Space Water Recycling Experiment Flying High Aboard Space Shuttle

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In a remote, hostile, totally alien environment, every life-sustaining resource is precious. In space, other than air, none is more precious than water.

Improving the careful use of that critical resource is the goal of the Vapor Compression Distillation Flight Experiment, which is undergoing tests during the STS-107 Space Shuttle mission launched January 16.

The experiment, managed by NASA's Marshall Space Flight Center in Huntsville, Ala., is a full-scale demonstration of technology being developed to convert crewmember urine and wastewater aboard the International Space Station into clean water for drinking, cooking and hygiene. Based on results of the experiment, an operational urine processor could be installed aboard the Station in the future, thus reducing the amount of water that must be re-supplied from Earth.

"We operated successfully on Saturday, Sunday and Monday (Jan.18-20)" said Cindy Hutchens, manager of the Vapor Compression Distillation Flight Experiment. "Our data look very similar to that on the ground, so we feel very confident about our hardware. Mission Specialist Laurel Clark described our processed water samples as clear, which is very good. On Sunday, we did a test to see how it would start up if it lost power, and that appears to be successful. We're looking forward to getting back our samples and the recorded data for analysis," she said.

Aboard the Space Station, each of the three crewmembers is allocated just 4.4 gallons of water per day. By comparison, the average American uses 60 gallons per day on Earth. Not only is it costly to carry water into space aboard the Space Shuttle and Russian Progress spacecraft, but also cargo space is already much in demand for carrying up food, clothing, equipment and scientific experiments. NASA is working to collect and recycle as much water as possible to save space and reduce costs.

"The water recovery system on the Space Station will be similar to a water treatment plant on Earth. The process has to be different on the Station in order to operate in the weightlessness of space and to fit in the area of about two phone booths," Hutchens said.

The experiment is part of a NASA effort to reduce technical risk between the design of flight hardware and actual installation aboard the Space Station, Hutchens said. The vapor compression distillation process mechanically mimics Earth's natural process of evaporation. Instead of heating water with the power of the sun, however, these systems boil wastewater to produce and collect water vapor that is 97 percent free of minerals, chemicals and microbes.

The experiment is designed to verify the recycling concept in microgravity, the low-gravity environment created as a spacecraft orbits the Earth. For the experiment, de-ionized water containing some salts was used instead of urine.

The experiment occupies a refrigerator-sized rack in the SPACE HAB module in the Shuttle payload bay for the STS-107 mission. Experiments will test the system under a series of normal and abnormal operating scenarios. The Shuttle crew activated the experiment, but it is primarily automated. The experiment team monitors operations and receives data in a control room at NASA's Johnson Space Center in Houston.

Part of the Station's water processing system was tested on a KC-135 aircraft in 2002 that simulates microgravity conditions.

"When this technology is installed aboard the Space Station, it will be able to process about 4,400 pounds (2,000 kg) of waste water annually to support the crew, and decrease the water requirements on resupply missions," Hutchens said. "Beyond that, further human exploration of space will require water recycling technology. And it may even have applications on Earth, where many people don't have ready access to a clean water supply," she said.

For more information about the STS-107 mission:

www.spaceflight.nasa.gov