Life on earth could be transformed by NASA space technology

October 21 2010, By Ruth Dasso Marlaire

For years, NASA has been developing technology to establish long-duration human presence in space. As part of this ongoing effort, NASA developed a closed-loop system that recycles urine and gray water into drinking water. In addition, recent research suggests that it also may be used to generate and store energy, which would not only benefit space habitats and travel, but may have application on Earth as well.

Recently, the U.S. Congress passed the 2010 NASA Authorization Act (S. 3729), which establishes a commitment to human exploration for our nation's civilian space program. According to lawmakers, technologies developed for space may help motivate and accelerate the development of technologies and industrial capabilities for widespread applications. As part of NASA's life support research, scientists at NASA's Ames Research Center, Moffett Field, Calif., have started developing the needed infrastructure for sustainable economic activities in space.

"Our initial interest was recovering drinking water from hygiene (gray) water," said Michael Flynn, a research scientist at Ames. "By collaborating with outside entities, an off-the-shelf forward osmosis membrane was developed that we later used to recover drinking water from wastewater and grow algae in seawater as a biofuel. Today, we are researching power generation from the forward osmosis process." Results of these findings were recently presented at the International Conference on Environmental System in Barcelona Spain.

Sponsored by the Exploration Technology Development Program in

NASA's Exploration Systems Mission Directorate, Ames scientists have been researching forward osmosis (FO) technology. It is a process that purifies water by drawing it through a membrane, leaving behind organics and dissolved solids.

Originally developed for NASA's exploration life support water recycle hardware, this technology is called the Direct Osmotic Concentration system (DOC). The DOC membrane also was used to examine and develop short mission commercial products for emergency and contingency water recovery. Soon after the initial prototype was delivered to Ames, NASA targeted the DOC technology for rapid development.

NASA was not the only entity to use these commercial FO membrane products, which also were used for disaster relief, military operations and recreational wilderness travel applications. These products use the principle of forward osmosis to draw water from a contaminated source across a cellulose triacetate membrane into a sugar solution that is then safe to drink.

The success of the DOC project soon lead to the development of the Light Weight Contingency Water Recovery System (LWC-WRS) project, which recovers water from urine. By adding activated carbon to the forward osmosis process, this new system removes the majority of organic carbon impurities from urine. The treated water then becomes a refreshing, thirst-quenching drink for any human on Earth, or floating in space.

As these space technologies continue to evolve, they also are being repurposed for application on Earth. An example is NASA's Sustainability Base, a candidate for the Leadership in Energy and Environmental Design (LEED) platinum-certified office building being constructed at Ames. A modified water recovery system will be installed

to reduce water consumption. The new system will filter the building's gray water so it can be used for irrigation and toilets.

"Sustainability Base will be a showcase of NASA technologies," said Steve Zornetzer, associate director at Ames. "NASA is leading the way with its innovation and ideas that have the potential to transform our country's overall energy and environmental performance."

Sponsored by a Google Inc. Green Technology Grant, the latest concept for osmotic technology is the Pressure Retarded forward Osmosis power with Tertiary Treatment, referred to as PRO/TT. This new technology not only not only treats water, but it also generates power.

In the PRO/TT process, wastewater is placed on one side of a membrane and seawater is placed on the opposite side. This develops an osmotic potential across the membrane, which causes water from the wastewater to pass through the membrane and dilute the seawater. This filtered water increases the pressure of the diluted seawater until the osmotic potential is equalized. Energy from the increased pressure then can be harvested as hydraulic power through a turbine.

"It's like the energy created from a dam. The water's pressure spins a turbine to create energy," said Flynn.

Perhaps like the Hoover Dam that has improved millions of Americans' lives by generating power for homes and industry, NASA technology may be re-used to improve conditions and life on Earth by solving some of our country's environmental challenges.

Provided by JPL/NASA

Citation: Life on earth could be transformed by NASA space technology (2010, October 21)