By Clare Pierson

To Infinity and Back

In space and on Earth, water reuse is the future

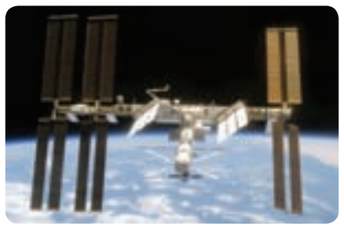
On March 15, 2009, space shuttle Discovery and its crew of seven took off on a cool, crisp evening from Cape Canaveral, Fla., and launched into the depths of outer space for 13 days. The mission: among other things, to supply a replacement part for the International Space Station's (ISS) water recycling system, which transforms human fluids such as sweat and urine into potable water for the crew members.

ARTICLE SUMMARY

Challenge: NASA needed to find a more efficient and inexpensive way to provide potable water to its astronauts at the International Space Station and on other space missions.

Solution: NASA and its partner research companies developed a water recycling system that can recycle astronauts' bodily fluids and other wastewater aboard the station into drinking water, which will save the agency millions of dollars.

Conclusion: Companies here on Earth have used this technology in third-world countries and remote areas and for disaster relief. They have found that the MCV resin and portable recycling units present an inexpensive way to provide areas with adequate drinking water.



The International Space Station has been a testing ground for NASA's water recovery system, a technology that will be used much more in future deep space missions.

Since NASA began staffing astronauts in the ISS, it has spent about $80 million on carrying literally tons of water to the station—around $40,000 per gal. A functional water recycling station in the ISS will save NASA millions of dollars, and there is also another benefit—the technology may aid NASA in completing a mission to Mars.[1] This kind of mission would take almost two years, and shuttling water back and forth to aid the mission for that period of time would be extremely costly.

Reuse in Space

NASA's Marshall Space Flight Center in Huntsville, Ala., together with Hamilton Sundstrand Space Systems Intl. in Connecticut, has designed and tested a few different technologies that could recycle the two main consumables used by astronauts up in space—air and water.

The water recovery system (WRS) used by the ISS consists of a urine processor assembly and a water processor assembly. Product from the urine processor combines with other wastewater (sweat, condensate, tears, exhaled breath, etc.) and is delivered to the water processor for treatment. The first step is removal of free gas and solids, such as hair and lint. The water passes through multifiltration beds and is then purified by an MCV iodinated resin developed by Umpqua Research Co., Myrtle Creek, Ore. Water is tested by electrical conductivity sensors, where the conductivity of the water increases in the presence of contaminants. Unsatisfactory water is reprocessed, and clean water flows to a storage tank for astronaut use.[2]

The WRS must provide water that meets strict purity standards before it can be used by the flight crew. NASA estimates that the system reduces the net mass of water and consumables that would need to be launched from Earth to support six crew members by 15,000 lb per year.

According to NASA's description of these systems: "On deep space missions in the future, resupply will not be possible due to the distances involved, and it will not be possible to take along all the water and air required due to the volume and mass of consumables required for a voyage of months or years. Regenerative life-support hardware, which can be used repeatedly to generate and recycle the life-sustaining elements required by human travelers, is essential for long-duration trips into space."

Here on Earth

Learning about this new technology may lead one to consider that if NASA can provide water recycling in space, there are certainly remote areas here on Earth with severely inadequate water supplies that could benefit greatly from this technology.

A company in Reno, Nev., called the Water Security Corp. (WSC) had this exact thought. It has partnered with NASA and Hamilton Sundstrand to develop and use the same MCV technology to deliver clean, potable water to remote, third-world countries. To do this, WSC acquired the rights in 2000 to develop the MCV resin from Umpqua Research for its own systems to be used in non-space applications.

WSC's two main systems are the Apollo and Discovery. The Apollo—a 0.5-gal-per-minute (gpm), 3,000-gal capacity system ideal for remote areas and mobile disaster relief—comes with a hand pump and can be directly inserted into source water for treatment. The Discovery is a 4-gpm, 30,000-gal capacity system; it is a bit larger and therefore more ideal for small villages in remote areas. It can be linked to additional Discovery systems for higher throughput.

Both systems use the MCV iodinated resin for treatment and purification, as well as Iodosorb iodine scrubber resins and carbon filtration to treat chlorine, turbidity, bacteria, viruses, pesticides, herbicides and particulate matter. Each comes with a flowmeter that will signal when it is time for a cartridge change.

"[The systems] do not require electricity, can be used in a rural applications and can be packed in cartridges," said Ken Kearney, vice president of WSC. "The user does not have to monitor chemical concentrations and does not have to be a technician to use the system. It's ideal purification technology for the third world."

In 2006, WSC partnered with NASA on the

Villagers in Bakalot, Pakistan, use Water Security Corp.'s Discovery water purification system.

Residents in Malaysia use a Peddle Power System to purify drinking water. The system is manufactured by World Wide Water, Ltd., of New Zealand.

Concern for Kids project to install a water purification system in Kendala, Iraq, where the village's well had failed and people were forced to haul water from nearby muddy creeks and use crude cloth filters to try to purify the water for drinking.

Civil affairs units in the U.S. military have used WSC's systems in a few remote areas of Iraq to aid soldiers and villagers alike. Systems have been shipped to Pakistan, Kenya and Asia as well.

In the Future

The future need and growth potential for stand-alone, portable water recycling systems is enormous.

"We're now seeing third-party companies around the world come up with unique things," Kearney said, "such as a bicycle-like, pedal-powered water system that is larger and provides higher flows, or the 'survival bag'—a cartridge and filter in a bag used for disaster relief."

These products and others like the Lightstraw—an 18-in. tube-like straw that purifies water straight out of a drinking glass and sells for around $4—have the potential to drastically improve the water situation in rural and poor areas.

In space and on the ground, it is clear that water reuse and purification technology is saving time and money and aiding important missions, whether it be a trip to Mars or providing an Iraqi villager a clean, clear glass of water to drink. WWD

References

[1] "Beyond Tomorrow," video, Water Security Corp., www.watseco.com/video.asp.

[2] NASA Marshall Space Flight Center, www.msfc.nasa.gov/newsroom/background/facts/eclss.pdf.

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