultra-sensitive detectors.

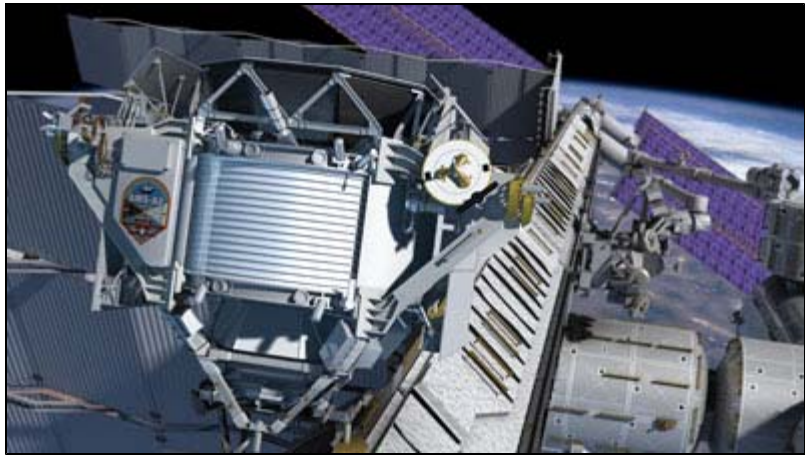
The experiment's indirect dark matter survey in space will join massive underground cosmic ray detectors around the world seeking direct evidence of the mysterious particles, which are about five times more prevalent in the universe than regular matter.

Scientists know there's dark matter and an even more enigmatic force called dark energy based on studies of the behavior of stars and galaxies. Something unseen with immense gravity is pulling on objects in space, according to astrophysicists.

"The evidence that there is something fishy about the amount of mass which is needed to explain the gravitational effects is overwhelming," said Roberto Battiston, the deputy scientist for AMS. "There is even some indication that there could be dark matter effects within the solar system."

AMS is running several months late after the project's scientists changed out the spectrometer's powerful magnet to match it's lifetime to the extended operations of the space station.

The experiment was supposed to fly with a helium-cooled magnet, but testing earlier this year showed the superfluid coolant woil boil off within two or three years, yielding the payload useless after 2013.



Artist's concept of AMS on the space station. Credit: NASA

"After three years, if we didn't change (the magnet), we'll become a museum piece," Ting said. "So we decided to change to a permanent magnet."

With work underway to extend the station program through at least 2020, the AMS team installed the less powerful permanent magnet that flew on an AMS testbed aboard the space shuttle in 1998.

Ting, the spectrometer's principal investigator, said Thursday the Chinese-built replacement magnet will produce approximately six times better data because of its longer life.

Researchers put more detectors in the experiment to compensate for the permanent magnet's weaker field. The extra detectors, combined with its unlimited life, will ensure AMS collects as much data as possible, Ting said.

Engineers will put the nearly 16,000-pound instrument inside Endeavour's cargo bay early next year. AMS will be joined in the shuttle by six veteran astronauts, a cache of spare parts and other experiments.

Endeavour's crew and the experiment's managers gathered at the shuttle runway to greet the arriving cargo plane.

"This is our main payload for this mission," said Mark Kelly, Endeavour's commander. "It's also, as far as I can tell, the most expensive piece of the space station that will be installed."

Endeavour's February flight is the last planned shuttle mission, but NASA could add one more launch to the manifest next summer, pending money from Congress.

"I think it's important to note that it's going to be completed with a very complex and hopefully very successful physics experiment," Kelly said. "We look forward to seeing the results that Dr. Ting is going to produce over the next decade."

Thursday's milestone signals the spectrometer's 15-year struggle to reach space is nearing an end.

AMS was struck from the shuttle launch schedule after the Columbia accident, leaving its future in doubt. But in 2008, the U.S. Congress authorized an extra shuttle flight to deliver the experiment to the space station.

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